The *Journal of International Agricultural and Extension Education* (*JIAEE*) is the official refereed publication of the Association for International Agricultural and Extension Education (AIAEE). The purpose of the *JIAEE* is to enhance the research and knowledge base of agricultural and extension education from an international perspective. Acceptance rates for the past 3 volumes are: Volume 15=20%; Volume 16=10%; Volume 17=16%.

Articles intended for publication should focus on international agricultural education and/or international extension education. Articles should relate to current or emerging issues, cite appropriate literature, and develop implications for international agricultural and extension education. **Manuscripts, or portions of manuscripts, must not have been published or be under consideration for publication by another journal.** Three types of articles are solicited for the *JIAEE*: Feature Articles, Tools of the Profession Articles and Book Reviews.

**Feature Articles**
Feature articles focus on philosophy, current or emerging issues, and the methodology and practical application of specific research and appropriate technologies, which have implications for developed and developing countries. For publication in the *JIAEE*, feature articles must pass the *JIAEE’s double blind, referee process*, where peer reviewers evaluate manuscript content and ensure readability. Reviewers are selected from the AIAEE membership of current and past authors. In the double blind, referee process, all references to authors are removed before the manuscript is sent to reviewers. Feature articles may be submitted for peer review a total of three times before they are no longer acceptable for publication in the *JIAEE*. Failure to meet the submission formatting guidelines will result in an automatic 1st rejection.

**Other Article Types**
Commentary articles state an opinion, offer a challenge, or present a thought-provoking idea on an issue of concern to international agricultural and extension education, including a published article in the *JIAEE*. These articles are invited by the editors. Tools of the Profession articles report specific techniques, materials, books and technologies that can be useful for agricultural and extension educators in a global context and/or in a country/region. Book Reviews provide insight on current books related to international agricultural education.

**Subscriptions**
Subscriptions may be acquired online at http://www.aiaee.org/subscribe.html. The individual membership rate of $70 provides a yearly subscription to the online journal. Individuals may also complete the form and return via US mail using http://www.aiaee.org/images/stories/AIAEE/Member_Form.pdf. Domestic and international libraries and subscription agencies may register their IP range for online access for subscribers for $150 per year. Individual memberships and subscriptions are payable to J. Mark Erbaugh, AIAEE Treasurer, The Ohio State University, 113 Ag. Admin. Bldg., 2120 Fyffe Rd., Columbus, OH 43210.
Journal of International Agricultural and Extension Education

Volume 18 Number 3 Fall 2011

Editorial Board and Leadership Team

From the New Executive and Managing Editors

Feature Articles
Determinants of Adoption of Improved Maize Varieties and Chemical Fertilizers in Mozambique

Eunice Cavane, Eduardo Mondlane University
Cynthia Donovan, Michigan State University

An Examination of Trinidad Extension Officers’ Behavioral Beliefs and Intent to Participate in an International Extension Experience

Amy Harder, University of Florida
Alexa J. Lamm, University of Florida
Wayne Ganpat, University of the West Indies
James R. Lindner, Texas A&M University

Rural Development Centers (Farm Stores) in Afghanistan, Do They Work? The Business Owners’ Perspectives

Tim Kock, Louis Berger Group
Jerry Turnbull, Louis Berger Group

Diffusion of Technologies by the Tikonko Agricultural Extension Center (TAEC) to Farmers of the Tikonko Chiefdom in Sierra Leone: Impacts, Problems, Proposed Solutions, and an Updated Outlook

Samba Moriba, Oklahoma State University
Joseph B. A. Kandeh, Njala University
M. Craig Edwards, Oklahoma State University

Blurring Cultural Boundary between Scientists and Farmers in the Philippines through a Mediated Bilateral Model

Eric P. Palacpac, Philippine Carabao Center

Recommended Competencies Needed for Teaching in International Extension Settings

Robert Strong, Texas A&M University
Amy Harder, University of Florida
Editorial Board

The editorial board consists of the editors, the past editor and other members representing regions of the world.

