



The Journal of Agricultural Education and Extension

Competence for Rural Innovation and Transformation

ISSN: 1389-224X (Print) 1750-8622 (Online) Journal homepage: <https://www.tandfonline.com/loi/raee20>

Claims and counterclaims: institutional arrangements and farmers' response to the delivery and adoption of innovations in the Okavango Delta, Botswana

Sekondeko Ronnie Noga, Oluwatoyin Dare Kolawole, Olekae Tsompi Thakadu & Gaseitsiwe Smollie Masunga

To cite this article: Sekondeko Ronnie Noga, Oluwatoyin Dare Kolawole, Olekae Tsompi Thakadu & Gaseitsiwe Smollie Masunga (2017) Claims and counterclaims: institutional arrangements and farmers' response to the delivery and adoption of innovations in the Okavango Delta, Botswana, *The Journal of Agricultural Education and Extension*, 23:2, 121-139, DOI: [10.1080/1389224X.2016.1260485](https://doi.org/10.1080/1389224X.2016.1260485)

To link to this article: <https://doi.org/10.1080/1389224X.2016.1260485>



Published online: 28 Nov 2016.



Submit your article to this journal [↗](#)



Article views: 373



View related articles [↗](#)






View Crossmark data [↗](#)



Citing articles: 2 View citing articles [↗](#)

Claims and counterclaims: institutional arrangements and farmers' response to the delivery and adoption of innovations in the Okavango Delta, Botswana

Sekondeko Ronnie Noga ^{a,b}, Oluwatoyin Dare Kolawole ^a,
Olekae Tsompi Thakadu ^a and Gaseitsiwe Smollie Masunga^a

^aOkavango Research Institute, University of Botswana, Maun, Botswana; ^bDepartment of Agricultural Research, Ministry of Agricultural Development and Food Security, Maun, Botswana

ABSTRACT

Purpose: This article examined how institutional factors influencing the promotion of two elephant crop-raiding deterrent innovations (ECDIs) introduced to farmers through a ministry-based extension system in the Okavango Delta, Botswana, have impacted farmers' adoption behaviour. *Methodology:* A standardised interview schedule was used to elicit responses from 388 randomly sampled subsistence arable farmers on how institutions influenced the adoption of ECDIs in five communities in the study area. This was complemented by focus group discussions to obtain in-depth information on the subject-matter. Key informants interviews were also conducted with purposively selected extension agents, village project committee chairpersons and village dikgosi. *Findings:* Four institutional factors were found to be critical for the adoption of ECDIs. These include institutional relations, availability and/or supply of deterrent innovation inputs, farmers' contact with extension agents and government support for extension services. *Theoretical Implications:* Immediate and widespread adoption of ECDIs in the ever-changing socio-economic and political environment can be enhanced by context-specific institutional arrangements in addressing social and organisational constraints to innovation adoption. *Originality:* This paper invoked organisational theory to contribute to the scholarly debate on how agricultural extension systems influence farming clientele's behaviour and social change. It offers the first attempt in the investigation of the role of extension and associated institutions/organisations in promoting adoption of ECDIs among subsistence farmers in the Okavango Delta, Botswana. Findings indicate that local farmers do not perceive extension agencies to hold monopoly of ideas and solutions to their unique problems.

ARTICLE HISTORY



Received 10 May 2016
Accepted 25 October 2016

KEYWORDS

Adoption; biodiversity; conservation; extension; food security; innovations; institutions; perceptions; subsistence farmers

Introduction

Institutions that develop and/or spread agricultural innovations play a fundamental role in ensuring that their clientele system adopts them (Meinzen-Dick et al. 2004). This is

CONTACT Sekondeko Ronnie Noga  sr.nogas@gmail.com, snoga@gov.bw  Okavango Research Institute, University of Botswana, Private Bag 285, Shorobe Road, Sexaxa, Maun, Botswana; Department of Agricultural Research, P.O. Box 151, Maun, Botswana

achieved through their influence and regulatory power on how and when innovations are implemented (King et al. 1994). Thus, prior to the introduction of any agricultural innovation, new institutional arrangements that enable adoption of the new practices are necessary. Adoption of some innovations may require access to markets for inputs and outputs, supply of complementary inputs, appropriate government policies and information dissemination, as well as specialised training, which are institutional factors far beyond individual person's control (Lionberger 1960; Hornik 2004). All things being equal, removal of institutional barriers can facilitate a quick adoption of innovations by subsistence farmers (Muzari, Gatsi, and Muvhunzi 2012). It is argued that one way to achieve this is by consulting with the people to understand how best they feel they can be assisted. This process is important in that it helps to align the new institutional arrangements with locally related, contextual factors such as culture and power relations that govern how people interact and learn within a given society (Meinzen-Dick et al. 2004). According to Juma (2011) and Brooks and Loevinsohn (2011), development, dissemination and use of agricultural innovations should result from actions and interactions of different key stakeholders such as farmers, governmental and non-governmental institutions, who concertedly can greatly enhance the adoption of an innovation. Such an approach demands greater consideration for innovation users' opinions in major decision-making processes to ensure that the technologies being pushed meet users' needs and realities (Tendler 1993). The role of institutions advocating change should then be to systematically coordinate and facilitate stakeholder interactions in a way that is effective, trustworthy and inclusive to achieve desirable results (King et al. 1994; Meinzen-Dick et al. 2004).

The Okavango Delta – a UNESCO World Heritage Site – remains one of the elephant hotspot areas in northern Botswana (ODMP 2002). Thus, the need to conserve nature and at the same time promote local people's agricultural livelihood activities has remained a development conundrum in the area. Consequently, the subsistence arable farmers (and the entire rural communities) living within the area are constantly in conflict with problem elephants (NPR 2007; Warner 2008; Songhurst and Coulson 2014). Without any doubt, crop-raiding by elephants have affected food supply and economies of individuals and their families in the Okavango Delta, Botswana (NPR 2007). Ultimately, human–elephant conflict continues to receive attention from the government, wildlife managers and international agencies. A series of initiatives directed towards mitigating the conflict has been underway in the Okavango Delta since 2007. The Department of Wildlife and National Parks (DWNP), which is a ministry-based extension system tasked with the onus of directing and coordinating the elephant crop-raiding mitigation initiative, began providing technical assistance to the Village Project Committees (VPCs). The committees were constituted and established in each trial community by the DWNP with the mission to diffuse elephant crop-raiding deterrent innovations (ECDIs). These contact farmer groups were then expected to train other farmers on how to promote chilli pepper and beehive fence innovations across five rural communities in the eastern side of the upper panhandle along the Okavango River. The past nine years saw a growing advocacy that chilli pepper and beehive fence are important and effective in preventing crop-raiding elephants from entering fields and destroying crops.

Despite the growing awareness of ECDIs, studies by Mmape (2012) and Noga et al. (2015) in the Okavango Delta indicated that subsistence farmers have not been sufficiently

responsive in adopting the innovations, especially beehive fence. These studies found that farmers' low levels of income, education and inadequate contact with extension agents, limited farm labour and inputs, as well as farmers' unfavourable perceptions of ECDI effectiveness were major constraints to adoption. The findings, although preliminary, gave important scholarly insights on the factors influencing adoption of ECDIs in the area and called for the implementation of a more comprehensive study. Also, results from these studies generally corroborated the findings obtained in Graham and Ochieng's (2008) study which found labour and resource constraints, age of farmers and local politics to have impeded the adoption of ECDIs, which they referred to as farm-based elephant deterrents. The aforementioned studies traditionally focused on personal, cultural and socio-economic characteristics of farmers, but with little or no attention paid to institutional factors influencing the adoption of ECDIs.

