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Adoptive Behaviors of Farmers After Training and Their Subsequent Diffusive Behaviors In Uasin Gishu County, Kenya

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Abstract

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Keywords

Technology, innovations, adoption, diffusion, Extension, participation, sociallearning framework, social network, farmer-to-farmer

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Introduction

At a time when considerable progress in the area of food security has occurred in many parts of the world, sub-Saharan Africa continues to suffer chronic and recurrent undernourishment, with a quarter of its population so affected (Baro & Deubel, 2006; United Nations Development Program [UNDP], 2012). This is the only region that has not experienced any reduction in the number of undernourished people since 1990 (United Nations Economic and Social Council, Economic Commission for Africa, 2011). Projections suggest that this trend will probably continue more or less the same in 2020 (Rukuni, 2002). The disparity between food-security indicators in Africa and in most other parts of the world makes it unlikely that inadequate agricultural knowledge or technology is primarily to blame. One possible contributing factor, however, to large-scale hunger in sub-Saharan Africa is inefficiency in the diffusion of important agricultural innovations at the level of small-holder farmers. According to Kroma (2003), "There is a wide gap between agricultural technologies produced in research institutions and the adoption of such technologies by small farmers and rural households in sub-Saharan Africa."

Literature Review

A number of efforts have been made to assess the overall effectiveness of agricultural extension work in Sub-Saharan Africa. Davis (2008), reviewing what has been done, concluded that "little is known about the capacity, quality of service, and performance of extension systems in Sub-Saharan Africa. Agricultural extension services in the region have been chronically under-funded, and few governments can allocate more resources (Venkatesan, 1996). Eicher (2003) noted that during the 1990s donor funding to African agriculture declined, but at the same time the number of programs rose. This suggests that although agricultural extension systems in sub-Saharan Africa can probably make significant contributions to improvement in regional food security, it will be necessary to identify supplementary mechanisms in the effort to redress the pattern of recurrent famine.

Juma (2011) proposed the concept of *innovation systems* as a framework through which to understand national and regional economies. He defined an innovation system as a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect their behavior and performance. There is value, however, in seeing the wider context in which the diffusion of agricultural innovations, in particular, is an important component. Juma focused his study primarily on agricultural innovation on the African continent. Miller and Shinn (2012), referring to Juma's research, observed that "Innovation systems are integral to African agricultural development." Rivera (2006) stressed the importance of a comprehensive vision for investing in innovation research and encouraging innovation development, from the national to the local level.

Davis and Place (2003), building on the work of Anderson and Crowder (2000), observed that there is a movement toward a pluralistic model of extension services in Africa. Governments have not been able consistently or adequately to fund delivery of extension services, and NGOs have had neither the coordination nor the long-term funding to fill the need. Birner et al. (2006) provided a detailed discussion of how this

kind of pluralistic, multi-faceted approach to extension services might be designed. Mwangi (1998) noted that extension workers can increase their own effectiveness in facilitating adoption of improvements by investing time in developing relationships of trust and rapport with farmers. A study of Integrated Pest Management (IPM) dissemination in Uganda (Erbaugh, Kibwika, & Donnermeyer, 2007) assessed knowledge levels of extension agents and found low levels for almost half of them. The authors recommended strategies for knowledge improvement as a way of increasing rates of IPM diffusion. Follow-up research concluded that "farmers' participation in on-farm trial demonstrations, accessing agricultural knowledge through researchers, and prior participation in pest training were associated with increased adoption of most IPM practices" (Bonabana-Wabbi, 2002). Erbaugh, Maseki, Kilima, and Larson (2011) studied constraints on adoption of improved sorghum varieties in Tanzania. They identified limitations such as the effects of inconsistent rain on seed multipliers, low demand for retailers, poor transportation infrastructure for distributors, and uneven knowledge on the part of extension agents.

There has been a growing consensus that enlisting as much local participation as possible in training, learning, and decision-making has a strong positive influence toward adoption and implementation of agricultural innovations. Kroma (2003) explored a farmer-centered, participatory approach to management of innovations in Ghana, using a social-learning framework. An overview and evaluation of participatory methods in extension delivery appeared in Davis' (2008) survey of extension models in Africa. This sort of partnership has seemed to be especially needful when dealing with a technological innovation or adaptation of technology (Lev and Acker, 1994).