Editors

Kim E. Dooley, Executive Editor
Agricultural Leadership, Education & Comm.
Texas A&M University
2116 TAMU, 128B AGLS Bldg
College Station, TX 77843-2116
Ph. 979-845-6923
k-dooley@tamu.edu

Tracy Irani, Associate Editor (Tools & Book Reviews)
Agricultural Education and Communications
University of Florida
220 Rolfs Hall
Gainesville, FL 32611-0502
Ph. 392-0502 ext. 225
irani@ufl.edu

Brenda Seevers, Managing Editor
Agricultural and Extension Education
113 Gerald Thomas Hall
New Mexico State University
Las Cruces, NM 88003
Ph. 575-646-4511
bseevers@nmsu.edu

Maria Navarro, Associate Editor (Commentary)
The University of Georgia
105 Four Towers
Athens, GA 30602-4355
Ph. 706-542-0262
mnavarro@uga.edu

James R. Lindner, Past Editor
Agricultural Leadership, Education & Comm.
Texas A&M University
2116 TAMU, 128D AGLS Bldg
College Station, TX 77843-2116
Ph. 979-458-2701
j-lindner@tamu.edu

Amy Harder, Managing Editor Elect
University of Florida
P.O. Box 110540
Gainesville, FL 32611-0540

Association for International Agricultural and Extension Education Officers

James R. Lindner, President
Texas A&M University
2116 TAMU
College Station, TX 77843

T. Grady Roberts, Secretary
University of Florida
P.O. Box 110540
Gainesville, FL 32611-0540

David Lawver, Past President
Texas Tech University
Box 42131
Lubbock, TX 79409

J. Mark Erbaugh, Treasurer
The Ohio State University
113 Ag. Admin. Bldg., 2120 Fyffe Rd.
Columbus, OH 43210

Theresa Murphrey, President Elect
Texas A&M University
2116 TAMU
College Station, TX 77843

Barnabas Dlamini
Board Member-at-Large
University of Swaziland
PO Box 1711
Manzini M200
Swaziland

Samantha Alvis, Graduate Student Representative
Texas A&M University
2116 TAMU
College Station, TX 77843
<table>
<thead>
<tr>
<th>U.S./World Representatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adewale Johnson Alonge</td>
</tr>
<tr>
<td>Miami-Dade Public School System</td>
</tr>
<tr>
<td>9034 SW 163 Terrace</td>
</tr>
<tr>
<td>Miami, FL 33157</td>
</tr>
<tr>
<td><a href="mailto:alongeaj@yahoo.com">alongeaj@yahoo.com</a></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Barnabas Dlamini</td>
</tr>
<tr>
<td>University of Swaziland</td>
</tr>
<tr>
<td>Agricultural Education and Extension</td>
</tr>
<tr>
<td>PO Luyengo, Swaziland</td>
</tr>
<tr>
<td><a href="mailto:bmd@africaonline.co.sz">bmd@africaonline.co.sz</a></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>David Dolly</td>
</tr>
<tr>
<td>University of West Indies</td>
</tr>
<tr>
<td>Agricultural Economics and Extension</td>
</tr>
<tr>
<td>St. Augustine, Trinidad and Tobago</td>
</tr>
<tr>
<td><a href="mailto:farmdavid42@hotmail.com">farmdavid42@hotmail.com</a></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Amy Harder</td>
</tr>
<tr>
<td>University of Florida</td>
</tr>
<tr>
<td>Agricultural Education &amp; Communication</td>
</tr>
<tr>
<td>307B Rolfs Hall</td>
</tr>
<tr>
<td>Gainesville, FL 32611-0540</td>
</tr>
<tr>
<td><a href="mailto:amharder@ufl.edu">amharder@ufl.edu</a></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Delwar Hossain</td>
</tr>
<tr>
<td>Centre for Rural and Remote Area Health</td>
</tr>
<tr>
<td>University of Southern Queensland (USQ)</td>
</tr>
<tr>
<td>West Street, Toowoomba, Qld 4350, Australia</td>
</tr>
</tbody>
</table>
From the New Executive and Managing Editors

It has been two years since JIAEE transitioned to a fully electronic journal hosted by CyperPress, thanks to the leadership of past editor, Dr. James Lindner, and executive editor, Dr. Kim Dooley. Dr. Dooley also initiated the process of registering JIAEE articles with doi numbers. These efforts have increased the accessibility and visibility of JIAEE while accelerating the publishing process. At the same time, the integration of all of AIAEE’s Web presences into one system has been beneficial to current and potential members who now only need to visit one location to access a wide variety of resources. The vision shared by Drs. Lindner and Dooley has moved JIAEE to higher levels. Their work is deeply appreciated.

As the incoming editorial team, we hope to continue the positive momentum generated by past editorial leadership. Beginning in Volume 19, the editors will invite commentary articles to focus on key issues and trends within international agricultural and extension education. A new email address for journal matters has been created (jiaee@aiaee.org). An expanded reviewer list is being developed to strengthen the review process. You can help by going to JIAEE FastTrack (http://jiaee.expressacademic.org/login.php) and checking the accuracy of your contact information, institution, and areas of expertise. Please contact us directly if you’re no longer interested in serving as a reviewer or if you’re interested in serving as a reviewer and have published in JIAEE in the past five years. We know that the success of the journal is directly related to time and energy given by our reviewers and we are grateful.