However, there is an emerging view in literatures (although not entirely novel) that suggests that non-institutional factors (such as personal, demographic, socio-economic backgrounds and innovation-specific characteristics) are somehow connected to a number of institutional factors which are arguably fundamental to explaining the probability of innovation adoption (Kolade, Harpham, and Kibreab 2014). A reconnaissance survey carried out in the study area showed that DWNP provided farmers with necessary inputs and training free of charge (as incentives to adopt these innovations) on how to properly implement the ECDIs initiative.

All that said, the thrust of this paper is to examine institutional factors influencing the adoption of ECDIs in the Okavango Delta, Botswana. The article, therefore, addresses specific questions of how: (1) contact between farmers and extension agents has affected adoption of ECDIs in the area; (2) institutional relations between extension agents and farmers have affected adoption of ECDIs; (3) access to necessary inputs has influenced farmers' decisions to adopt or not adopt ECDIs; and (4) the role of government in extension services has affected DWNP's effectiveness in promoting ECDIs in the Delta.

Theoretical approach

In examining the institutional factors influencing farmers' adoption decisions of ECDIs in the Okavango Delta, the paper drew largely upon institutional theory of organisations (Meyer and Rowan 1977; DiMaggio and Powell 1991; King et al. 1994; Scott 2005) to understand how extension and cognate institutions affect farmers' adoption behaviour. Organisational theory (OT) is, in fact, a meta-theory of organisations, and as such derives its theoretical propositions from other theories to explain human behaviour and social actions (Dacin, Goodstein, and Scott 2002). Modern theories of organisations tend to be based on the notion that an organisation is a system which has to adapt to changes in its environment (Kast and Rosenzweig 1972; Scott 1981). The concept of environments is adjudged fundamental or foundational in OT because they are conceived to play a prominent role in creating and shaping organisational structures, processes and activities that help the organisation to achieve its purpose (Scott 1981).

Although the relationship between an organisation and its environment, particularly social environmental actors (individual, group or organisation), is and should be a two-way flow of communication, most organisations surreptitiously attempt to adopt a one-way approach in influencing the behaviour of their stakeholders or clientele system

(Walonick 1993). When promoting a new practice, for example, an organisation uses its influential capacities to persuade a target community to adopt the innovation or does so by invoking its regulatory powers such as directives or actions that limit the hapless users' choice of options (King et al. 1994). According to Rogers (2003), organisations may also use incentives (in whatever form) to support and motivate potential adopters in adopting an innovation. The bottom line is to alter people's behaviour in a way deemed desirable by the organisation. But rather than predispose themselves to know better than the target community, organisations (or their representatives) need to carefully engage their clientele system with a view to enabling them understand and eventually accept the change that is being promoted. A favourable relationship between an organisation and the clients is thus crucial for the success of any development programme (Haider and Kreps 2004).

There are suggestions that successful interaction of an organisation with its environment enhance organisational performance (Rice 1963; Meyer and Rowan 1977; Scott 1981; DiMaggio and Powell 1983). Thus, a good fit between technical and institutional imperatives is supposed to yield an effective and efficient system (Lawrence and Lorsch 1967; Hassard 1993; Scott and Davis 2007). As Rice (1963) asserts, the primary role of a leader (or change agent) should then be to create and manage such an appropriate relationship, which is devoid of rancour and suspicion. To successfully carry out its duties, however, an organisation should have both financial and motivated, skilled human resources to do so (Belay and Abebaw 2004). Thus, OT emphasises the importance of healthy communication and integration of both individual and organisational interests which affect the overall organisational effectiveness (Blau and Scott 1962). In their study of Electronic Data Exchange, Lyytinen and Damsgaard (2001) argue that innovation success depends not only on individual adopters' goals and desires, but also on the effectiveness of institutional and regulatory regimes. The government as the regulator and overseer plays a vital role in creating an enabling environment for organisations to flourish (Scott 1981).

Methodology

Study area

The study was undertaken in five rural communities within the Okavango sub-district, north-western Botswana (Figure 1). The Ngamiland region is notable for its exceptional inland delta known as the Okavango Delta (Kgathi et al. 2006), which supports a dazzling array of wildlife and vegetation species (Mendelsohn and el Obeid 2004). The last two aerial surveys of wildlife in Botswana have shown a growing elephant population in the eastern Okavango Delta Panhandle (Chase 2011; DWNP 2012). The population grew from about 14,000 in 2011 (Chase 2011) to approximately 15,000 individuals in 2012 (DWNP 2012). The Okavango River, which emanates from the Angolan highlands and flows through Namibia, empties into the upper Okavango Delta in north-western Botswana (Ramberg et al. 2006). The River's water and ecosystem resources are critical for the survival of the riparian community people (Kgathi et al. 2006) and wildlife (including elephants) in the area.

The 2011 national census figures show that there are 16,306 people living in the Okavango sub-district (Central Statistics Office 2011a). And most of them live in villages and

settlements spread along the Okavango River. Population sizes within studied villages range between 630 and 2700 people of diverse ethnic groups and livelihood strategies. However, subsistence agricultural activities are a commonality among the people. Gudigwa village is located in the distal end of the Okavango sub-district, with its inhabitants consisting largely of BaSarwa ethnic group (Taylor 2002). In their new struggle for socio-economic advancement in the modern era of economic and political change (making them to be marginalised from their traditional way of life) (Vogt 2007), the BaSarwa now grow crops and rear livestock, among other things. The people in Beetsha comprise mainly the HaMbukushu (who are predominantly crop and livestock farmers), and a number of BaKgalagadi and BaSarwa ethnic extractions. While Eretsha community comprises two ethnic groups, which are of the HaMbukushu and BaYei extractions, Gonutsuga community is home to mostly the BaYei ethnic group. Seronga village, which can be described as the capital of the eastern side of the upper panhandle villages (of the Okavango sub-district) on the account of a higher population and economic activities, comprises a combination of the above-mentioned ethnic groups who pursue various livelihood activities, but largely farming.

Nearly half (47.3%) of the people live below the poverty datum line and about 29.3% of them are unemployed (Central Statistics Office 2011b). Hence, subsistence agriculture remains predominantly an important livelihood strategy in the area (Motsholapheko, Kgathi, and Vanderpost 2011). Crop production is mostly occurring near the Okavango River (Tawana Land Board 2005; VanderPost 2009), with a high population of elephants ranging all over the area. Thus, subsistence arable farmers are riddled with elephant crop-raiding (Masunga 2007; NPR 2007).

