Predictors of Knowledge-Sharing Behaviors Among Community-Based Natural Resources Organizations in the Okavango Delta, Botswana

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Abstract

The study investigated the relative contribution of selected predictors of knowledge-sharing behaviors among local community leaders involved in natural resources management programs within the Okavango Delta, Botswana. The theory of reasoned action and the responsible environmental behavior framework guided the study. Thirteen community-based natural resources management projects' boards of trust, comprising a total of 120 subjects, participated in a quasi-experimental study. Results indicate that a combination of knowledge, attitude, and locus of control significantly predicts knowledge-sharing intentions, with knowledge and attitudes as the most important predictors. Implications and recommendations for practice are discussed, and directions for future research are suggested.

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Increasing environmental problems require a concerted approach from stakeholders in promoting responsible environmental behaviors (REBs). Attempts to promote pro-environmental behaviors among the general public worldwide have been primarily through communication and education, which are considered key to raising public awareness and understanding of environmental concerns (Chan, 1998). The common approach employed is the use of interpersonal and mass media channels, although the latter is reckoned suboptimal in effects (Rogers, 2003; Stamm, Clark, & Eblacas, 2000). Drawing from diffusion research, diffusion interventions have relied on the use of change agents and opinion leaders, considered as innovation champions, to disseminate information regarding innovations (Rogers, 2003). The approach has also been widely used in extension in order to disseminate information to wider audiences. The use of innovation champions has potential to facilitate broad-based impacts in terms of information dissemination and social change. However, although effective communication of information requires an understanding of agents' knowledge-sharing behaviors, this aspect has not been given adequate attention.

Environmental problems constitute one of the key challenges in Botswana, with the State and other stakeholders continually seeking solutions to address them. Environmental awareness is enhanced within the public through interventions such as environmental education and communication, in both formal and informal sectors. Environmental state agencies and nongovernmental organizations use opinion leaders to diffuse information concerning environmental issues to their constituents. For example, members of boards of trustees in community-based natural resources management (CBNRM) projects have been used as agents to communicate environmental information to communities in order to create awareness and broader social impacts. The CBNRM projects' leaders are used because one of their projects' objectives is to promote sustainable resources utilization through environmental conservation and education (Government of Botswana, 2007). Most of the conservation information shared with board members entails the state of the environment in community areas and mitigation strategies specifically demanding appropriate behavioral response from community members. The agencies do so with the expectation that board members will share knowledge and information acquired with their general membership.

Some communities have expressed concerns about the lack of feedback from elected board members in areas such as the general trust management issues and conservation-related matters (Arntzen et al., 2003). Boards are blamed for not sharing information from meetings and workshops attended. Attempts to resolve the problem have included recommendations for capacity-building initiatives and policy changes, such as stipulating minimum qualifications for board members (Arntzen et al., 2003). While issues such as literacy may be among situational factors inhibiting knowledge sharing with constituent communities, little empirical research has been done to explore other possible contributing factors beyond situational ones.

In order to understand how to promote environmental knowledge-sharing behaviors among the opinion leaders, it is necessary to identify salient factors that will promote the likelihood that they will share knowledge acquired. This becomes urgent because agencies will continue to use representative structures such as boards in order to channel conservation messages to their broader constituents. Therefore, a good understanding of factors that will promote knowledge sharing benefits both the communities that are on the receiving end of the environmental ills and the environmental agencies that have vested interest in effectively reaching the general public with environmental information for sustainable development. This study, therefore, focuses on investigating factors that promote environmental knowledge-sharing behaviors among stakeholders, with a view to informing and guiding the practice of environmental information diffusion.

Literature Review

Studies related to knowledge sharing as a behavior in environment/natural resources communication abound in diffusion of innovations literature and knowledge management fields (e.g., Cummings, 2003; Wolfe & Loraas, 2008; Yang & Wu, 2008). The diffusion literature sheds light on innovation diffusion and adoption, the sources and their attributes, the recipients (adopters), the characteristics of the innovations, and environmental contexts within which diffusion and adoption can be effectively facilitated (Fuglie & Kascak, 2001; Guerin & Guerin, 1994; Halila, 2007; Rogers, 1976; Tucker & Napier, 2002; Valente & Rogers, 1995). The diffusion model has guided studies and communication interventions in diverse fields, such as public health, environmental conservation, agriculture, economics, and political science (Rogers, 2003; Valente & Rogers, 1995; Wejnert, 2002). Diffusion, regarded as "a special type of communication concerned with the spread of messages that are perceived as new ideas" (Rogers, 2003, p. 35), has over

decades contributed to a better understanding of knowledge-sharing processes and practices that result in adoption of innovations.

Knowledge sharing or information diffusion is an action taken by an individual to disseminate acquired knowledge to other members (M.-H. Hsu, Ju, Yen, & Chang, 2007; Rogers, 2003, Ryu, Ho, & Han, 2003; Yu, Lu, & Liu, 2010) within a social system. Institutions and organizations rely mainly on their stakeholders, referred to as change agents or opinion leaders (Rogers, 2003), to spread information to their membership. Knowledge sharing is a diffusion process that facilitates development of new capacities for action among the recipients.

Making knowledge acquired by an individual into organizational knowledge is of considerable import for organizations and the success of knowledge management practice (Choi, Kang, & Lee, 2008; Kuo & Young, 2008). Sharing information at the individual level is the basic building block toward creating collective knowledge and understanding to effect the desired social change (Choi et al., 2008, Rogers, 2003). Diffusion literature has demonstrated that knowledge sharing warrants examination and understanding of people who will do it successfully for effective and broad-based social change (Rogers, 2003, Wejnert, 2002).

While knowledge sharing may be perceived as a natural and social process, in practice it is not always a simple task (Bock, Zmud, Kim, & Lee, 2005; Kolekofski & Heminger, 2003; Ryu et al., 2003). It is a "people-to-people process" (Ryu et al., 2003, p. 113) and is key in the knowledge management process. Studies have shown that knowledge-sharing behaviors are influenced by a number of factors, coming from the social system (environmental), an individual (personal), the nature of the knowledge (contextual), or even social networks (M.-H. Hsu et al., 2007; Rogers, 2003; Ryu et al., 2003; Wejnert, 2002; Yang & Wu, 2008). However, most of these studies were conducted in developed countries, which do not mirror developing countries in most aspects, mainly sociocultural characteristics. Rogers (2003) noted this gap as one of the criticisms leveled against the diffusion research. Despite the efforts made to date in closing this gap (e.g., Reed, 2007; Thakadu & Tau, 2012), there is still a need to extend the studies to the developing world, other sectors, and other settings in order to broaden the understanding of knowledge-sharing behaviors.