This edition of the journal features articles that will encourage the readership to think about strategies for professional development, adoption and diffusion of innovations, and clientele perspectives on change. Authors represent six universities and two international organizations living and working in five countries on three continents. We’re encouraged by the diverse perspectives provided in this journal and are committed to continuing to provide a journal that highlights issues of importance to all of our readers. If you have any suggestions or comments for improving JIAAE, we look forward to hearing from you.

Sincerely,

Brenda Seevers & Amy Harder
Executive & Managing Editors, 2012-2014
JIAEE
Determinants of Adoption of Improved Maize Varieties and Chemical Fertilizers in Mozambique

Eunice Cavane
Eduardo Mondlane University
ecavane@uem.mz or cavaneeu@msu.edu

Cynthia Donovan
Michigan State University
donovanc@anr.msu.edu

Abstract

In Mozambique, adoption of improved maize seed and chemical fertilizers is still limited. This study assessed farmers’ attitudes towards hybrid maize SC513, Nitrogenous (N) Phosphorous (P) Potassium (K), (NPK 12-24-12) and urea fertilizers in highlands and lowlands of the Manica District. The study determined the influence of farmers’ characteristics, attitudes, sources of information, and agro-ecological conditions on adoption of these technologies during 1995 through 2005. A questionnaire was administered during April and May 2006 with a randomly selected sample of 293 households. In general, farmers held positive attitudes towards improved maize varieties and chemical fertilizers, but the strength of attitudes towards fertilizers, in particular, varied by source of information. Farmers who learned about fertilizers from extension had stronger positive attitudes than farmers who learned about fertilizers from neighbors, although with hybrid seeds adoption there was no significant difference between key sources. Overall, the number of farmers using SC513 was higher than the number of farmers using NPK and urea. Farmers’ decision to adopt SC513 was positively associated with agro-ecological conditions, knowledge, production traits and marketability of the maize. Agro-ecological conditions, knowledge of fertilizer application, and extension contact influenced adoption of chemical fertilizers. The results differentiate a simpler process of adoption of new seed from a more complex process of adoption of fertilizers which demands greater knowledge of timing and soils as well as basic computational skills. Factors determining adoption of hybrid maize varieties and chemical fertilizers should be considered when designing extension programs for these technologies.

Keywords: Adoption, attitudes, chemical fertilizer, extension, improved maize varieties
Introduction

Improving maize production is one of the most important strategies for food security in Mozambique. However, chemical fertilizers and improved maize varieties are not yet widely adopted in Mozambique. In 2008 less than 5 percent of approximately three million farmers used chemical fertilizers and about 10 percent used improved maize varieties (Ministry of Agriculture [MINAG], 2009). Hence a widespread adoption of improved seed varieties and chemical fertilizers is a challenge for agricultural development policy in Mozambique.

Improved maize varieties include hybrids and open pollinated varieties (OPVs) whose traits have been improved for selected characteristics such as drought tolerance, disease resistance, short maturity rate, increased yield per unit of land, and quality protein (Byerlee, 1994). Adoption of improved maize varieties can help farmers face labor constraints, food insecurity and lack of income. Research in Southern Africa (Byerlee, 1994; Kaliba et al., 2000) indicated that farmers prefer early maturing maize to better deal with labor constraints, risk considerations and crop rotations. Sometimes farm households would improve food security by planting an early maturing variety that can be consumed in the “hungry season,” before the main harvest. In areas with small scale irrigation and near market places for fresh maize, early maturing varieties provide sources of income for farmers (Rotter & Keulen, 1996).

Expanded use of fertilizer in Sub-Saharan Africa has been stressed as one of the solutions to alleviate production shortfalls and land degradation in the region (Pinstrup-Andersen, Pandya-Lorch, & Rosegrant, 1997). Farmers can benefit from applying chemical fertilizer to maize. When used in optimal amounts, chemical fertilizers increase production and farm efficiency. Optimal applications of commercial fertilizers replenish the nutrients removed by the crop and in some cases exceed levels of nutrients found in the soils before they were farmed. In Kenya, Rotter and Keulen (1996) found that there was tremendous potential for increasing maize yields, and hence national production, by applying moderate amounts of nitrogen (N) and phosphorous (P) fertilizers in the lowlands and midlands.