Vreyens (1999) stressed the importance of becoming familiar with local farmers' internal thought processes regarding decisions about adopting new methods or technology, in order for a change agent to select the most effective approach in encouraging adoption. This was the approach of Tuttle, Lindner and Dooley (2004) in their study of farmer preferences in regard to extension delivery methods in Mexico. They found that with reference to the format of community seminars, both male and female farmers "favored hands-on delivery strategies that included a social component."

Ketema's (2008) research in Ethiopia showed that networks of family and friends were the most effective sources of information relating to diffusion of innovations. He recommended forming informal farmers' networks to capitalize on social networking for encouraging adoption of improvements. A significant rate of innovation diffusion in a community seems to require a certain "critical mass" or proportion of farmers who have received appropriate sensitization and training (Rogers, 2003).

An analysis of extension methodologies in Tanzania emphasized the need to include greater participation by local farmers in planning and execution (Douglah & Sicilima, 1997). Vatta *et al*. (2008) conducted research on goat health with participation from Zulu farmers. Involving these farmers in the research process itself was associated with a subsequent increase in their effectiveness in farmer-to-farmer diffusion of knowledge. Research by Pedzisa, Minde, and Twomlow (2010) in Zimbabwe found that technology demonstration with farmer participation was

a major positive factor in subsequent adoption and adaptation of the innovation.

Davis (2004) made an extensive study of the technology dissemination among farmers in Meru Central District, Kenya, and how this process was affected by farmers' participation in local groups. She determined that some factors related to participants' success in technology diffusion were the kind of group, the age of the group, location of the group, amount of training done with the group, homogeneity of the group, and the number of group linkages to other entities and networks. Davis and Negash (2007) followed with an analysis of wealth and gender as factors in the performance of farmers' groups in the same district. Wealth was not found to be highly influential, but there was gender-related differentiation of activity.

Wambugu studied farmers' adoption of fodder shrubs in Kenya and concluded that participation in farmers' groups was an important positive factor in that process (Franzel, Wambugu, & Tuwei, 2003; Wambugu, 2006). Juma (2011), in his lengthy treatment of agricultural-innovation systems, advocated taking advantage of existing traditional and cultural community structures as linkages necessary for storing and disseminating knowledge.

Theoretical Framework

The theoretical framework for the study was the work of Everett Rogers (2003) on the diffusion of innovations, with a focus on how well Kenyan farmer-participants in agricultural workshops performed as informal change agents to diffuse innovations in the local community. Rogers argued that innovation diffusion can be advanced by informal change agents, persons who influence others in their social networks to consider and eventually adopt a new practice or technology. The study focused on seminar attendees first as innovation adopters themselves, who might then become informal change agents diffusing the innovation to others. Next, the same farmers were interviewed to assess the degree to which they as adopters had influenced other members of their social networks. Correlations between the selected variables and the data gathered from follow-up interviews with farmers were interpreted in light of Rogers' theoretical framework, with particular attention to his discussion of diffusion networks and the role of the informal change agent.

Purpose and Objective

The purpose of the study was to identify and describe associations between the adoptive behaviors of participants and their subsequent diffusive behaviors as farmers in the Uasin Gishu County of Kenya in the dissemination of agricultural innovations. Innovations that can potentially improve agricultural yields and add value are available, but sub-Saharan smallholder farmers have been slow to adopt these innovations (Aker, 2010; Diagne, n.d.; UNDP; Nkonya, Koo, Marenya, & Licker, 2012). It was hoped that by adding to the knowledge of how key variables function in association with innovation diffusion by informal change agents, the study would contribute to the capacity of these Kenyan farmers to promote improved agricultural practice and consequently better food security and quality of life in the region.

Delimitations, Limitations and Assumptions

This study proceeded with the following geographical, demographic, temporal and numeric delimitations. Research participants all lived and conducted farming activities within the area of a ten-kilometer radius of the

demonstration farm at which the three agricultural workshops took place.

Several factors affecting the study could not be controlled and must be noted as limitations to be taken into account when evaluating the results and interpreting the findings. One was that the research samples were necessarily convenient rather than random in nature, consisting of farmers who chose to attend agricultural seminars. This weakened the possibility of extrapolating results to the general population of Kenyan or sub-Saharan African farmers.

Two additional limitations were related to language requirements and distance from the site, both of which made it necessary to rely on Kenyan research assistants. The first language of almost all of the research respondents is Kalenjin. Local informants unanimously recommended that the survey and structured-interview instruments be printed in English, for the sake of precision and also because the local population is accustomed to English as a medium for communication related to education. At the same time, the recommendation was made that these instruments be administered by persons competent in both English and Kalenjin, so that explanation could be provided as needed in more than one linguistic channel.