Building on this concept, the current study examined the relative contribution of selected predictors of knowledge-sharing behaviors in explaining knowledge-sharing intentions among the CBNRM board members in the Okavango Delta, Botswana. The contribution of the study is threefold: First, it extends the scholarly research on knowledge sharing by providing empirical

evidence in a different field of study and setting; second, it examines knowledge sharing in community-based organizations (CBOs); and third, it brings along additional factors in an integrated model in an attempt to better understand knowledge-sharing behavior. The study will provide insights to environmental communication and education practitioners and extension on effective means of promoting knowledge-sharing behaviors among opinion leaders to foster broad-based environmental information diffusion and social change.

Theoretical Framework

The study was guided by the theory of reasoned action (TRA; Ajzen & Fischhoff, 1980) and the REB model framework (Hines, Hungerford, & Tomera, 1986). The TRA posits that individuals make rational judgments in decision making related to behavioral performances (Ajzen, 1985; Chang, 1998). The theory postulates behavioral intention as the main and lone determinant of behavior (Ajzen, 1985, 1991). An intention to act is a conscious depiction of an individual's willingness to engage in a specific behavior. Most studies have consistently demonstrated intentions as good and valid proxy measure of behaviors (e.g., Eccles et al., 2006; Madden, Ellen, & Ajzen, 1992). The theory further postulates intention as a product of two factors: subjective norms and attitude toward the behavior. Attitude toward a behavior is, in turn, influenced by behavioral beliefs, constituting an individual's beliefs concerning desirable behaviors and their outcomes (Armitage & Christian, 2003; Chang, 1998). Subjective norms are influenced by normative beliefs, that is, what specific significant others think one should do and how much one is motivated to comply with those important others.

The REB model framework postulates behavior is influenced by two factors: intention and situational (Hines et al., 1986). The model framework depicts a direct relationship between behavioral intention and actual performance of behavior. Intention is a product of two broad groups of factors: the cognitive and affective components. The cognitive factors constitute knowledge, viewed from three different forms: issue, action-strategy, and skill knowledge. The affective factor constructs include attitudes, locus of control, and personal responsibility. These are psychosocial variables that influence behavior (Ripple, 1965), referred to as personality factors by Hines et al. (1986). They are factors related to an individual's feelings or emotions toward an object or phenomenon (Hwang, Kim, & Jeng, 2000). It is assumed that these three forms of knowledge (cognitive) and the affective factors concertedly contribute to influencing an individual's intention to behave in a certain way.

While the REB model categorized knowledge into three forms, Kaiser and Fuhrer (2003) suggested that a fourth component of knowledge, representing social knowledge, be included in the knowledge domain of the REB model. Cognizant of the proposition, the current study proposed and examined a similarly related concept of knowledge, traditional ecological knowledge (TEK), as Kaiser and Fuhrer's cognate of social knowledge. TEK is proposed as the fourth form of knowledge, hypothesized to have an indirect effect on behavior. The term *traditional ecological knowledge* was opted for in this study as opposed to *social knowledge*, based on indigenous knowledge system literature that denotes TEK as a basic component of communities' environmental knowledge (Berkes, Colding, & Folke, 2000; Houde, 2007; Warren & Cashman, 1988). TEK, commonly referred to as "indigenous knowledge," represents a body of socioecological knowledge, practices, and beliefs accumulated by communities over time through adaptive process and transmitted culturally across generations (Berkes et al., 2000). The knowledge is acquired from millennia of sociocultural and ecological interaction with the environment and is based on people's beliefs (Berkes et al., 2000; Houde, 2007). TEK deserves consideration because scholars have argued that it represents an environmental or ecological knowledge (Drew, 2005; McGregor, 2004).

The behavior of interest targeted by this study is knowledge-sharing behavior, viewed as an action taken by an individual to disseminate acquired information to other members (M.-H. Hsu et al., 2007; Ryu et al., 2003). In respect to the REB framework, the requisite REB is environmental knowledge sharing done by individuals.

Conceptual Model

Drawing from literature and the two theories, a research model integrating selected constructs from the two theories was conceptualized to inform the current study. The theories were integrated by bringing together components lacking from each one of them to develop a conceptual model (Figure 1). The constructs explored—drawn from the two theories—are knowledge, beliefs, attitudes, locus of control, and intention. The conceptualized model used two constructs common to the two theories: attitudes and intentions. Belief construct is specific to TRA, while knowledge, including its three knowledge domains together with locus of control, was drawn from the REB framework. While the REB model posits knowledge to be a product of three knowledge domains, the current research proposed an additional fourth knowledge domain, TEK, to have a direct influence on the broader knowledge construct and belief.
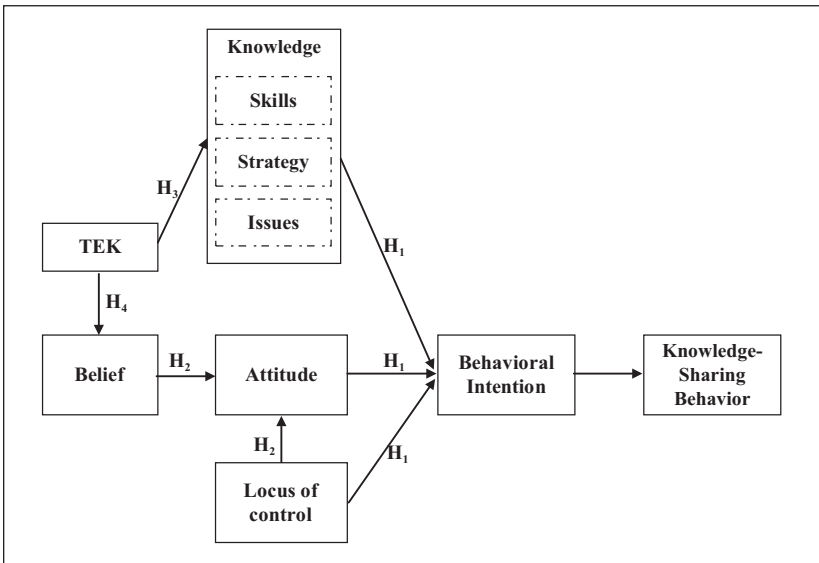
Figure 1. Conceptual research model
Note: TEK = traditional ecological knowledge.