For widespread adoption of improved varieties and chemical fertilizer by farmers, extension educators need to understand the factors affecting technology adoption (Abebaw & Belay, 2001). Adoption of technology is influenced by physical, socio-economic, and mental factors including agro-ecological conditions, age of farmer, family size, education of farmer, how-to-knowledge, source of information, and farmer’s attitudes towards the technology (Feder et al., 1985; Byerlee & Polanco, 1986; Neupane et al., 2002; Rogers, 2003). High levels of adoption of improved maize varieties and chemical fertilizers are more likely to be found among farmers located in agro-ecological regions with high rainfall (Kaliba et al., 2000; Hintze et al., 2003). Young farmers are more likely to adopt a new technology because they have had more schooling and are more open to attitude change than older farmers (International Maize and Wheat Improvement Center [CIMMYT], 1993; Visser & Krosnick, 1998). Education is expected to enhance decision making and the adoption of agricultural technologies. Family size plays a role on labor provision. Adoption of new varieties often requires more labor inputs (Feder et al., 1985). It is assumed that large families provide the labor required for improved maize production practices. Access to sources of information, such as extension, market, and neighbors, enhances the adoption of technology (Abebaw & Belay, 2001). Knowledge influences adoption. Farmers who have adequate knowledge of technology use are more likely to adopt it (Abebaw & Belay, 2001; Rogers, 2003).
Knowledge of technology application acts as an intervening variable between “attitudes towards the technology” and “use of the technology” (Rogers & Havens, 1961). Farmers’ attitudes are important in determining adoption of improved technology. Attitudes are evaluative responses towards the technology, and are formed as farmers gain information about it. Adopters tend to hold positive attitudes towards the technology (Chilonda & Van Huyslenbroeck, 2001). The literature suggests that attitudes towards improved maize varieties place great emphasis on two factors: production characteristics and income factors. Similarly, for chemical fertilizers, the literature suggests two factors: effect of fertilizer and costs factors (Enyong et al., 1999; Thompson, 1992).

The objectives of this study were twofold: firstly, to assess farmers’ attitudes towards adoption of hybrid maize SC513, NPK, and urea fertilizers in highlands and lowlands of the Manica District; and secondly, to determine the influence of farmers’ characteristics, attitudes, source of information, and agro-ecological conditions on adoption of hybrid maize SC513, NPK, and urea fertilizers.

Materials and Methods

This study involved a cross-sectional survey with 293 randomly selected households growing maize in the highlands of Machipanda and lowlands of Vanduzi in the Manica District, central region of Mozambique. Machipanda and Vanduzi were selected purposely because of the importance of maize in the farming systems and the availability of maize technology dissemination programs in the two areas. Vanduzi and Machipanda represent two distinct agro-ecological zones, R4 and R10 respectively. Machipanda is located at higher altitude (900-1500 m), and gets higher annual rainfall (900-1500 mm) than Vanduzi which is located at 200-1000 m above sea level with annual rainfall of about 900-1000 mm.

Data were collected between April and May, 2006, using personal interviews with 120 farmer household heads from Machipanda, and 173 from Vanduzi. The explanatory variables measured in the questionnaire are presented in Table 1.

The Logistic Model

In the field of agriculture, adoption of technologies is measured as a dichotomous response variable (0 = non-adoption of innovation and 1 = adoption of innovation). The logistic model is the standard method of analysis, when the outcome variable is dichotomous (Hosmer & Lemeshow, 2000). The logistic regression model characterizing adoption of SC513, NPK or urea by the sample of households is specified as follows:

\[
\pi = \frac{e^{\alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_p X_p + \varepsilon}}{1 + e^{\alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_p X_p + \varepsilon}}
\]

(1.0)

Where:

\(\pi\), is the actual proportion of farmers adopting the technology for particular values of independent variables \(X_1, X_2, \ldots, X_p\) that influence adoption of SC513, NPK or urea. \(\beta_1, \beta_2, \ldots, \beta_p\) denote the regression coefficients associated with independent variables \(X_1, X_2, \ldots, X_p\). \(\alpha\) is the constant terms and \(\varepsilon\) is the error term. From the equation (1.0), we arrive at a simple linear regression equation through logit transformation (Chatterjee et al., 2000; Hosmer & Lemeshow, 2000):

\[
\log[\pi/(1 - \pi)] = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_p X_p + \varepsilon
\]