Finally, the amount of time allowed between each of the three workshops and the first follow-up interview (relating to adoption of innovations by training participants), and between the first- and second-round interviews (relating to diffusion of innovations by training participants) was a limitation. Both of these time intervals were about four or five weeks in most cases. It is possible or even likely that longer intervening time periods would have resulted in findings of higher degrees of both participants' adoption and diffusion than were recorded in the study.

The first of several assumptions guiding the study was that the innovations recommended in the agricultural workshops for adoption by farmers would actually be beneficial to them. Second, it was assumed that a period of about four weeks would make it possible, at least for farmers in the innovator and early-adopter, if not early-majority, categories, to make an initial decision about adoption and take some preliminary or threshold action on adoption. A third assumption was similar, that another four weeks (or at least eight weeks after a workshop) would allow a reasonable opportunity for others in the workshop participants' networks to begin to be influenced by the trainees' activities as informal change agents in the diffusion process.

Methodology

The context of this study was the farming community of Twiga, which is roughly 25 miles north-northeast of the city of Eldoret and 30 miles southeast of the town of Kitale. Most of the residents are ethnically Kalenjin with few ethnic Luhyas. Most residents in and around Moiben are smallholder farmers who cultivate maize (corn) and wheat primarily, along with lesser amounts of a number of other cereal, root-and-tuber, and leaf crops. The Twiga demonstration farm consists of about three acres of land on which a variety of selected plants and trees are cultivated in ways designed to exemplify best agricultural and horticultural practices.

Three agricultural seminars presented at the farm provided the basis for this study. The first concerned management and care of dairy cattle (November 2011). The second was on poultry projects (December 2011). The third was a workshop on bee-keeping (January 2012). Improved practices recommended for dairy cattle

included a feeding regimen of Napier grass, maize stover, wheat stems, and bean straw; clean drinking water supply; AI for breeding; and health-maintenance measures such as de-worming, spraying, and dipping. Recommendations for poultry farmers were using a house with raised or cement floor; acquiring improved breeds; implementing regular vaccination or adding more types; increasing feed variety; and using a chick brooder. For bee-keeping, trainers recommended starting apiaries; acquiring improved hives; maintaining hive health by access to clean water, access to food, protection from predators, and safe distance from humans; and harvesting and processing improvements such as harvesting in late evening and early morning, using clean storage containers, and utilizing effective purification methods.

Population and samples

The target population for the study was Kenyan farmers. According to the CIA's World Factbook (2014), the total rural population in Kenya is estimated at 33,559,306. The accessible population for the research was farmers living within an eight-kilometer radius of the Moiben community/trading center in the Uasin Gishu County, Kenya. The total population in this area is estimated to be approximately 12,696 people (Falling Rain, 2010). Applying the national percentage of the total population aged fifteen-to-sixty-four (55.1%) yields a rough estimate of the number of active farmers in the accessible population of 6,995. The sample sizes were 32 persons (dairy-management seminar), 30 persons (poultry-keeping seminar), and 28 persons (bee-keeping seminar).

Instrumentation

A preliminary survey was administered to farmers who participated in the three agricultural workshops at Twiga. The purpose of this instrument was to estimate parameters of the target population to help determine the external validity of the study. Most of the demographic data was nominal and ordinal in nature, the exceptions being the ages and farm sizes of the respondents. The data gathered by means of this survey were foundational in selecting and operationalizing the variables used in the correlational analysis.

Data Collection

The questionnaires were administered by research assistants. The administration of the data-collection instruments typically took place at the workshop venue on the demonstration farm or respondent's home. In most cases a research assistant carefully explained each item. After responses on each questionnaire were recorded, the items were reviewed to check for completeness and intelligibility of the data provided. When any question arose in relation to the recorded information from participants, one of the research assistants contacted the respondent again to clarify or amplify his or her response. This review and follow-up procedure provided further warrant for confidence in the reliability of the data received. The likelihood of the occurrence of non-response issues was negligible because of the direct administration of the interview schedules by the research assistants to the seminar participants.