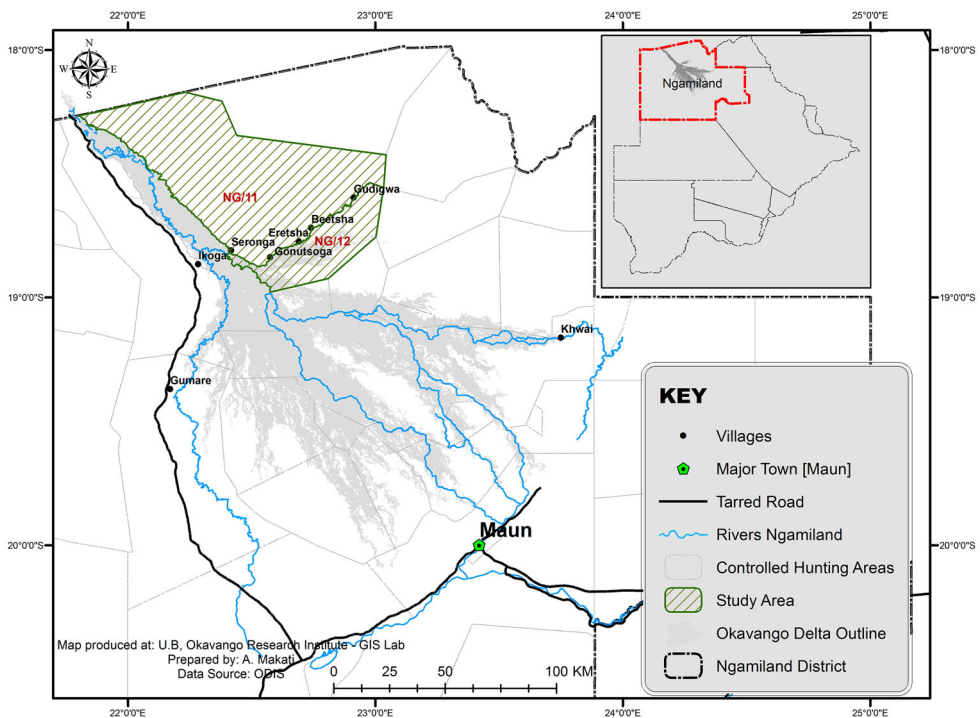


Figure 1. Map of the Okavango Delta showing study sites and elephant range (NG11 and NG12).

Study design

The study used a descriptive and interpretive cross-sectional design to investigate the influence of institutional factors on subsistence, arable farmers' adoption behaviour. This research was implemented through a single occasion, data collection from multiple information sources within a relatively short time (Johnson and Christensen 2013). The data were then analysed largely through qualitative and partly quantitative methods. Qualitative research is rooted in the interpretive paradigm which '... is concerned with how the social world is interpreted, understood, experienced, produced or constituted' (Mason 2002, 3). It posits that each person's reality is unique, providing unique insights into why they behave in the manner they do, and that the reality can be understood most effectively through or from the perspectives of that individual (Jonassen 1991; Creswell et al. 2003). Interpretivist paradigm is thus organised around the idea of natural context observation, including the relationship between the researcher and the researched, which is central to understanding the phenomenon under investigation in a deep, comprehensive manner (Gelo 2012).

In order to gain an in-depth understanding of respondents' subjective experiences while also enhancing credibility of the study, data triangulation comprising quantitative (using semi-structured interview schedule) and qualitative (focus group discussions [FGDs] and key informant interview) approaches was employed to collect relevant information (Creswell et al. 2003; Kuper, Lingard, and Levinson 2008). Also, we ensured 'trustworthiness' of the findings by adopting a non-judgemental position towards the thoughts and words of participants (especially during interviews) and consistently examined the underlying ideas, assumptions and conceptualisations that are theorised as shaping or forming the behaviour of farmers in relation to ECDIs (Krefting 1991).

Community entry protocol was observed prior to the commencement of the research. This is because it is a common practice in Botswana to first consult and seek consent from community leadership such as village *dikgosi*¹ before conducting any study in their area of jurisdiction. This was done in an effort to explain the purpose and goal of the study and to also build mutual understanding and trust with the people in order to motivate them to participate in the study and truthfully respond to research questions. Besides, individual consent was sought from all respondents, including explaining to them the purpose and why they were requested to participate in the study. Moreover, respondents were informed that their participation was voluntary and were free to withdraw from the study whenever they felt so without necessarily having to give explanations. Overall, the study's protocol was approved by the Ministry of Environment, Wildlife and Tourism, and by the Ethics Committee of the University of Botswana.

Sampling procedure and sample size

The study sample comprised subsistence arable farmers from five villages (Seronga, Gonutsuga, Beetsha, Eretsha and Gudigwa) participating in a pilot project initiated by DWNP aimed at testing the efficacy of chilli pepper and beehive fence as preventative measures against elephant crop-raiding. The villages experience relatively high frequency or severity of elephant crop-raiding incidents (see, e.g. NPR 2007). But in spite of this challenge and perhaps due to the rampant poverty and lack of paid employment in the area

(Central Statistics Office 2011b), the population continues to rely heavily on subsistence farming for their livelihoods (NPR 2007; Motsholapheko, Kgathi, and Vanderpost 2011).

Given this scenario and with the lack of available farmer's associations and/or limited access to farmer database in the study area, households were used as 'point of entry' to individual arable farmers. Thus, the 2011 national census enumeration area maps were used to verify the number and location of households in the villages. Using a simple random sampling technique, a total of 388 farmers was selected from the list of all households in the individual villages at 99% confidence level and with a margin of error of 4.47. The sampling procedure followed this order: all households in each village were sequentially listed in separate pieces of paper, and then the required sample size (the equivalent of 30% of the households) was drawn one by one from the complete collection (Eaton and Kessler 2012). With the help of VPC members, 10 male and female arable farmers (5 piece) known to have opinions and experience on the subject-matters from each of the five villages were purposively selected to participate in FGDs (Marshall 1996b). Generally, the sample sizes provide sufficient power to allow for reliable estimations of ECDIs adoption, responses on the institutional arrangements and to perform basic statistical analysis (Balnaves and Caputi 2001).

Furthermore, a key informant sample involving two extension agents from the DWNP, five village *dikgosi* and five VPC chairpersons from the respective study communities was chosen for the study. The selection of this category of people was generally informed by the knowledge they possess about the subject-matters under investigation (Marshall 1996b), and special positions of responsibility and influence they occupy in their communities or those in which they operate (Marshall 1996a).

Data collection

The study was conducted between February and July 2015 on the eastern side of the Okavango Delta Panhandle in north-western Botswana. Data were collected through formal interviews and five FGDs. Standardised interview schedules, designed with open- and close-ended questions were administered by one of the researchers and two trained enumerators recruited from the Okavango Research Institute. Farmers were asked about their contact and institutional relations with extension agents, access to the supply of inputs for implementing mitigation measures, and their awareness of the role of government in extension services and whether or not they have adopted one or both of the ECDIs, and the reasons for doing so. A reconnaissance survey was first carried out in December 2014 with a view to ensuring adequate planning and informed decision-making to guide and improve the main data collection efforts (Denzin and Lincoln 2005; Creswell and Plano Clark 2007; Creswell 2013). Overall, the preliminary information obtained was used to construct valid questions in the research instruments, namely interview schedule, key informant and FGD guides. Besides, the content and adequacy of the instruments were jointly developed by researchers and further judged by a panel of experts in Social Sciences at the Okavango Research Institute.

Contact with extension agents was measured by the number of times the farmer was visited by extension agent per quarter. Institutional relations, access to inputs and the role of government in extension services were measured by close-ended and open-ended questions. To measure farmers' adoption status, the researchers computed the

adoption index from the ECDIs introduced by DWNP to arable farmers. Here, adoption meant an individual farmer's decision to incorporate either chilli pepper or beehive fence or both into their on-going arable farming practices. Considering that two innovations were introduced, a farmer who had adopted both the ECDIs had an index of 1 point, while those who adopted only one had an index of 0.5. Farmers who had not adopted any at all had an index of zero.