(2.0)
Table 1
Description of Explanatory Variables Measured in the Questionnaire

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Variable type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agro ecological region (X₁)</td>
<td>Dichotomous</td>
<td>0 = Lowlands (Vanduzi), 1 = Highlands (Machipanda)</td>
</tr>
<tr>
<td>Age (X₂)</td>
<td>Continuous</td>
<td>Farmer’s age (years)</td>
</tr>
<tr>
<td>Family size (X₃)</td>
<td>Continuous</td>
<td>Number of members in the family</td>
</tr>
<tr>
<td>Level of education (X₄)</td>
<td>Dichotomous</td>
<td>0 = illiterate, 1 = some schooling</td>
</tr>
<tr>
<td>Knowledge of advantages and disadvantages of improved maize and knowledge of fertilizer application (X₅)</td>
<td>Dichotomous</td>
<td>0 = not knowledgeable, 1 = knowledgeable</td>
</tr>
<tr>
<td>Source of information (X₆)</td>
<td>Multiple category variable</td>
<td>For improved maize SC513: 1 = neighbors, 2 = market, 3 = extension</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For chemical fertilizers: 1= market, 2 = extension, 3 = neighbors</td>
</tr>
<tr>
<td>Attitude (X₇)</td>
<td>Interval</td>
<td>Factor scores for attitude toward marketability of grain of improved maize SC513</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Factor scores for attitude toward production traits of improved maize SC513</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Factor scores for attitude toward NPK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Factor scores for attitude toward urea</td>
</tr>
</tbody>
</table>

Data Analysis

Data were analyzed using the Statistical Package for Social Sciences SPSS version 15 (SPSS Inc. 2006). Attitude statements were measured using a 5-point Likert scale with 1 = Strongly Agree, 2 = Agree, 3 = Neutral, 4 = Disagree, and 5 = Strongly Disagree. Exploratory and confirmatory factor analyses were used to create summed scales of attitudes towards SC513, NPK and urea. A two-factor model for improved maize variety SC513 had an excellent fit, \( X^2 = 7.550, p > 0.05 \). Comparative index (CFI) was greater than 0.90. Although the RMSEA was greater than 0.05, the 90% confidence interval for RMSEA was 0.030 to 0.184. This interval includes 0.05 criteria which indicate “reasonable” errors of approximation in the population. A one-factor model for urea had a reasonable fit. Comparative index (CFI) was slightly greater than 0.90. This means that although \( X^2 = 7.285, p > 0.01 \). Each of the two factors of the scale on attitudes towards maize variety SC513 had three items. Hence, for each factor the summed score across items for a given respondent ranged from 3 to 15, with scores lower than 9 indicating favorable attitudes,
and scores greater than 9 indicating unfavorable attitudes. The scale of attitudes towards NPK /Urea had four items. The summed score across items for a given respondent ranged from 4 to 20, with scores lower than 12 indicating favorable attitudes, and scores greater than 12 indicating unfavorable attitudes. One-Way ANOVA was used to compare mean attitude scores for the three groups of sources of information on the technology, neighbors, market, and extension.

To create attitude scores for subsequent use in logistic regression, factor scores were estimated through principal component and varimax procedure (Hair et al., 2005). Two-factor solutions for the attitude scale on SC513, explained about 59.3 percent of the variance in attitudes toward SC513. One factor solution for the attitude scale on NPK explained about 48 percent of the variance in attitude toward it. One factor solution for the attitude scale on urea explained about 56.4 percent of the variance in attitudes toward urea.

Variance Inflation Factor (VIF) estimates were examined for collinearity diagnostic in Multiple Logistic Regression. Most of VIF estimates had values less than 2, which indicate no serious problems of collinearity.

**Results and Discussion**

**Characteristics of Farmers**

The last section of the questionnaire measured the general characteristics of the farmers. The results are presented in Table 2.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Machipanda Frequency</th>
<th>Machipanda Percent</th>
<th>Vanduzi Frequency</th>
<th>Vanduzi Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years)</td>
<td>(n = 120)</td>
<td>(n = 173)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 44</td>
<td>65</td>
<td>54.2</td>
<td>89</td>
<td>51.4</td>
</tr>
<tr>
<td>45 to 60</td>
<td>38</td>
<td>31.7</td>
<td>59</td>
<td>34.1</td>
</tr>
<tr>
<td>61 to 76</td>
<td>12</td>
<td>10.0</td>
<td>21</td>
<td>12.1</td>
</tr>
<tr>
<td>More than 76</td>
<td>5</td>
<td>4.2</td>
<td>4</td>
<td>2.3</td>
</tr>
<tr>
<td>Level of education (n = 120)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>17</td>
<td>14.2</td>
<td>53</td>
<td>30.6</td>
</tr>
<tr>
<td>Primary School</td>
<td>95</td>
<td>79.2</td>
<td>109</td>
<td>63.0</td>
</tr>
<tr>
<td>Secondary/High School</td>
<td>8</td>
<td>6.7</td>
<td>11</td>
<td>6.4</td>
</tr>
<tr>
<td>Family size (n = 120)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 8</td>
<td>79</td>
<td>65.8</td>
<td>112</td>
<td>64.7</td>
</tr>
<tr>
<td>9 to 12</td>
<td>30</td>
<td>25.0</td>
<td>44</td>
<td>25.4</td>
</tr>
<tr>
<td>More than 13</td>
<td>11</td>
<td>9.2</td>
<td>17</td>
<td>9.8</td>
</tr>
</tbody>
</table>