Data Analysis

Most of the data collected during the follow-up interviews was categorical rather than interval-level. Accordingly, two nonparametric correlations were considered to analyze the data: Spearman's *rho* (r_s) and Kendall's *tau* (τ). Field (2009), in his chapter on correlations, noted that while

Spearman's *rho* is the more popular of the two, Kendall's *tau* is probably more appropriate for relatively small sample sizes and data that contain many similar values. He added that the latter may also provide a more accurate indication of the actual correlation in the population. Based on these observations, it was decided to rely on Kendall's *tau* for this study's analyses of correlations between measurements of adoptive and diffusive behaviors.

The use of descriptive data in combination with correlational analysis has been used in a number of other studies. An Indian researcher conducted an inquiry into consumer adoption of personal computers in India, investigating relationships between demographic variables and adoption and behaviors in ways similar to those used in the present study (Krishnaswamy, 2006). Decker's (1987) research in business sociology reflected similar methodology and Bursal (2006) investigated mathematics-related anxiety in pre-service elementary teachers with correlational analysis. The work of Cavane and Donovan (2011) on the adoption of improved maize varieties and chemical fertilizers was correlational research. Adisa (2011) utilized descriptive-questionnaire data and basic correlational analysis to research conflicts between farmers and herdsmen in Nigeria.

Findings

Among the improved practices recommended in the dairy-management workshop (diversification of feed components, regular treatment and prevention of parasite infestation, and artificial insemination), participant-adopters reported highest levels of dissemination to one or more persons of improved feed ingredients (84%), and least dissemination of A.I. (28%). Recommendations from the poultry seminar included improved housing, improved breeds, use or increased use of vaccination, greater variety of feeds, and use of a chick brooder. Follow-up interviews with trainees indicated most effective diffusion to other farmers of using greater poultry feed variety (53%), and lowest level of dissemination for use of a chick brooder (13%). The bee-keeping workshop covered several improved practices, including use of improved hives, proper maintenance of hives, and optimal methods of harvesting and processing (in addition to starting an apiary, for those not having kept bees before). The highest rate of dissemination to one or more other farmers was 68% for initiating an apiary, followed closely by use of improved harvesting and processing techniques (67%). Effective hive-maintenance practices were disseminated at the lowest rate for this seminar (50%).

The dataset from each of the agricultural seminars was analyzed separately. Tables 1-3 contain the results of the correlational analyses conducted on five variables, two connected with adoption behaviors and three connected with diffusion behaviors. Two of the variables were binary (adopter/non-adopter, diffuser/non-diffuser). The others were ordinal measures of the extent of adoption or diffusion behaviors, either in terms of the number of recommended practices implemented/disseminated or in terms of the participants' reports of the number of other people who adopted particular innovations.

Table 1 presents Kendall's *tau* (τ) correlations among these five variables calculated for the participants in the dairy-management seminar. Most of the correlations were small and positive, except for the association between the extent of adoption and the extent of diffusion by number of innovations. These two were correlated with a medium-sized positive τ coefficient (.41).

Table 1
Correlations Between Adoption and Diffusion Behaviors (Dairy-Management)

	Correlation coefficients	Diffuser or non-diffuser	Extent of diffusion by # innovations diffused	Extent of diffusion, by est. # who later adopted
Adopter or non-adopter	τ	.29	.21	.11
Extent of adoption by # innovations adopted	τ	.22	.41	.21

Note. n = 32.

Table 2 displays results of correlational calculations among five variables related to adoption and diffusion behaviors, using Kendall's *tau* (τ), for participants in the poultry-keeping workshop. All coefficients reported in the table were positive. Four of the six had large magnitudes (greater than .50), and the other two were in medium range (greater than .30). These correlation-sizes point to moderate to strong positive relationships between the research participants' adoption and diffusion decisions and between their rates of success in both areas of activity.

Table 2
Correlations Between Adoption and Diffusion Behaviors (Poultry-Keeping)

	Correlation coefficients	Diffuser or non-diffuser	Extent of diffusion by # innovations diffused	Extent of diffusion by est. # who later adopted
Adopter or non-adopter	τ	.54	.44	.47
Extent of adoption by # innovations adopted	τ	.53	.54	.52

Note. n = 30.

Table 3 displays Kendall's *tau* (τ) correlations for farmers who attended the bee-keeping seminar. The coefficients were calculated on associations between five variables related to post-training adoption and diffusion activities. All six relationships were positive and registered substantial correlation-sizes, with five above, and one approaching, the conventional threshold for large magnitudes. Again, these correlations represent strong to very strong positive

relationships among the variables tested. Workshop participants who implemented recommended practices after the training went on to diffuse the same practices to others to a greater extent than those who did not make post-training adoption decisions, or adopted fewer improved practices.