After the individual farmers' interviews, a FGD was held in each sample community to collect supplementary qualitative information on their opinions and perceptions about the ECDIs and their response to the delivery of these innovations by DWNP. A total of 12 key informant interviews were also held with extension agents from DWNP and some community leaders such as *dikgosi* and VPC chairpersons.

Data analysis

Descriptive statistics were used to summarise the data. Generally, descriptive analyses were used to estimate the proportion of respondents who were aware of the role of government in extension services, number of contacts with extension agents, as well as the adoption of ECDIs among the respondents. Analysis of the associations between extension delivery strategies and farmers' adoption of ECDIs was determined using Pearson chi-square test of independence at 5% significance level. But prior to using the statistic, we verified all underlying assumptions, including the assumption underscoring the need for a minimum cell (of expected) frequency of five, two variables measured either at nominal or ordinal level and observations being independent of each other (Field 2009; McHugh 2013).

Qualitative data generated through key informant interviews and FGDs were recorded and transcribed. Thematic analysis was used in the description of qualitative data (Braun and Clarke 2006; Liamputtong 2009). Themes within data from FGDs and key informants interviews were continuously identified as data collection was ongoing in order to respond to inevitable changes brought about by the uncontrolled, natural setting, interactions and evolving events in which the study was undertaken (Patton 1990). Although key themes were generated in a theoretical approach, resulting in themes of institutional context (Boyatzis 1998; Frith and Gleeson 2004), analyses were conducted mainly within the interpretative paradigm (or latent thematic analysis) to describe and understand the underlying processes that shape and give meaning to farmers' adoption behaviour towards ECDIs implementation (Jonassen 1991; Creswell et al. 2003). Most importantly, interpretation of the relevant experiences, opinions and perspectives of respondents were not only based on their prevalence as 'measured' by the number of different speakers who articulated them, but also in terms of whether they captured 'important information' in relation to the overall research question (see Braun and Clarke 2006 on this important subject).

Results and discussions

Adoption of ECDIs

Over two-thirds (69%; $n = 268$) of farmers in the study adopted chilli pepper. However, only one farmer (0.3%) used the beehive fence innovation. While only two farmers

(0.5%) have incorporated both innovations, a relatively large proportion of farmers (30.2%; $n = 117$) said they had not adopted them at all. These farmers indicated that they used traditional methods (such as drumming, guarding and lighting fire all night) to deter crop-raiding elephants. In some cases, farmers who initially adopted the innovations had discontinued their use citing ineffectiveness of ECDIs in preventing elephant crop-raiding as the major reason. Nonetheless, the perceived complex nature of the procedures for implementing the innovations and their labour-intensive attributes, particularly beehive fence, were among other reasons adduced for discontinuance. However, detailed explanations on the adoption or non-adoption of the ECDIs are subsequently discussed in some parts of the following sections of the paper.

Institutional factors influencing farmers' adoption behaviour

Farmers raised a number of issues associated with the adoption of ECDIs during individual interviews and FGDs conducted in the study. Insufficient contacts with extension agents, stakeholder (institutional) relationship and limited access to inputs, as well as government's limited support for extension services were among the factors highlighted by farmers in the study area.

Contact with extension agents

Individual interviews and FGDs with farmers showed that there were concerns about farmers' contact with extension agents. Majority of the farmers (72.9%, $n = 283$) indicated that they were contacted by extension agents only once per quarter (Table 1). According to these farmers, inadequate contacts with the extension agents restricted information acquisition and understanding of how to properly implement the innovations. To them, the insignificant adoption of ECDIs, especially beehive fence is due in part to their lack of expertise on the implementation of the innovations. Expressing their limited knowhow, some of the farmers remarked that 'We were only given inputs but without any training to help us understand how to properly implement the innovations'.

One particular farmer in Eretsha had this to say:

I don't think we have had enough training to effectively use the deterrent innovations prescribed by the extension agency. While the trainings carried out by VPCs were not thorough and sketchy, extension agents never visit us at our fields to conduct field demonstrations and provide advice.

The above comment is a reflection of how farmers felt the DWNP should have handled the implementation of the ECDIs. Thus, farmers were of the opinion that a majority of them

Table 1. Farmers' contact with extension agents in the Okavango Delta, Botswana.

Number of extension contacts	Frequency	%
Once/quarter	283	72.9
Twice/quarter	91	23.5
Thrice/quarter	10	2.6
Always	4	1.0

Source: Fieldwork (2015).

would have understood the intricacies involved in the adoption procedures of the innovations if extension agents had visited them with the aim of giving advice and demonstrating ECDIs on their fields. This finding is consistent with that of Elias and his team which found that perceived frequency of extension contact had a positive impact on farmers' overall satisfaction with the agricultural extension service in North West Ethiopia. They posited that regular contacts between extension agent and farmer could provide information as well as help farmers to develop trust and make them accountable to adopt improved technologies (Elias et al. 2016).

Contrary to the viewpoint of farmers on lack of training, the extension personnel opined that farmers were sufficiently trained to imbibe the skill of implementing the introduced innovations. One extension agent pointed out that:

... at the beginning of the training for each component of the deterrent innovations, we do consult with experts in an attempt to make people better understand technical issues on ECDIs; what the innovations are all about, how they are used, how to construct, say, beehives, and all the rest. All these were done to the extent that some farmers went outside the country for benchmarking ...

The contradictions in the above claim, however, quickly came to the fore when the agent further noted that it was not possible to train or send all farmers abroad for benchmarking, effectively acknowledging that some farmers may have lacked necessary expertise in implementing the ECDIs. In furtherance of their claim, the two extension agents interviewed argued that besides the workshops they normally conduct for farmers, VPCs were meant to always have people on the ground, and make information about ECDIs available to farmers and as well assist them in the adoption procedures. Indeed, the extension agents stood their ground saying that VPCs (serving as contacts points) were the necessary platforms meant to promote adoption. This viewpoint corroborates the diffusion theory which assumes that a diffusion–adoption process that involves local players serving as change agents (who are generally homophilious to the population to which change is introduced) is more likely to be effective in promoting behaviour change of individuals (Rogers 2003). Instead, extension agents attributed the low use of ECDIs to lack of commitment by farmers to implement these innovations, berating the latter for expecting everything to be done for them. In a way, the claims made by the extension agents countered those of the farmers (on the subject-matter), who in turn perceive extension agents as ineffective in the discharge of their statutory roles.

From the VPCs chairpersons' perspective, however, the low adoptions were due to extension agents' failure of not availing resources (such as vehicles) to the VPCs to train farmers. Interviews with all committee chairpersons consistently indicated that there were vehicles procured specifically for project implementation. To them, the laissez-faire dispositions of the extension agency to provide transport to enable the VPCs carry out their work with ease demonstrate lack of true commitment and dedication to extension policy targets. The VPCs chairpersons explained that farmers' fields are scattered around, with some being significantly distant away from villages, indicating that lack of transportation facilities has adversely affected the effectiveness of project implementation.