Farmers were similar regarding age and family size. In both study locations the majority of farmers had an age < 44 years and family size < 8 members. However, for level of education the respondents showed differences. Vanduzi had a larger number (30.6 %) of illiterate farmers than Machipanda (14.2 %). It is possible that farmers in Machipanda had more access to school due to proximity to Zimbabwe, than farmers in Vanduzi.
The results on family size indicate that about 25 percent of households in both study areas have between 9 and 12 members. These numbers are higher than the average family size in rural areas of Mozambique which is approximately six members. Assuming that adoption of new varieties requires more labor inputs (Feder et al., 1985), we would think that 25 percent of the rural households in Machipanda and Vanduzi, have relatively large families to rely upon for labor demands. However, the total number of family members does not always mean availability of labor, because some families may have higher dependency rates than others. Thus while the relatively large family size may suggest more labor for cultivation, more precise results on labor availability would need to be provided by information on dependency ratios.

Farmer’s Attitudes Towards Improved Maize SC513, NPK and Urea Fertilizers

To capture farmers’ attitudes, farmers were asked the extent of their agreement with six statements on characteristics and marketability of improved maize variety SC513, four statements on chemical fertilizer NPK, and four statements on chemical fertilizer urea. Tables 3, 4 and 5 present farmers’ attitudes towards improved maize variety SC513, NPK and urea fertilizers. Mean score was based on a 5-point interval scale where 1 equals Strongly Agree, 2 equals Agree, 3 equals Neutral, 4 equals Disagree, and 5 equals Strongly Disagree. The scale was reversed for negative statements.

Farmers’ attitudes towards SC513 consisted mostly of cognitive responses, expressed as beliefs by farmers about the relationship between the seed and the production and marketability characteristics that describe the seed. In general, respondents from Machipanda and Vanduzi held positive attitudes towards the marketability of improved maize variety SC513, production characteristics of SC513, and use of NPK and urea for maize production. For improved maize variety SC513, most farmers in Machipanda (93.9%) and Vanduzi (63.3%) appreciated the quality of the seed and maize meal obtained with maize variety SC513. Other studies found that farmers are favorable toward production characteristics of improved maize varieties (Hintze et al., 2003).

For chemical fertilizers most farmers (>80%) in Machipanda and Vanduzi appreciated the effect of NPK and urea on increasing maize yield. Farmers agreed that NPK and urea were good for increasing maize yield. Farmers’ attitudes towards use of chemical fertilizer on maize consisted of both cognitive and affective responses. The cognitive responses were expressed as beliefs farmers have about the relationship between the fertilizer and its capacity of increasing maize yield as well as the relationship between the fertilizer and its value for maize production.

The affective response was expressed as a good or bad feeling experienced by farmers when fertilizers are paired with their effect on the crop and soil. For example, farmers, particularly in Machipanda, expressed a negative attitude towards the effect of NPK on the soil. These farmers might have learned the affective response “Chemical fertilizer is not good for the soil” through direct emotional experiences offered by those instances when farmers stopped applying fertilizer and obtained low yields. As farmers explained when asked why they thought chemical fertilizer was not good for the soil, “NPK kills the soil. Once you use it, you should keep using it. The soil becomes dependent on it. If you stop using NPK your soil will not produce as much as before” (Farmers in Machipanda, 2006). This suggests that some farmers in Machipanda view the application of NPK as an intrusion of plant nutrients into a balanced environment. Another aspect explicit in farmers’ explanations is a fear of
their maize production becoming dependent on an input (NPK) which they feel cannot afford buying it regularly. These results highlight the need of increasing farmers’ knowledge of optimal fertilizer use, and improving access to fertilizer.