Based on the TRA and REB studies and literature, the conceptualized model (Figure 1) postulates knowledge, attitude, and locus of control as immediate determinants of behavioral intention. The model postulates that TEK, with its characteristic belief connotations, influences an individual's belief as well as the broader knowledge domain. Attitude is influenced by behavioral belief and locus of control. An individual's TEK, belief, and locus of control have an indirect influence on intention to behavior in a certain way.

Based on the aforementioned, the following were hypothesized:

Hypothesis 1: Knowledge, attitudes, and locus of control will jointly influence behavioral intention.
Hypothesis 2: Belief and locus of control will jointly influence attitudes toward knowledge sharing.
Hypothesis 3: Traditional ecological knowledge has a positive effect on knowledge.
Hypothesis 4: Traditional ecological knowledge has a positive effect on belief toward knowledge sharing.

Rationale for Conceptual Extended Model

The development of the extended research model was motivated by two factors. First, the REB and TRA models do not individually provide requisite constructs to adequately explore pro-environmental behaviors such as environmental knowledge sharing. Some studies, realizing this limitation, have either proposed or used extended integrative models comprising the two frameworks (e.g., Carrus, Passafaro, & Bonnes, 2008; Corbett, 2005; Valle, Rebelo, Reis, & Menezes, 2005). Most studies in knowledge management relied entirely on the use of TRA and its extension, the theory of planned behavior (TPB), to examine knowledge-sharing behaviors (e.g., Bock et al., 2005; Kolekofski & Heminger, 2003; Kuo & Young, 2008; Reychav & Weisberg, 2010). The TPB included the perceived behavioral control construct to address the TRA's limitation on dealing with nonvolitional behaviors (Ajzen, 1985, 1991). Notwithstanding this, several scholars have either used or proposed development of extended models incorporating TRA/TPB models' constructs to examine knowledge-sharing behaviors apart from the perceived behavioral control (e.g., Chen, Chen, & Kinshuk, 2009; Kuo & Young, 2008; Poliakoff & Webb, 2007).

Despite this, knowledge-sharing studies continued to neglect investigating the role of knowledge in influencing knowledge-sharing behaviors. The neglect is understandable, more so considering that empirical studies conducted relied on TRA/TPB models, which do not have knowledge as a construct in their frameworks. Second, the REB studies have suggested inclusion of additional factors to improve explanatory power of the model (e.g., Cottrell, 2003; Cottrell & Graefe, 1997; Hargreaves, 2011; S.-J. Hsu & Roth, 1998; Mobley, Vagias, & DeWard, 2010). They recommended inclusion of a wide range of constructs to provide more accurate explanation of REBs and to refine the theories for more accurate prediction of human behaviors. These served as the basis of conceptualizing the current research model.

Method

Study Setting and Sampling

The study was conducted in the Okavango Delta, situated in the Ngamiland District, Botswana (Figure 2). The delta and its immediate environs are home to multiethnic groups, with a history of intimate relations to the Okavango Delta and its resources, accounting for a total population of about 152,000 people (Central Statistics Office, 2011). The delta stakeholders, mainly local
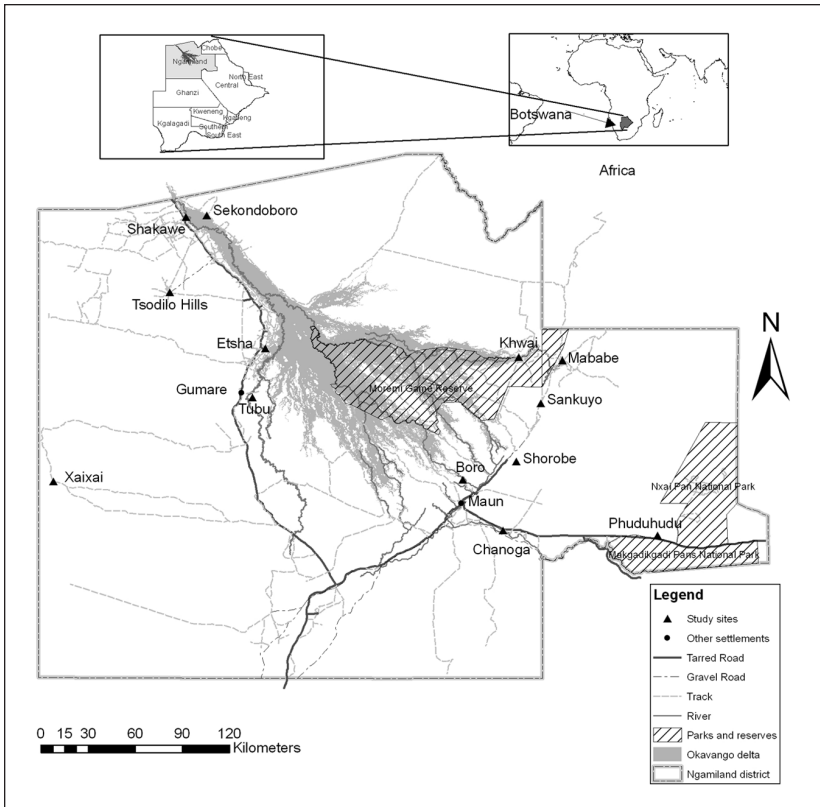
Figure 2. Map of Okavango Delta and study sites

communities, reside in a renowned wetland of international importance. The district's unique natural resources and outstanding natural features have attracted a growing number of tourism activities that serve as the backbone of the booming tourism industry and CBNRM projects.