Contrary to VPC chairpersons' point of view, the extension agents explained that the idea behind the establishment of VPCs is to encourage local communities' ownership of

the ECDI project, indicating that members can interact easily with other community members without the need to travel long distances for assistance. It was further buttressed by the agents that a vehicle could only be temporarily provided to the VPCs when they needed to travel long distances or undertake joint activities. The extension agents also affirmed that while the committee members were each provided with a cellular phone and BWP100 (~US\$9.58) worth of airtime per month as well as a t-shirt for ease of communication and identification, each of the VPCs in all the five trial communities were given two bicycles to enable them commute easily to farmers' fields. Admittedly, these efforts are commendable. But it appears they were not done based on the understanding of the local context, particularly with the use of bicycles. Analyses showed that, due to the sandy terrain of the study area, bicycles were of no benefit to those for whom they were meant. This could only mean that VPCs had a genuine concern about the need for an appropriate transportation system. Indeed, one extension agent stated in our interview that there was only one vehicle provided for the DWNP to facilitate control and quick coverage of all the five villages by the leader of the project (referred to in this study as the project implementing extension agent). While acknowledging shortage of transportation facilities, the agent was, however, quick to mention that the VPCs were advised to draw up their work plans so that all could easily be assisted with transport when the need arose. It is, therefore, probable that lack of capacity on the part of the VPCs may have resulted in their inefficiency. In the end, the claims and counterclaims made by both farmers and extension agents may not have been mutually exclusive after all. The problem lies in the way both stakeholders perceive their roles and responsibilities and how they are discharged in line with the available facilities. Of course, communication and information failure may engender frictions in interpersonal relations between stakeholders where these are not promptly addressed. Herein lies the need for individual parties to understand and agree from the outset, on what needs to be done; why it has to be done; by who; and how to do it at designated times and locations (see for instance, Kolawole 2010).

Nonetheless, a chi-square test of independence showed that VPCs contributed significantly to farmers' adoption decisions of ECDIs, $\chi^2(4, n = 388) = 42.29, p = .00$. The significant association between VPCs and farmers' adoption decision suggest the important role played by the VPC towards the adoption of ECDIs. Ultimately, it is necessary for extension agents to strongly support VPCs in their work to ensure that farmers acquire the right knowledge on ECDIs and are adept at using them. But prior to this, it is crucial for extension agents to do a situational analysis to identify problems and their causes. It is also imperative to do the same in relation to human and other resources with a view to ensuring that available resources are productively used. The success of this action, however, may depend on a favourable institutional relationship between extension agents and the clientele system (Haider and Kreps 2004).

Institutional relations and farmers

As earlier noted, involvement of local people in the ECDIs project through the formation of VPCs was essential to enhancing receptivity and consequent adoption of ECDIs. Although some local communities applauded the VPC initiative, interviews with VPC chairpersons, however, pointed to one thing: there were issues of power relations

between extension agents and VPC members, which urgently required attention if the elephant crop-raiding mitigation programme was to fully realise its potential. The VPCs described themselves as nothing more than a distribution channel of inputs provided by DWNP. Many of the VPC chairpersons expressed a feeling of powerlessness as one VPC chairperson rejoined that '[i]t seems to me that our role is simply to deliver inputs to the farmers; we have no powers to make or influence any key decision about the implementation of the project'. We argue, therefore, that this is the more reason why farmers attributed the low levels of ECDIs adoption to the 'failure' of extension agents to listen to their advice with regard to problem identification, analysis and the way forward.

But as DeCaro and Stokes (2008) point out, local stakeholders should be fully empowered to take lead in issues that affect them by including them in management decisions so that they are able to genuinely administer and manage any development initiative, here in this case, elephant crop-raiding mitigation programme. This will motivate local partners and makes it more likely for them to support any development programme, as in the case of implementing ECDIs and sustaining them (DeCaro and Stokes 2008; Zimmermann et al. 2009; Madden and McQuinn 2014). Failure to do so may cause local people to 'revolt against' the development practice and (deliberately) fail to implement or sustain any introduced innovations (Sitati and Walpole 2006; Songhurst 2010), even if they were beneficial.

Throughout the FGDs, discussants were apt to conclude that extension agents had no respect for rural communities, and as such had no empathy for their situations. FGD discussants were more concerned that the government is doing little to assist them. A Gudigwa farmer said:

... most government officials do not take us [people living in rural areas] or what we say seriously. Wildlife managers take a long time to respond to reports of crop-raiding incidences, and at times they never show up. Elephants destroy our crops and leave us with nothing to feed our children. We have complained several times about the issue, but no one seems to be listening to us. But when you kill an elephant, DWNP officials will immediately be all over the place. Clearly, wild animals are being valued and prioritised over the people.

This remark indicates that community people perceive social interactions that are characterised by respect and courtesy as key to development practice. As Juma (2011, 15) points out, '... [t]he process of technological innovation involves interactions among a wide range of actors in society, who form a system of mutually reinforcing learning activities ...' Thus effective institutional relationships influence stakeholders' attitudes, decisions, and actions for mutual benefit.

Although the extension agents dispelled claims by VPC chairpersons and those of farmers, they could, however, not confirm that they implemented local communities' suggestions in the process of implementing ECDIs. Instead, they alleged that the VPCs failed to produce a plan on how they could be better assisted. One extension agent said '... we hold meetings more often with all the VPCs as part of our commitment to work with local people and provide them a platform to raise their concerns and problems'.

Moreover, the extension agents unanimously opined that:

... the achievement of the project objectives normally depends on how its beneficiaries have received it. Batswana generally do not like to fully take charge of things. They expect you to

do things for them from the beginning to the end. We do not encourage this. We want people to stand up for themselves and make efforts to augment the efforts of government toward the success of any project.

The above remarks, however, beg the question of whether or not the VPCs were adequately accorded the technical training and skills to enable them draw up their own plans without the assistance of extension agents. From Belay and Abebaw's (2004) perspective, the role of extension agents goes beyond mere technology transfer but also has to do with the development of the rural people themselves. Therefore, extension agents need to discuss pertinent social issues with local stakeholders, identify problems together and support them in the problem-solving process. Elsewhere, Mugwagwa, Wamae, and Outram (2010) and Brooks and Loevinsohn (2011) had argued that change agents need to constantly engage and communicate with their stakeholders to achieve sustainability of new practices in the ever-changing innovation environment.

Access to inputs

Access to input and markets influences the adoption of agricultural innovations (Mazvivi-mavi and Twomlow 2009; Muzari, Gatsi, and Muvhunzi 2012). Given that farmers have access to inputs provided by the extension agency (i.e. DWNP), it is logical to suggest that this may have increased the probability of ECDIs adoption among farmers. In the FGDs and interviews held with the farmers, participants cited, among others, limited access to necessary and supplementary inputs (such as used oil or grease) as major constraints impeding the adoption of ECDIs. Nonetheless, the extension agents pointed out that there were limited sources of necessary inputs available locally, particularly chilli pepper. They particularly stated that 'there were attempts by the DWNP to directly produce chilli pepper locally, and or encourage community trustees or individual farmers to grow the chilli pepper as a buffer plant in their fields'. At the time of these investigations, however, it was discovered that the initiative was yet to be implemented in the area; even the DWNP had not planted chilli pepper in their field located in Eretsha village (see Figure 1). It is, however, noteworthy that only one semi-commercial farmer on the fringes of Seronga was found to have planted chilli pepper as a buffer plant in his field. As chilli pepper was largely sourced from abroad, the extension agents indicated that procurement of inputs had been costly, thus greatly impacting supply to farmers. This scenario may have provided the opportunity for farmers to utilise local/indigenous knowledge and methods to address not only the complexities that are associated with the new practices, but also input supply concerns. There is need, therefore, to improve and encourage use of indigenous methods because it is sustainable and farmers are familiar with them which in turn encourages their sustainability (Kolawole 2001; Korzun, Adekunle, and Filson 2014).