Table 3
Farmers’ Attitudes Towards Improved Maize Variety SC513

<table>
<thead>
<tr>
<th>Attitude toward marketability of improved maize variety SC513.</th>
<th>Percent of Response Categories in Machipanda (n = 115)</th>
<th>Percent of Response Categories in Vanduzi (n = 91)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain is easy to sell.</td>
<td>SA 7.8 A 66.1 N 19.1 D 6.1 SD 9.2 M SD 7.7 M SD 62.6 M SD 29.7</td>
<td>- M 2.2 M SD 2.6</td>
</tr>
<tr>
<td>Fresh maize is easy to sell.</td>
<td>7.0 51.3 A 38.3 N 2.6 D 2.4 SD 2.2 M 50.5 M 41.8 M 4.4 M 1.1 M 2.5 M 0.7</td>
<td></td>
</tr>
<tr>
<td>Planting SC 513 is a waste of time and money.</td>
<td>4.3 77.4 A 5.2 N 11.3 D 1.7 SD 3.8 M 3.3 M 67.0 M 24.2 M 4.4 M 1.1 M 2.3 M 0.7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attitude toward production characteristics of SC513.</th>
<th>Percent of Response Categories in Machipanda (n = 115)</th>
<th>Percent of Response Categories in Vanduzi (n = 91)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed has good germination.</td>
<td>12.2 M 78.3 M 7.0 A 1.7 D 9.2 SD 2.0 M SD 46.2 M SD 33.0</td>
<td>- M 2.1 M SD 1.1</td>
</tr>
<tr>
<td>Grain is good for milling.</td>
<td>28.7 65.2 A 3.5 N 2.6 D 1.8 SD 1.8 M 42.9 M 28.6 M 1.1 M 1.1 M 2.1 M 0.8</td>
<td></td>
</tr>
<tr>
<td>When rainfall is low, local variety has better production than SC513.</td>
<td>7.0 73.9 A 7.0 N 12.2 D 2.2 SD 8.5 M 5.5 M 53.8 M 27.5 M 13.2 M 2.5 M 0.8</td>
<td></td>
</tr>
</tbody>
</table>
### Table 4  
**Farmers’ Attitudes Towards NPK**

<table>
<thead>
<tr>
<th></th>
<th>Machipanda (n = 117)</th>
<th>Vanduzi (n = 145)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SA</td>
<td>A</td>
</tr>
<tr>
<td>NPK is good for maize.</td>
<td>5.1</td>
<td>80.3</td>
</tr>
<tr>
<td>NPK increases maize yield.</td>
<td>6.0</td>
<td>78.6</td>
</tr>
<tr>
<td>NPK is not good for the soil.</td>
<td>2.6</td>
<td>16.2</td>
</tr>
<tr>
<td>NPK is a waste of time and money.</td>
<td>1.7</td>
<td>61.5</td>
</tr>
</tbody>
</table>

### Table 5  
**Farmers’ Attitudes Towards Urea**

<table>
<thead>
<tr>
<th></th>
<th>Machipanda (n = 118)</th>
<th>Vanduzi (n = 144)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SA</td>
<td>A</td>
</tr>
<tr>
<td>Urea is good for maize</td>
<td>15.3</td>
<td>82.2</td>
</tr>
<tr>
<td>Urea increases maize yield.</td>
<td>17.8</td>
<td>78.0</td>
</tr>
<tr>
<td>Urea is not good for the soil.</td>
<td>7.6</td>
<td>64.4</td>
</tr>
<tr>
<td>Urea is a waste of time and money.</td>
<td>7.6</td>
<td>78.0</td>
</tr>
</tbody>
</table>
Influence of Source of Information on Farmers’ Attitudes Towards Improved Maize SC513, NPK and Urea Fertilizers

This study also performed comparisons between mean attitude scores and sources of information within each study location. The results, of ANOVA and Scheffe’s post hoc multiple comparison method, are presented in Table 6.