The study subjects comprised members of the CBNRM projects' boards of trustees. The Boards are often used by the natural resources management agencies as organs of environmental information dissemination to local communities. The sampling frame consisted of registrants on the Ngamiland District CBNRM Forum. Twenty-one CBOs registered with the CBNRM Forum were listed and 13 CBO boards randomly sampled. The study used a probability cluster sampling design wherein only preexisting groups, that is,

individual boards, in which subjects were members, were randomly selected and exposed to the treatments (Ary, Jacobs, Sorensen, & Razavier, 2009). The unit chosen is the group of individuals and not an individual per se. While the sampling technique was random cluster sampling, the sample is a convenience one since it was drawn from the accessible population only.

This sampling design limits generalization to the population from which the sample was drawn (Ary et al., 2009), namely, the Ngamiland CBNRM boards. However, since the workshops (treatments) were held in the subjects' respective natural localities, artificiality was ruled out, thereby enhancing generalizability to other settings. The replication of the study across the 13 CBOs also ensured that the study could be generalized to different settings (Ary et al., 2009; de Vaus, 2001). Generally, the target population and the accessible population used in this study share key relevant characteristics such as demographics, livelihoods, and governance styles, as well as policies and practices guiding their operations.

Participants

A total of 120 subjects, drawn from 13 CBNRM boards of trustees comprised the study sample. Boards of trustees constitute individuals democratically elected within CBOs dealing with natural resources in Botswana. The CBNRM boards comprise a maximum of 15 trustees, depending on the number of the participating villages, ex officio members inclusive. The sample comprised mostly males (71.7%, $n = 86$). The mean age of the sample was 35.95 years ($SD = 13.02$), with a range of 20 to 72 years. Of the 120 subjects, 43.3% held executive positions on the board, 39.2% were additional members, and 17.5% served as ex officio members of the board. Males overwhelmingly were in decision-making positions of the board. Only two females held the top two executive posts, one a chairperson and the other a vice chairperson, with the highest proportions of females holding nonexecutive positions, that is, additional member (52.9%, $n = 18$), when compared to males, followed by secretarial positions (26%, $n = 9$). A total of 55.0% of the subjects had completed secondary education, a further 28.3% had completed primary school, 5% tertiary, and 11.7% had no formal education.

The sample demographics generally mirror the board of trustees' characteristics across the district and nationwide in terms of education, gender, and the makeup of decision-making positions, although not the general public. CBNRM reviews have lamented the capture of CBNRM leadership by the local elites, the domination by males, and the relegation of females to board positions with no or little authority in decision making (Binot et al., 2009;

Mbaiwa, 2011; Thakadu, 2005), a scenario evident in the current sample. A review by Mbaiwa (2011) indicated that female trustees largely hold secretarial positions, merely taking minutes, while most of the higher positions such as chairperson continue to be the domain of the males. These suggest that the sample is generally representative of the broader population of boards of trustees district- and nationwide in key aspects.

The subjects' sources of environmental knowledge, mainly related to wildfires and waste management, included schools, environmental agencies, experts, and oral tradition.

Research Design

The study employed a quasi-experimental design. This was because the subjects were within existing intact groups, in the form of established boards of trustees. Random assignment of subjects was not feasible as the target group were existing groups (Ary et al., 2009; Greeno, 2002). Specifically, the study employed a counterbalanced design, where all groups of subjects receive all treatment conditions in different orders of administration. For example, the Sankuyo Tshwaragano Management Trust received the traditional verbal presentation first, followed by the visualized, while the second group, Shorobe Community Development Trust, received the visualized presentation first, followed by the traditional verbal (Table 1). The choice of the first experimental treatment used (traditional verbal) for the initial replication was randomly selected from the two treatments, with the subsequent replications following accordingly in a reversed treatment order.

The utility of the quasi-experimental counterbalanced design is that it allowed subjects to take part in both treatments, thereby eliminating the confounding effects of order and carryover (Ary et al., 2009; Becker & Maunsaiyat, 2004; Siegel, Alvaro, Crano, Lac, & Ting, 2008). The design also helped to rotate out any preexisting differences that might exist between the groups since the study did not randomly assign subjects to experimental treatments (Ary et al., 2009). Moreover, a counterbalanced design ensures that the groups serve as their own controls, thereby making comparisons between treatments feasible (Cook & Campbell, 1979). The design facilitated undertaking the research study in a natural setting of the subjects.

Data Collection Instrument

Data was collected using a retrospective pretest[1] (post-then-pretest) instrument, where the subjects' pretest and posttest ratings were assessed

Table 1. Research Counterbalanced Design

| | Experimental treatments | | |
| | Traditional verbal | Visualized | No. of |
Replication	presentation	presentation	subjects
1	Sankuyo Tshwaragano Management Trust[a]	Sankuyo Tshwaragano Management Trust	9
2	Shorobe Community Development Trust	Shorobe Community Development Trust[a]	5
3	Okavango Kopano Mokoro Comm. Trust[a]	Okavango Kopano Mokoro Comm. Trust	9
4	Mababe Zokotsama Community Trust	Mababe Zokotsama Community Trust[a]	7
5	Khwai Development Trust[a]	Khwai Development Trust	13
6	Xhauxhwatubi Development Trust	Xhauxhwatubi Development Trust[a]	9
7	Chanoga Community Trust[a]	Chanoga Community Trust	6
8	Tubu Community Trust	Tubu Community Trust[a]	7
9	Okavango Jakotsha Community Trust[a]	Okavango Jakotsha Community Trust	12
10	Okavango Panhandle Community Trust	Okavango Panhandle Community Trust[a]	10
11	Itekeng Community Trust[a]	Itekeng Community Trust	7
12	Tsodilo Community Development Trust	Tsodilo Community Development Trust[a]	6
13	Cgaecgae Tlhabololo Trust[a]	Cgaecgae Tlhabololo Trust	11
Total			120

a. The first experimental treatment in each replication started with-for counterbalancing.

simultaneously after the intervention (Allen & Nimon, 2007; Hill & Betz, 2005; Lamb, 2005). In a retrospective pretest method, individuals make a postintervention self-assessment first (posttest), followed by a preintervention self-assessment concurrently after the intervention. Subjects are asked at the end of each intervention to rate themselves after an intervention (posttest) and then to think back and rate their preintervention levels, making it retrospective pretest.