The role of government in extension services

As a government institution, DWNP relies heavily on government funding to carry out its mandate. Thus, the amount of resources/funds allocated to the extension agency plays a significant role in ensuring better public service delivery. Farmers were interviewed (individually and in focus groups) with a view to finding out whether they understood the role

of government in extension services. Most (70.1%, $n = 272$) farmers said that government provided logistic and financial support to drive extension activities. Nonetheless, others opined that the government was not doing enough in terms of training extension personnel and promoting extension activities. The subsistence farmers expressed dissatisfactions with government's failure to create enough extension offices in the study area, which they said would otherwise have addressed the challenge of inaccessibility to information sources. Also, the issue of compensation for crop damage (caused by elephant raiding) emerged in the FGD sessions held with farmers. Apart from the cumbersome nature of the compensation scheme, farmers complained that the amount of money paid was not commensurate with the extent of damages caused by elephants. They, therefore, called upon the government to review the compensation policy in order to adequately address their concerns. Clearly, community people understand what the government should do to improve the productivity of the extension agency.

In the same vein, one extension agent underscored the need for government to provide extension personnel both extrinsic and intrinsic motivations to enable them discharge their responsibilities effectively. He specifically pointed out that 'public personnel working in rural areas would require morale boost either through proper housing, promotion at work, further training and/or salary increments'. Admittedly, the efficiency of extension work depends principally on well trained and motivated extension personnel who are committed and responsive to the ever-changing social, economic and political environment (Birkhaeuser, Evenson, and Feder 1991; Belay and Abebaw 2004). This view finds relevance in OT, which suggests the need to capacitate both organisation and its personnel for optimal organisational performance (Blau and Scott 1962). On compensation scheme, the extension agents, although providing some sweeping comments, conceded that the current compensation structure for wildlife damages may not necessarily be addressing increases in the farmers' cost of living. Indeed, adequate compensation of farmers would probably serve as a relief from their social and economic hardships, thereby encouraging farmers to have a better perspective about the value of elephants and their conservation (Jackson et al. 2008). Incorporating a compensation system into the broader elephant crop-raiding mitigation programme would appear effective, at least theoretically, in addressing elephant crop-raiding through the use of non-consumptive elephant deterrent methods such as chilli pepper and beehive fence to scare away elephants from crop fields. In the end, the success of the project should not be a matter of chance but immense contribution of the government in creating conducive institutional environment for achieving food security and environmental conservation.

Conclusion

This paper employed institutional theory of organisations to analyse the effects of institutional factors on the delivery and adoption of ECDIs in the Okavango Delta, Botswana. It probed a ministry-based extension system's (i.e. DWNP's) roles in agricultural development in local communities with specific emphasis on its contact with farmers and supply of necessary inputs to its clientele system. In other words, the paper provided answers to the question on the extent to which government's role in extension services has affected DWNP's effectiveness in promoting adoption of ECDIs in the study area. The findings revealed that almost 70% of the sampled farmers adopted at least one ECDI while 30%

did not adopt any at all. Findings also showed that institutional relations, availability and/or supply of deterrent innovation inputs, farmers' contact with extension agents, government support for extension services and the roles of extension agents affected farmers' adoption or non-adoption decisions. However, the supply of inputs and training by both DWNP and VPCs may have increased the likelihood of ECDI adoption. This suggests that adoption of ECDIs and ultimately reduction in human–elephant conflict (HEC) is achievable if access to institutional extension support is broadened in the affected communities, and where, from the onset, a more participatory approach that puts emphasis on strengthening local people's HEC problem-solving capacities is implemented.

That said, the bureaucratic bottlenecks associated with the current approach to HEC management in the Okavango Delta may have made local communities as mere implementers of government programmes and not co-partners, and decision-makers who otherwise should have the wherewithal to determine their own destiny (NPR 2007). The results demonstrated the importance of meaningful communication and institutional relations between DWNP and the local community in securing a consolidated effort to push for the success of the ECDI initiative. Based on the claims and counterclaims elucidated in this paper, lack of proper grassroots consultation from the onset of the ECDI initiative, limited resources and ambiguities associated with project implementation are implicated in the failings of extension agents in their push for the adoption of the innovations (Webber, Hill, and Reynolds 2007). Similarly, contact between farmers and extension agents were also found to be crucial for achieving set objectives. While acknowledging the importance of local people's involvement in promoting the ECDIs project, the all-important role of the extension agents in bringing about social change cannot be overemphasised. The technical information and advice they provide remain handy in assisting farmers to understand the intricacies involved the adoption procedures of ECDIs. Rather than engage in buck passing, DWNP needs to employ appropriate strategic interventions that will facilitate the smooth discharge of VPCs duties.

Given that there were about 30% of the farmers who had not adopted the ECDIs and also some reported cases of innovation discontinuance, it is apparent that many challenges still exist in the area. As the ECDIs project is relatively new and arguably the first of its kind in the area, it is crucial to build capacity of extension agents in delivering quality extension services. Secondly, increased contact between the extension agents, VPCs and farmers is essential for providing veritable institutional support for farmers in their ECDIs implementation efforts. Thirdly, as chilli pepper is still mainly sourced outside Botswana, it is also important for the extension agency to make a concerted effort in ensuring that chilli pepper is produced locally for the purpose of enhancing the sustainability of the project. That said, an effective and efficient extension system can make these elephant deterrent innovations adoptable, sustainable and useful to the target community, thus contributing towards reduction of HEC and alleviating food insecurities among the rural populace. As things stand, the important role of government in extension services cannot be overemphasised. But then, stemming HEC in general remains an important problem for wildlife custodians and policy-makers to resolve in elephant inhabited countries like Botswana.

It is also important for policy-makers to address the prevalent, farmers' socio-economic hardships by having a rethink on the current crop damage compensation scheme. The provision of adequate reward system for those living side by side with wildlife is desirable

for a sustainable environmental conservation. In conclusion, it is necessary for future studies to focus on analysing the effectiveness of ECDIs and their relationships with farmers' outputs in the Okavango Delta and other similar social-ecological contexts.

Note

1. *Kgosi* is a democratically approved local/traditional leader of a particular social system or ethnic group. It's *dikgosi* when plural.

Acknowledgements

The authors gratefully acknowledge financial support from Southern Africa Science Service Center for Climate Change and Adaptive Land Management (SASSCAL) and the German Federal Ministry of Education and Research (BMBF). We thank the anonymous reviewers for their constructive and insightful comments that contributed to improving the quality of the final version. We are also indebted to DWNP and the rural communities, which we studied, for consenting to participate in this research.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This study was part of the Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) (Task 314) funded by the German Government through the Federal Ministry of Education and Research (BMBF).