Table 3
Correlations Between Adoption and Diffusion Behaviors (Bee-Keeping)

		Diffuser or non-diffuser	Extent of diffusion by # innovations diffused	Extent of diffusion, by est. # who later adopted
Adopter or non-adopter	τ	.78	.65	.60
Extent of adoption by # innovations adopted	τ	.65	.58	.44

Note. For adoption data, n = 28; for diffusion data, n = 24.

Conclusions

Although caution would be necessary when considering whether to apply these findings to other populations, they served to suggest potentially productive directions and points of focus for subsequent research. Farmers across the samples who exhibited higher levels of adoption of workshop-recommended innovations also had a moderate to strong likelihood of showing correspondingly higher levels of diffusion-related behavior. These conclusions agree with Rogers (2003) in his discussion of change-agent credibility. His research indicated that prior personal adoption of an innovation increases a person's credibility as a persuader with other potential adopters, and thus increases the likelihood of success in efforts to diffuse the innovation among network members.

Feder and Slade (1984) applied diffusion theory to the spread of agricultural innovations among Indian farmers and also concluded that one of the key factors was farmers who, having already adopted a new practice, influenced other farmers in their community likewise to implement it until a majority had done so. Bandura (2006) emphasizes the roles of social modeling and perceived self-efficacy as predictors of human decision-making behavior. Adopters of the improved agricultural practices recommended by the seminar trainers became social modelers of those innovations, thereby exerting a persuasive influence on others in their networks. This seems to have been reflected in the relatively strong correlations between adoption decisions by participants and the associated subsequent adoption of the innovations by others. In the social cognitive framework, one of the results of social modeling is to increase personal self-efficacy beliefs.

Thus, social modeling not only exerts persuasive influence on potential adopters in terms of the demonstrated benefits of the innovation, but also serves to increase their self-efficacy beliefs, which further raises the likelihood of making a decision to adopt. Again, this corresponds well with the associations observed between the adoptive and diffusive patterns exhibited

by the farmer-participants at the Twiga seminars.

Implications

Although the rates of adoption and diffusion by the workshop participants varied widely across the entire number of recommended practices, the grand mean percentage of those who diffused to others at least one improved practice from a seminar was 54.19%. There are, of course, many other factors to consider in the comprehensive evaluation of a training event, but these percentages provide some evidence for the effectiveness of the Twiga workshops in training farmers who diffuse innovations to other community members. One implication to identify tentatively from this rate of trainee dissemination of recommended practices is that such seminars—planned, hosted, and conducted by local leaders in partnership with qualified instructors—can be an important component in an overall strategy for community-focused agricultural development. Opportunities for cost-sharing and for the creation of new, long-term partnerships with both governmental and nongovernmental agencies are only two of the auxiliary benefits that could be listed. Among the most important is the financial empowerment of farmers who receive training and implement innovative practices. One farmer who attended the bee-keeping workshop, because of the training and a personal contact made at the seminar, was able some months later to sell his honey and pay his child's school fees with the proceeds.

A second implication relates closely to another of the central purposes of this study—to contribute to a better understanding of the ways in which Twiga-area farmers, after community-based seminar training, could serve as informal change agents in diffusing agricultural innovations. This implication is that many of the participants in the three Twiga seminars appeared to function in a kind of informal-change-agent role, distinct from the full-fledged change agents, the para-professional aides, or even the opinion leaders whom Rogers (2003) described at some length in his chapter on change agents. There were recognizable change agents, aides, and opinion leaders present occasionally or residentially in the Twiga community.

Most of the participants in this research, however, did not fit neatly into those categories, and yet many of them were quite active in diffusion-related activity. Toward the end of his discussion of change agents, Rogers (2003) included a section describing centralized and decentralized diffusion systems. In the process he made this observation regarding the latter type: "In many cases, adopters served as their own change agents in diffusing their innovations to others" (p. 395). Although Rogers did not use the words "informal change agent" in this context, his reference to some adopters in a decentralized diffusion system functioning "as their own change agents" makes the descriptor seem appropriate.