The instrument measured the effects of each intervention treatment on the subjects' knowledge, beliefs, attitudes, and behavioral intention both after the treatment administration (posttest) and retrospectively before the intervention (pretest). Locus of control was assessed only once and was not subjected to a retrospective pretest and treatment condition, as it was not targeted by the intervention. Although TEK was also not subjected to retrospective pretest, it was assessed twice based on the treatment condition subject matter. The post-then-pretest design was deemed suitable for the study because the goal was to examine the efficacy of the two interventions (Colosi & Dunifon, 2006; Davis, 2003; Hill & Betz, 2005).

The retrospective pretest enabled subjects to give pretest answers that are based on a more accurate frame of reference as it is administered at the same time as the posttest (McDiarmid & Binns, 2005; Pratt, McGuigan, & Katzev, 2000). The greatest strength of the retrospective-pretest design is that it addresses the threat to validity found in the traditional pretest-posttest design—the response shift bias (Howard & Dailey, 1979; Howard Schmeck, & Bray, 1979; Rohs, 1999). Response shift bias can lead to either an overestimation or an underestimation of intervention effectiveness (Drennan & Hyde, 2008; Lamb & Tschillard, 2005). A retrospective pretest, therefore, facilitates a provision of responses based on a more accurate, informed, and uniform frame of reference. Thus, the ratings are more likely to accurately reflect the effects of the intervention without the confounding effects of confusion and misinformation.

The instrument scales and item measures were developed using the theoretical-rational approach, where item construction is informed, adopted, and/or adapted from existing theories, scales, literature, and research (Clark & Watson, 1995). Theory and scholarly literature that guided item development include the TRA/TPB, the REB model, and related studies (e.g., Ajzen, 2006; Bock et al., 2005; Hamilton, 1991; Hayward, 1990; Hines et al., 1986; Hwang et al., 2000; Marcinkowski, 1988; Ryu et al., 2003). Face and content validities of instrument items were determined by a panel of six experts.

Knowledge was measured subjectively using a 12-item scale. Informed by previous similar studies (e.g., Hines et al., 1986; Hwang et al., 2000), the scale comprised three knowledge subscales: issue, action-strategies, and skill, each represented by 4 items. The subjects were asked to rate their perceived level of knowledge in respect to the three subscales retrospectively using a 5-point Likert-type scale, ranging from 1 (*very low*) to 5 (*very high*).

TEK was measured using a six-item scale developed by the researchers, based on the literature review and qualitative research studies undertaken within the study area related to the subject matter (see Cassidy, 2003; Thakadu, 1997). Prior to administering the scale, the relevance of the TEK items derived

from literature was ascertained with local traditional authorities. Subjects were asked to rate their level of knowledge regarding indigenous phenomena related to an environmental issue on a 5-point Likert-type scale ranging from *very low* to *very high*. The items assessed individuals' knowledge regarding indigenous practices relating to management of wildfires and waste. These included traditional practices such as using fires in clearing land for agriculture, shaping ecosystem for range management of livestock and wildlife, indigenous waste segregation techniques, and indigenous waste management techniques, such as burning, composting, and burying.

Attitudes and beliefs toward knowledge sharing were measured using the semantic differential scale. The subjects were asked to respond to affective and instrumental bipolar items such as "sharing knowledge with other people is . . ." *very good . . . very bad, very enjoyable . . . very unenjoyable*, and *very important . . . very unimportant*.

Locus of control was measured using a 5-point Likert-type scale ranging from *strongly agree* to *strongly disagree*. Subjects were presented with a set of statements about knowledge sharing regarding environmental issues and asked to respond on a 5-point scale. Scale items were mostly adapted from Hamilton's (1991) communication-specific locus of control instrument.

Subjects' intention to share knowledge was measured using a six-item 5-point Likert-type scale ranging from *highly unlikely* to *highly likely*. Subjects were asked to indicate the likelihood of engaging in specified knowledge-sharing activities such as sharing "knowledge/information acquired . . ." with their constituents. Intentions were measured using self-prediction items, which are considered more reliable in predicting behaviors when compared to other forms of measures, such as desires and intentions (Ajzen & Fischhoff, 1980; Armitage & Conner, 2001; Bagozzi, 1992; Sheppard, Hartwick, & Warshaw, 1988).

Cronbach's alphas were examined to ensure reliability of the different scales making the instrument. As listed in Table 2, all the reliability coefficients except the alpha coefficient for intention (posttest) measures were greater than the suggested threshold of .7 (Nunnally, 1978), signifying adequate scale reliability.

The mean value of each construct is given in Table 3.

Procedure

The subjects from sampled boards volunteered to participate in the applied research study and took part in the two experimental treatments; one presentation, the visualized communication method, used a PowerPoint presentation with photographs as visuals, while the other was entirely verbal, a traditional

Table 2. Cronbach's Alpha Coefficients for Constructs of the Retrospective Pretest Instrument

Construct		Traditional verbal presentation		Visualized presentation	
	Reliability	Posttest	Pretest	Posttest	Pretest
Locus of control	.79	—	—	—	—
Traditional ecological knowledge		.94		.71	
Knowledge		.91	.90	.90	.96
Beliefs		.79	.97	.76	.88
Attitudes		.85	.88	.80	.93
Intention		.94	.92	.65	.91

Table 3. Descriptive Statistics for Study Constructs Per Treatment

Variable	N	Verbal		Visual	
		M	SD	M	SD
Knowledge	117	4.30	0.48	4.32	0.59
Belief	117	4.54	0.56	4.57	0.54
Attitude	117	4.79	0.48	4.81	0.40
Intention	117	4.63	0.51	4.55	0.57
Locus of control	117	3.58 (.38)			
Traditional ecological knowledge	117	3.66	0.87	3.55	0.69

Note: SD for locus of control is in parentheses.

communication method. The visualized presentation focused on waste management in the Okavango Delta. The presentation highlighted a national picture regarding issues of waste and its management. It showed the causes, effects, and mitigation and prevention measures, focusing on reusing, reducing, and recycling. The presentation addressed different waste prevention methods and approaches (e.g., public education, waste management strategies and plans, political action, and research monitoring) and examples of indigenous waste management practices. The photographs used as visuals were captured within the Ngamiland district and depicted local waste management issues, challenges, and scenes. The choice of photographs used was made on the basis of simplicity and cultural and contextual relevance.