ORCID

Sekondeko Ronnie Noga  <http://orcid.org/0000-0002-9908-6611>
Oluwatoyin Dare Kolawole  <http://orcid.org/0000-0002-3977-8747>
Olekae Tsompi Thakadu  <http://orcid.org/0000-0003-3903-4198>

References

- Balnaves, M., and P. Caputi. 2001. *Introduction to Quantitative Research Methods: An Investigative Approach*. London: Sage.
- Belay, K., and D. Abebaw. 2004. "Challenges Facing Agricultural Extension Agents: A Case Study from South-western Ethiopia." *African Development Review* 16 (1): 139–168.
- Birkhaeuser, D., R. E. Evenson, and G. Feder. 1991. "The Economic Impact of Agricultural Extension: A Review." *Economic Development and Cultural Change* 39 (3): 607–650.
- Blau, P. M., and W. R. Scott. 1962. *Formal Organizations: A Comparative Approach*. San Francisco, CA: Jossey-Bass.
- Boyatzis, R. E. 1998. *Transforming Qualitative Information: Thematic Analysis and Code Development*. Thousand Oaks, CA: Sage.
- Braun, V., and V. Clarke. 2006. "Using Thematic Analysis in Psychology." *Qualitative Research in Psychology* 3 (2): 77–101.
- Brooks, S., and M. Loevinsohn. 2011. "Shaping Agricultural Innovation Systems Responsive to Food Insecurity and Climate Change." Paper presented at the Natural Resources Forum.

- Central Statistics Office. 2011a. *Human Population and Housing Census*. Gaborone: Government of Botswana.
- Central Statistics Office. 2011b. *Preliminary Results of the Botswana Core Welfare Indicators (Poverty) Survey 2009/10*. Gaborone: Government of Botswana.
- Chase, M. 2011. Dry Season Fixed-wing Aerial Survey of Elephants and Wildlife in Northern Botswana. Kasane, Botswana: Elephants Without Borders.
- Creswell, J., and V. Plano Clark. 2007. *Designing and Conducting Mixed Methods Research*. Thousand Oaks, CA: Sage.
- Creswell, J. W. 2013. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Los Angeles: Sage.
- Creswell, J. W., V. L. Plano Clark, M. L. Gutmann, and W. E. Hanson. 2003. "Advanced Mixed Methods Research Designs." *Handbook of Mixed Methods in Social and Behavioral Research*: 209–240.
- Dacin, M. T., J. Goodstein, and W. R. Scott. 2002. "Institutional Theory and Institutional Change: Introduction to Special Research Forum." *Academy of Management Journal* 45 (1): 45–56.
- DeCaro, D., and M. Stokes. 2008. "Social-Psychological Principles of Community-Based Conservation and Conservancy Motivation: Attaining Goals within an Autonomy-Supportive Environment." *Conservation Biology* 22 (6): 1443–1451.
- Denzin, N., and Y. S. Lincoln. 2005. *Handbook of Qualitative Research*. London: Sage.
- DiMaggio, P. J., and W. W. Powell. 1983. "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields." *American Sociological Review* 48 (2): 147–160.
- DiMaggio, P. J., and W. W. Powell. 1991. "Introduction." In *The New Institutionalism in Organizational Analysis*, edited by Walter W. Powell, and Paul J. DiMaggio, 1–38. Chicago, IL: University of Chicago Press.
- DWNP. 2012. *Dry Season Aerial Census of Animals in Botswana*. Gaborone: Department of Wildlife and National Parks.
- Eaton, W. W., and L. G. Kessler. 2012. *Epidemiologic Field Methods in Psychiatry: The NIMH Epidemiologic Catchment Area Program*. Orlando: Academic Press.
- Elias, A., M. Nohmi, K. Yasunobu, and A. Ishida. 2016. "Farmers' Satisfaction with Agricultural Extension Service and Its Influencing Factors: A Case Study in North West Ethiopia." *Journal of Agricultural Science and Technology* 18 (1): 39–53.
- Field, A. 2009. *Discovering Statistics Using SPSS*. London: Sage.
- Frith, H., and K. Gleeson. 2004. "Clothing and Embodiment: Men Managing Body Image and Appearance." *Psychology of Men & Masculinity* 5 (1): 40–48.
- Gelo, O. C. G. 2012. "On Research Methods and their Philosophical Assumptions: "Raising the Consciousness of Researchers" Again." *Psychotherapie und Sozialwissenschaft* 14 (2): 111–130.
- Graham, M. D., and T. Ochieng. 2008. "Uptake and Performance of Farm-based Measures for Reducing Crop Raiding by Elephants *Loxodonta Africana* among Smallholder Farms in Laikipia District, Kenya." *Oryx* 42 (1): 76–82.
- Haider, M., and G. L. Kreps. 2004. "Forty Years of Diffusion of Innovations: Utility and Value in Public Health." *Journal of Health Communication* 9 (S1): 3–11.
- Hassard, J. 1993. *Sociology and Organization Theory: Positivism, Paradigms and Postmodernity*. Cambridge: Cambridge University Press.
- Hornik, R. 2004. "Some Reflections on Diffusion Theory and Role of Everett Rogers." *Journal of Health Communication* 9: 143–148. doi:10.1080/1081070490271610.
- Jackson, T. P., S. Mosojane, M. S. Ferreira, and R. J. van Aarde. 2008. "Solutions for Elephant *Loxodonta Africana* Crop Raiding in Northern Botswana: Moving Away from Symptomatic Approaches." *Oryx* 42 (1): 83–91.
- Johnson, B. R., and L. Christensen. 2013. *Educational Research: Quantitative, Qualitative, and Mixed Approaches*. 4th ed. London: Sage.
- Jonassen, D. H. 1991. "Objectivism Versus Constructivism: Do We Need a New Philosophical Paradigm?" *Educational Technology Research and Development* 39 (3): 5–14.
- Juma, C. 2011. *The New Harvest: Agricultural Innovation in Africa*. New York: Oxford University Press.