Conventional change agents are somewhat handicapped in their role by the heterophily that comes with being outsiders. Informal change agents, whose roots and residences are in the same community in which they seek to diffuse innovations, have high homophily and little or no heterophily within their local networks. They are thus ideally suited to bridge between "outsider" change agents and "insider" potential adopters. In the Twiga community there was some overlap between opinion leaders (the diffusion-of-innovations term) and these informal change agents, but many of the latter did not fit Rogers' description of opinion leaders. Informal change agents who

are members of one or more networks within the community—such as, for example, a farmers' group and/or a church congregation—may have useful combinations of strong- and weak-ties networks that facilitate both horizontal and vertical dimensions of diffusion. This is a notable instance of theoretical territory shared by two distinct models: Diffusion of Innovations and Social Network Analysis (Kadushin, 2012).

Recommendations for Practice and Research

One recommendation for practice is that farmers who adopt improved practices learned in training be identified specifically for further interventions related to implementation and diffusion of agricultural innovations. As an example of the need for this sort of intervention, early-adopter trainees often cannot afford to purchase improved hives and the protective and processing equipment needed for profitable bee-keeping. If these farmers could access low-interest loans, they would be more likely both to extend their adoption of recommended best practices and also to disseminate these innovations to others.

Second, it is recommended that agricultural seminars continue to be offered periodically at Twiga and in neighboring areas, and that conducting this kind of local workshop be initiated in rural communities where it has not been done before. When asked in follow-up interviews about the primary factor that influenced them to adopt an improved practice, a large majority of research respondents selected seminar participation. Davis (2004), after research on farmers' groups in Meru, Kenya, made a similar recommendation: "Provide capacity building in the form of training, cross-visits, agricultural shows and other mechanisms to build the capacity of farmers and groups" (p. 212). This type of training event, with a typical interactive and hands-on format, is an excellent way to equip informal change agents and to sensitize them to their potential role in the diffusion of developmentally crucial practices in their networks. Bandura (1982) cited experiences such as farmers go through during these workshops as significant ways to increase self-efficacy, and thereby to achieve desired changes in one's environment.

For further research, a first recommendation is to extend the analysis of the data used in this study by focusing on the minority of trainees who participated in two or in some cases all three of the seminars at the demonstration farm. What, if any, were the effects of their exposure to multiple iterations of training during a three-month period? Did they adopt improved practices more comprehensively or more rapidly than those who attended only one workshop? Did they disseminate to others more widely and effectively?

Bandura (2002, 2006b) argued at some length that the central construct of self-efficacy beliefs in social cognitive theory transcends cultural differences:

> Research testifies to the cross-cultural generalizability of self-efficacy theory….Not only is the structure of self-efficacy beliefs comparable cross-culturally, but so are their functional properties. Regardless of whether the culture is American, Italian, Korean, or Chinese, the stronger the perceived self-efficacy, the higher the performance attainments (2006b, p. 175).

A second recommendation, then, for further research is to test this assertion about the cross-cultural functionality of self-efficacy beliefs in an East African context, and

specifically in regard to the significance of self-efficacy as a predictor or explanatory factor with diffusion behavior by informal change agents. This researcher has not found any comparably detailed discussion of claims that the Theory of Personal Behavior and Social Network Analysis models are also robust in cross-cultural applications, but both of them have also been used in studying behavioral change and social-network issues in a variety of cultures (Hagger, Chatzisarantis, Barkoukis, Wang, Hein, Pihu, Soós, & Karsai, 2007; Ndah, Schuler, Uthes, & Zander, 2010; Parkhe, Wasserman, Ralston, 2006; Pavlou & Chai, 2002;Wilson, Zenda, McMaster, & Lavelle, 1992). It is recommended that studies be designed and conducted for the purpose of assessing the utility of these models for cross-cultural behavior-change analysis in general, and for diffusion of innovations in particular. Perhaps it would be advisable to begin with a meta-analysis of both frameworks to survey as many examples as possible in which they have been used in cross-cultural research.

A final research recommendation is to use the results of the present study as beginning points for other studies that may extend, confirm, or disconfirm these results. The criterion-variable correlations found to have small-to-medium and larger magnitudes could be explored further with random samples of farmers. Regression or factor analysis could be used to go beyond the initial correlational analysis and move toward explanations of outcomes that might permit generalization of results beyond the research samples. There is room not only for additional quantitative studies to extend or modify the findings of this research, but also for qualitative and mixed-methods approaches. It is expected that these diverse strategies will contribute significantly to empirically based knowledge about how East African farmers can work toward food security and overall improved livelihood as an attainable goal

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