Similarly, verbal presentation on wildfires began with an overview of wildfire issues and hotspot areas nationally, and then focused at the district level. The talk touched on the causes and the effects of wildfires and on mitigation and prevention measures (e.g., suppression, physical barriers, controlled burning, political action, research and monitoring, and wildfire management strategies and plans) and examples of indigenous wildfires management approaches. The examples given during the presentations were derived mainly from district-based research and technical reports, scenarios, and subject scholarly literature.

The presentations were given by the researcher, who spoke from a script to maintain consistency. Each presentation took approximately 40 minutes, with the presentation administered in the local Setswana language. To reduce the experimenter effect, procedures of treatment administration were standardized. Each presentation was comparable in terms of concepts, complexity, and length and dealt with a specific environmental scenario of the Okavango Delta. Presentations were developed in collaboration with a panel of experts and were pretested for manipulation checks.

Subjects completed a retrospective-pretest self-reports instrument after exposure to an experimental treatment. Prior to the distribution of the instrument, subjects were briefed about the procedure and steps of completing the questionnaire. They were informed that there were no right or wrong answers and encouraged to be objective when responding to the questionnaire.

Data Analysis

The data were analyzed using descriptive statistics and multiple regressions. Based on the results of a related study, which found no significance differences among the mean values of the two interventions, subjects' data were pooled together across the treatment conditions for analysis (see Thakadu, Irani, & Telg, 2011). The main assumptions related to multiple regression analysis were evaluated prior to the analysis and were found tenable for all the constructs measures except attitude scores, which were substantially negatively skewed (skewness = −2.64), thereby necessitating logarithmic transformation to improve normality.

Results

The goal of this study was to examine the relative contribution of selected predictors of knowledge-sharing behaviors toward explaining knowledge-sharing intentions. First, it was hypothesized that the immediate predictors of

Table 4. Variable Means, Standard Deviation, and Correlations Between Intention and Three Immediate Predictors

Variable	Correlations				M	SD
	1	2	3	4		
1. Intention	—	.51*	−.53*	.34*	4.64	0.47
2. Knowledge		—	−.30*	.20*	4.31	0.46
3. Attitudes			—	−.26*	0.16	0.16
4. Locus of control				—	3.57	0.37

Note: Attitudes were log transformed. $N = 118$.
*$p < .05$.

intention (knowledge, attitude, and locus of control) will together predict subjects' intention to share knowledge. The hypothesis was tested by performing a hierarchical multiple regression, with knowledge, attitudes, and locus of control used as predictor variables, controlling for pretest measures, age, and familiarity with the source institution. Table 4 shows means, standard deviations, and correlations for the sample. The three predictor variables show bivariate correlations of less than .70 among each other, indicating little collinearity. The variables are also significantly positively correlated, suggesting that as one increases or improves so does the other. Generally, the likelihood of demonstrating intention to share knowledge becomes high with increased knowledge about the environmental issue, with favorable attitude toward knowledge sharing, and in individuals exhibiting an internal locus of control.

The regression model significantly predicted the behavioral intention, $F(3, 114) = 30.22$, $p = .00$, suggesting the model was a good fit for data. All the predictors accounted for 44.3% of the variance in the behavioral intention and were statistically significant (Table 5). All predictors were positively related to behavioral intention, implying that behavioral intention measures increase as either one or both increase.

Knowledge alone explained 26.4% (adjusted $R^2 = .26$) of the variance in behavioral intention, $\Delta F(1, 116) = 41.61$, $p = .00$, and the addition of attitudes accounted for an additional 15.3% in total variance, $\Delta R^2 = .15$, $\Delta F(1, 115) = 30.13$, $p = .00$. The addition of locus of control improved the model prediction to 44.3%, $\Delta R^2 = .05$, $\Delta F(1, 114) = 5.35$, $p = .02$. So, as hypothesized, the three predictors jointly influenced behavioral intention, thereby supporting the hypothesis. The standardized regression coefficients (Table 5) indicate that knowledge and attitudes have a comparable degree of partial effect in the

Table 5. Summary of Regression Analysis for Variables Predicting Behavioral Intention

Dependent variable	Effect	B	SE B	β	R^2	ε
Intention					.443	.75
	Knowledge	0.38	.08	.37*		
	Attitude	−1.13	.23	−.37*		
	Locus of control	0.21	.09	.17*		
Attitude					.200	.89
	Locus of control	−0.08	.04	−.18*		
	Belief	−0.10	.02	−.37*		
Knowledge					.252	.86
	Traditional ecological knowledge	0.26	.04	.50*		
Belief					.151	.92
	Traditional ecological knowledge	0.26	.06	.39*		

Note: Attitude scores were log transformed.
*$p < .05$.

Table 6. Variable Means, Standard Deviations, and Correlations Between Predictors of Attitudes

	Correlations				
Variables	1	2	3	M	SD
1. Attitudes	—	−.26*	−.41*	0.16	0.16
2. Locus of control		—	.21*	3.58	0.38
3. Belief			—	4.56	0.58

Note: Attitudes measures were log transformed. $N = 118$.
*$p < .05$.

model, with locus of control being of lesser importance in the prediction of intention to share knowledge.

Second, it was hypothesized that belief and locus of control will jointly predict attitude toward knowledge sharing. To examine the relationship, hierarchical multiple regression analysis was conducted using belief and locus of control as independent variables, controlling for age, familiarity, education, and pretest scores. The results of correlation analysis (Table 6) show a significant positive association between the three variables. The result suggests

that more favorable attitudes were associated with corresponding favorable beliefs toward knowledge sharing and internal locus of control.