- Kast, F. E., and J. E. Rosenzweig. 1972. "General Systems Theory: Applications for Organizations and Management." *Academy of Management Journal* 15 (4): 447–465.
- Kgathi, D. L., D. Kniveton, S. Ringrose, A. Turton, C. Vanderpost, J. Lundqvist, and M. Seely. 2006. "The Okavango: A River Supporting its People, Environment and Economic Development." *Journal of Hydrology* 331 (1): 3–17.
- King, J. L., V. Gurbaxani, K. L. Kraemer, F. W. McFarlan, K. S. Raman, and C. S. Yap. 1994. "Institutional Factors in Information Technology Innovation." *Information Systems Research* 5 (2): 139–169.
- Kolade, O., T. Harpham, and G. Kibreab. 2014. "Institutional Barriers to Successful Innovations: Perceptions of Rural Farmers and Key Stakeholders in Southwest Nigeria." *African Journal of Science, Technology, Innovation and Development* 6 (4): 339–353.
- Kolawole, O. D. 2001. "Local Knowledge Utilisation and Sustainable Rural Development in the 21st Century." *Indigenous Knowledge and Development Monitor* 9 (3): 13–15.
- Kolawole, O. D. 2010. "Inter-Disciplinarity, Development Studies, and Development Practice." *Development in Practice* 20 (2): 227–239.
- Korzun, M., B. Adekunle, and G. C. Filson. 2014. "Innovation and Agricultural Exports: The Case of Sub-Saharan Africa." *African Journal of Science, Technology, Innovation and Development* 6 (6): 499–510.
- Krefting, L. 1991. "Rigor in Qualitative Research: The Assessment of Trustworthiness." *American Journal of Occupational Therapy* 45 (3): 214–222.
- Kuper, A., L. Lingard, and W. Levinson. 2008. "Critically Appraising Qualitative Research." *BMJ* 337 (aug07_3): a1035–a1035.
- Lawrence, P., and J. Lorsch. 1967. *Organization and Environment*. Cambridge, MA: Harvard University Press.
- Liamputtong, P. 2009. "Qualitative Data Analysis: Conceptual and Practical Considerations." *Health Promotion Journal of Australia* 20 (2): 133–139.
- Lionberger, H. F. 1960. *Adoption of New Ideas and Practices*. Ames: Iowa State University Press.
- Lyytinen, K., and J. Damsgaard. 2001. *What's Wrong with the Diffusion of Innovation Theory?* Jyväskylä: Springer.
- Madden, F., and B. McQuinn. 2014. "Conservation's Blind Spot: The Case for Conflict Transformation in Wildlife Conservation." *Biological Conservation* 178: 97–106.
- Marshall, M. N. 1996a. "The Key Informat Technique." *Family Practice. Oxford University Press* 13 (1): 92–97.
- Marshall, M. N. 1996b. "Sampling for Qualitative Research." *Family Practice. Oxford University Press* 13 (6): 522–526.
- Mason, J. 2002. *Qualitative Researching*. London: Sage.
- Masunga, G. 2007. Extent and Nature of Human–elephant Conflict in Northern Botswana. Department of Wildlife and National Parks, Maun, Botswana.
- Mazvimavi, K., and S. Twomlow. 2009. "Socioeconomic and Institutional Factors Influencing Adoption of Conservation Farming by Vulnerable Households in Zimbabwe." *Agricultural Systems* 101 (1): 20–29.
- McHugh, M. L. 2013. "The Chi-Square Test of Independence." *Biochemia Medica* 23 (2): 143–149.
- Meinzen-Dick, R., M. Adato, L. Haddad, and P. Hazell. 2004. *Science and Poverty: An Interdisciplinary Assessment of the Impact of Agricultural Research*. Washington, DC: International Food Policy Research Institute.
- Mendelsohn, J., and S. el Obeid. 2004. *Okavango River: The flow of a lifeline*. Cape Town, South Africa: Struik Publishers & RAISON.
- Meyer, J. W., and B. Rowan. 1977. "Institutionalized Organizations: Formal Structure as Myth and Ceremony." *American Journal of Sociology* 83: 340–363.
- Mmape, W. K. 2012. Adoption of Chili Pepper as Mitigation Measure for Controlling Human–elephant Conflict on Crop Raiding: A Case of Farmers in the Western Okavango Panhandle, Botswana. *Unpublished Undergraduate Report*. Okavango Research Institute, University of Botswana.

- Motsholapheko, M., D. Kgathi, and C. Vanderpost. 2011. "Rural Livelihoods and Household Adaptation to Extreme Flooding in the Okavango Delta, Botswana." *Physics and Chemistry of the Earth, Parts A/B/C* 36 (14): 984–995.
- Mugwagwa, J. T., W. Wamae, and S. M. Outram. 2010. "Agricultural Innovation and Food Security in Sub-Saharan Africa: Tracing Connections and Missing Links." *Journal of International Development* 22 (3): 283–288.
- Muzari, W., W. Gatsi, and S. Muvhunzi. 2012. "The Impacts of Technology Adoption on Smallholder Agricultural Productivity in Sub-Saharan Africa: A Review." *Journal of Sustainable Development* 5 (8). doi:5539/jsd.v5n8p69.
- Noga, S. R., O. D. Kolawole, O. Thakadu, and G. Masunga. 2015. "Small Farmers' Adoption Behaviour: Uptake of Elephant Crop-Raiding Deterrent Innovations in the Okavango Delta, Botswana." *African Journal of Science, Technology, Innovation and Development* 7 (6): 408–419.
- NPR. 2007. Okavango Delta Management Plan. Component 5: Wildlife Management – Human Elephant Conflict. *Final Report*. Natural Resources & People, Gaborone, Botswana.
- ODMP. 2002. Okavango Delta Management Plan. (edited by Project Secretariat), Government of Botswana, Maun.
- Patton, M. Q. 1990. *Qualitative Evaluation and Research Methods* (2nd ed.). Newbury Park, CA: Sage.
- Ramberg, L., P. Hancock, M. Lindholm, T. Meyer, S. Ringrose, J. Sliva, J. Van As, and Vander Post, C. 2006. "Species Diversity of the Okavango Delta, Botswana." *Aquatic Sciences* 68 (3): 310–337.
- Rice, A. K. 1963. *The Enterprise and Its Environment*. London: Tavistock.
- Rogers, E. M. 2003. *Diffusion of Innovations*. 5th ed. New York: Free Press.
- Scott, W. R. 1981. *Organizations: Rational, Natural, and Open Systems*. Englewood Cliffs, NJ: Prentice-Hall.
- Scott, W. R. 2005. "Institutional Theory: Contributing to a Theoretical Research Program." *Great Minds in Management: The Process of Theory Development*: 460–485.
- Scott, W. R., and G. F. Davis. 2007. *Organizations and Organizing: Rational, Natural, and Open System Perspectives*. Upper Saddle River, NJ: Pearson/Prentice Hall.
- Sitati, N. W., and M. J. Walpole. 2006. "Assessing Farm-based Measures for Mitigating Human Elephant–Conflict in Transmara District, Kenya." *Oryx* 40: 279–286.
- Songhurst, A. 2010. "Working Towards Coordinated Regional Approaches in Human–elephant Conflict Management." Paper presented at the Proceedings of a Workshop for the Kwando-Kavango Region Organized by Conservation International, Maun, Botswana.
- Songhurst, A., and T. Coulson. 2014. "Exploring the Effects of Spatial Autocorrelation When Identifying Key Drivers of Wildlife Crop-Raiding." *Ecology and Evolution* 4 (5): 582–593.
- Tawana Land Board. 2005. *Land Use Plan for Ngamiland*. Maun: Tawana Land Board.
- Taylor, M. 2002. "A History of Bugakhwe Territoriality." *Pula: Botswana Journal of African Studies* 16 (2): 98–109.
- Tendler, J. 1993. "Tales of Dissemination in Small-Farm Agriculture: Lessons for Institution Builders." *World Development* 21 (10): 1567–1582.
- VanderPost, C. 2009. "Molapo Farming in the Okavango Delta." Fact Sheet 7/2009. Harry Oppenheimer Okavango Research Centre, University of Botswana.
- Vogt, K. A. 2007. *Forests and Society: Sustainability and Life Cycles of Forests in Human Landscapes*. Wallingford: CABI.
- Walonick, D. S. 1993. "Organizational Theory and Behavior." Accessed April 11, 2016. <http://www.statpac.org/walonick/organizational-theory.htm>.
- Warner, M. Z. 2008. Examining Human–Elephant in Southern Africa: Causes and Options for Coexistence. Department of Earth and Environmental Studies, University of Pennsylvania.
- Webber, A. D., C. M. Hill, and V. Reynolds. 2007. "Assessing the Failure of a Community-based Human–Wildlife Conflict Mitigation Project in Budongo Forest Reserve, Uganda." *Oryx* 41 (2): 177–184.
- Zimmermann, A., T. E. Davies, N. Hazarika, S. Wilson, J. Chakrabarty, B. Hazarika, and D. Das. 2009. "Community-Based Human–Elephant Conflict Management in Assam." *Gajah* 30: 34–40.