The overall regression model was found to significantly predict attitudes, $F(2, 115) = 14.34$, $p = .00$. The two predictors accounted for 20% (adjusted $R^2 = .19$) of the total variance in attitudes toward knowledge sharing. Locus of control accounted for 6.9% of the initial variance, while the addition of belief measures improved the model prediction, $\Delta R^2 = .13$, $\Delta F(1, 115) = 18.82$, $p = .00$. The two predictors are positively related to attitudes, suggesting that attitudes become more favorable, as beliefs about knowledge sharing become more favorable and causal attributions become internal, that is, internal locus of control. In predicting attitudes, both were significant predictors, with belief having about double of the partial effect on the prediction of attitudes when compared with locus of control (Table 5).

Third, a positive relationship between TEK and knowledge was hypothesized. A simple linear regression was performed to test the hypothesis. The results indicated a significant, strong, positive relationship between TEK and composite knowledge, $r = .50$, $n = 118$, $p = .00$, suggesting that one improves as the other improves. The model significantly predicted knowledge scores better than the mean scores, $F(1, 116) = 39.05$, $p = .00$, suggesting that the regression model was a good model fit. TEK explained 25.2% (R^2 adjusted $= .25$) of the variance in knowledge. The model parameters ($B = .26$, $SE = 0.04$, $\beta = .50$) were significant ($t = 6.25$, $p = .00$), suggesting TEK to be a useful predictor of knowledge.

Fourth, a positive relationship between TEK and belief was hypothesized and was evaluated using a simple linear regression. The correlation analysis indicated a significant medium positive correlation between the two variables, $r = .39$, $n = 118$, $p = .00$. The coefficient of determination (R^2) was .15, suggesting that the TEK accounted for 15% of the variation in knowledge-sharing beliefs. The model prediction was significant, $F(1, 116) = 20.68$, $p = .00$, thereby suggesting that the regression model significantly predicts knowledge-sharing beliefs well. The standardized beta, $\beta = .39$, was significant, $t = 4.55$, $p = .00$, indicating that TEK was a useful predictor of knowledge-sharing beliefs.

The standardized regression coefficients in Table 5 were added in the path diagram (Figure 3), which was guided by the TRA and the REB models.

Discussion

The study evaluated the relative contribution of the different predictors of knowledge-sharing behavior in predicting behavioral intention through a
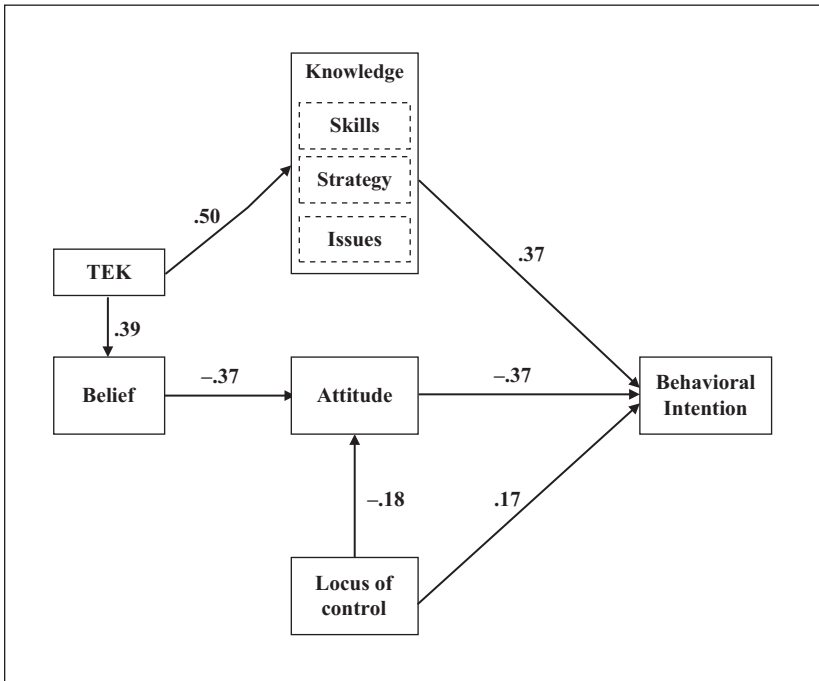
Figure 3. Path diagram for knowledge-sharing behavior with standardized regression coefficients
Note: TEK = traditional ecological knowledge.

series of regression models, informed by four hypothesized relationships derived from theory. All four hypothesized relationships were supported. The three direct predictors of behavioral intention—knowledge, attitude, and locus of control—significantly predicted intention, explaining about 44% of variation in the intention to share knowledge. The results indicated that an individual with a higher level of knowledge regarding an environmental issue, positive attitudes toward knowledge sharing, and a stronger internal locus of control is more likely to demonstrate increased intention to share knowledge acquired. Both knowledge and attitude had an equal relative importance in the prediction of behavioral intention, with locus of control exerting the least influence. The finding that attitude is one of the major factors in the prediction of intentions is consistent with the previous research in knowledge management studies (Chen et al., 2009; Kuo & Young, 2008;

Ryu et al., 2003), and the REB literature (e.g., Hines et al., 1986; S.-J. Hsu & Roth, 1998). However, the finding that locus of control exerted the least total partial effect on the prediction of behavioral intention contrasts study findings by Hwang et al. (2000), where locus of control had the largest total effect. The inconsistency may be explained in light of the expectation that the relative importance of behavioral intention predictors may vary, depending on the target behavior and situation (Ajzen, 1991; Ajzen & Fischhoff, 1980).

While literature suggests that knowledge does not necessarily translate into behavior (e.g., Frick, Kaiser, & Wilson, 2004; Hwang et al., 2000; Kaiser & Fuhrer, 2003), it should be noted that the significant effect of knowledge on intention, which is on par with attitudes in terms of partial effects, is not surprising for this study. The behavior evaluated in this study is a knowledge-sharing behavior, and hence knowledge becomes a critical factor in this regard. Generally, individuals will want to share confidently what they know.

This finding shows that subjects are more likely to demonstrate intention to share knowledge on environmental issues when they have requisite knowledge or understanding of an environmental issue. Knowledge sharing will be promoted when people are familiar and aware of basic facts surrounding the subject matter. Scholars have generally consented that while having knowledge about an environmental issue does not always result in behavioral change, having the right basic information regarding an issue is a prerequisite for informed decision-making, mainly among managers (e.g., Frick et al., 2004; Hungerford & Volk, 1990; Kaiser & Fuhrer, 2003; Schultz, 2002). This becomes even more relevant for managers used as information diffusion agents within their constituents; they will be more inclined to share information if they have basic and accurate information. In this respect, the intervention focused on imparting or improving the subject's knowledge regarding environmental issues may be effective in fostering knowledge-sharing behaviors. This, in turn, may promote REBs.

The significant relationship between TEK and belief, as well as the composite knowledge, suggests a possible link between these two factors. The finding is consistent with a proposition made by TEK scholars (e.g., Berkes et al., 2000; Kaiser & Fuhrer, 2003; Tanyanyiwa & Chikwanha, 2011). The scholars indicate that TEK is a product of local people's beliefs and knowledge acquired experientially, with the two interactively influencing each other (Mazzocchi, 2006). While the TEK is marginalized, literature demonstrated that it is consistent with the broader mainstream knowledge framework regarding ecological/environmental issues in most aspects (Tanyanyiwa & Chikwanha, 2011). During discussions, the subjects indicated that there

were similarities between conventional and traditional wildfire and waste management practices. Some indicated that they learned proper waste management techniques from their grandparents through oral and experiential instruction. These claims are corroborated by studies conducted locally and elsewhere (e.g., Cassidy, 2003, Izugbara & Umoh, 2004). Against this backdrop, this finding points to the potential utility of TEK in promoting learning of new environmental information, mainly among local rural communities. TEK is regarded as broad, spanning all disciplines. This allows it to be used during public instructional interventions, as a base for launching new environmental information phenomenon to promote information diffusion. Research has shown that learners tend to comprehend new information better and more effectively when it is linked with prior knowledge (Mayer, 2002).

Since communities have TEK as a part of their culture and practice, it offers opportunities for use in meaningful learning and elaboration, because it can facilitate learning by relating new information with the old, in this case TEK. In this way, meaningful learning can be fostered by linking the new information with TEK. However, the challenge with TEK is that it is diverse and less documented. It therefore calls for research focused on documenting the traditional knowledge so that it can inform public instructional communication campaigns.

Conclusion and Implications

The study examined the extent to which the selected predictors of knowledge sharing predicted intention to share knowledge among CBO leaders. The study demonstrated that knowledge, attitude, and locus of control were significant direct predictors of knowledge-sharing intention, with both knowledge and attitude being the most important predictors. However, the three predictors accounted for almost half of the variance in behavioral intention, indicating the likelihood that there are other factors excluded from the research model, which may contribute to an individual's intention to share knowledge. Future studies should explore the potential contribution of other factors such as subjective norms, normative beliefs, personal responsibility, self-efficacy, and situational factors, among others. This may help improve the predictive ability of the conceptualized environmental knowledge-sharing model. Finally, the additional proposed TEK factor significantly predicted knowledge and belief. This suggests that TEK may indeed have a role to play in people's belief toward knowledge sharing as well as the level and quality of information that an individual exhibits toward a specific environmental/ecological phenomenon, as TEK literature has suggested. This knowledge domain warrants attention as part of the

broader knowledge construct and framework. Previous research has demonstrated the contribution of the conventional three knowledge forms in influencing behaviors (e.g., Frick et al., 2004; Hines et al., 1986; Schultz, 2002). It is suggested that further research consider all the four knowledge forms and that their individual influence toward the prediction of knowledge be examined. This could not be achieved in the current study as the composite knowledge measure was made of the three conventional subscales, thereby limiting the potential to regress all the four subscales into the composite knowledge measure.

The study was not without its limitation, namely, the use of self-reports as compared to objective scales. The study also used a convenience sample targeted to one district group and one stakeholder group, thereby limiting generalizability of the study findings beyond similar boards outside the district and other stakeholder groups. The small sample size, although adequate for the statistical analysis used in data analysis, restricted potential use of more advanced statistical analysis such as structural equation modeling and AMOS, which are able to examine nonrecursive models. Future research should use larger samples that will facilitate evaluation of circular relationships, replicate the study to other stakeholders, and use objective assessments.

Notwithstanding these limitations, this study provided preliminary information and serves to stimulate research on knowledge sharing in the environmental/ natural resources management field, in order to inform environmental education and communication practitioners and policy makers to develop communication interventions that will promote maximal knowledge-sharing behaviors. Specifically, bringing together constructs from the TRA and REB models to examine knowledge-sharing behaviors was a unique contribution: mainly the knowledge component that is lacking in knowledge management research. It further makes an important contribution to environmental communications literature by advancing understanding of factors that promote knowledge diffusion among information dissemination agents.

The study findings also present twofold implications for practice. First, there are many factors influencing individuals' knowledge-sharing behaviors, making understanding of these factors by information source agencies a prerequisite. Practitioners should ensure a better understanding of these factors to guide and inform them in the design of public instructional communication interventions. By so doing, practitioners will target requisite factors that may result in effective promotion of knowledge-sharing behaviors. Practitioners should thereby undertake knowledge-sharing capacity needs and assessments of the intended agents of information diffusion with a view to better understanding them and providing the requisite capacity enhancement based on identified needs. Second, communication interventions will benefit most from

interventions that target people's attitudes toward knowledge sharing and gives people basic understanding of a relevant environmental issue. Communication interventions with agents should be a mix of awareness creation regarding the environmental issue, experiential training, and messages targeted to affecting salient attitudes and beliefs toward knowledge sharing.

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Note

1. A pretest used in this context differs from the traditional pretest through its relationship to the intervention. The pretest is administered after the intervention, as opposed to the conventional pretest-posttest design, with respondents asked to rate themselves with respect to questionnaire items as they were "then," before the intervention, making it retrospective. The retrospective measurement of a pretest is done at the time of the posttest. This type of pretest is often referred to as a retrospective pretest, post-then-pretest, or the "then" test in literature (e.g., Allen & Nimon, 2007; Campbell & Stanley, 1963; Hill & Betz, 2005; Howard & Dailey, 1979; Howard, Schmeck, & Bray, 1979; Lamb & Tschillard, 2005; Nimon, Zigarmi, & Allen, 2011).

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