Table 6
Sample ANOVA Table for Mean Attitude by Sources of Information

<table>
<thead>
<tr>
<th>Source Information</th>
<th>Machipanda</th>
<th></th>
<th></th>
<th>Vanduzi</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>F</td>
<td>Sig</td>
<td>N</td>
<td>Mean</td>
</tr>
<tr>
<td>Attitude toward marketability of SC513.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neighbors</td>
<td>72</td>
<td>6.81</td>
<td>2.02</td>
<td>.138</td>
<td>28</td>
<td>7.43</td>
</tr>
<tr>
<td>Market</td>
<td>35</td>
<td>7.37</td>
<td></td>
<td></td>
<td>26</td>
<td>7.15</td>
</tr>
<tr>
<td>Extension</td>
<td>8</td>
<td>6.25</td>
<td>6.73</td>
<td></td>
<td>37</td>
<td>6.73</td>
</tr>
<tr>
<td>Attitude toward production characteristics of SC513.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neighbors</td>
<td>72</td>
<td>5.99</td>
<td>7.04</td>
<td></td>
<td>28</td>
<td>7.04</td>
</tr>
<tr>
<td>Market</td>
<td>35</td>
<td>6.26</td>
<td>.661</td>
<td>.518</td>
<td>26</td>
<td>7.08</td>
</tr>
<tr>
<td>Extension</td>
<td>8</td>
<td>5.75</td>
<td>6.14</td>
<td></td>
<td>37</td>
<td>6.14</td>
</tr>
<tr>
<td>Attitude toward NPK.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market</td>
<td>41</td>
<td>10.7</td>
<td>9.52</td>
<td></td>
<td>25</td>
<td>9.52</td>
</tr>
<tr>
<td>Extension*</td>
<td>19</td>
<td>10.2</td>
<td>.512</td>
<td>.600</td>
<td>32</td>
<td>9.03</td>
</tr>
<tr>
<td>Neighbors*</td>
<td>57</td>
<td>10.6</td>
<td></td>
<td></td>
<td>88</td>
<td>10.2</td>
</tr>
<tr>
<td>Attitude toward urea.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market</td>
<td>41</td>
<td>8.63</td>
<td>9.46</td>
<td></td>
<td>26</td>
<td>9.46</td>
</tr>
<tr>
<td>Extension**</td>
<td>19</td>
<td>8.47</td>
<td>1.34</td>
<td>.265</td>
<td>30</td>
<td>8.33</td>
</tr>
<tr>
<td>Neighbors**</td>
<td>58</td>
<td>8.05</td>
<td>10.06</td>
<td></td>
<td>88</td>
<td>10.06</td>
</tr>
</tbody>
</table>

In the lowlands, the strength of positive attitudes towards fertilizers differed significantly (P<.01 and P<.001) between farmers who learned about fertilizers from extension and those who learned from neighbors. Farmers who learned about fertilizers from extension had stronger positive attitudes than farmers who learned about fertilizers from neighbors. Personal contacts between extension agents and farmers are more effective for delivering specific information to farmers and eventually persuade farmers to use fertilizers.

The results show that while all three sources of information, neighbors, market and extension can be used by farmers to learn and raise awareness about fertilizers, particular attention should be given to public extension to strengthen farmers’ attitudes towards fertilizers.

Pattern of Adoption of Improved Maize Variety SC513 and Chemical Fertilizers NPK and Urea in Machipanda and Vanduzi

The results on patterns of adoption of SC513, NPK and urea in Machipanda and Vanduzi are presented in Figures 1, 2, and 3. The curves are based on respondents’ recall of the year in which they first used the technology.
Farmers in Machipanda and Vanduzi, have been using improved maize variety SC513 since early 1990, while chemical fertilizers for maize production started much earlier, before 1990. Improved maize variety SC513 and chemical fertilizers NPK and urea were formally introduced in the study area in 1995. Since then new farmers joined each year increasing the percentage of usage (i.e. the number of farmers who have used the technology). This increase was more rapid in highlands of Machipanda than in lowlands of Vanduzi. A possible explanation is that hybrid maize seeds do better than local varieties in high rainfall regions and in these regions higher incidence of fertilizer use are also expected than in the lowland regions (Kaliba et al., 2000). In addition, Machipanda is much closer to Zimbabwe and farmers had access to inputs there. Since the increase of percentage of usage was different between the two agro ecological regions, these findings call attention to the evaluation of the suitability and accessibility of improved maize technology in a particular agro-ecological zone.

Figure 1. Pattern of Adoption of Hybrid Maize SC513 in Machipanda and Vanduzi from 1990 – 2005.
Figure 2. Pattern of Adoption of Fertilizer NPK in Machipanda and Vanduzi from 1970 – 2005.

Figure 3. Pattern of Adoption of Fertilizer urea in Machipanda and Vanduzi from 1970 – 2005.
Discontinuance of SC513, NPK and Urea

The pattern of adoption provides a positive picture in the sense that it expresses that through the years the number of farmers who had used the technologies was accumulating. Nevertheless, the current adoption was not high. For example, in both study areas the percentage of farmers cultivating improved maize variety SC513 and applying chemical fertilizer on maize during the growing season 2004 – 05 was lower than the cumulative percentage (Table 7). The current adoption (i.e. adoption in years 2004 and 2005) indicates that discontinuance occurred throughout the time since the first year farmers started using the technologies. One obvious reason for reduced adoption is discontinuance. After farmers had adopted the technologies, they may discontinue their use for various reasons including replacement, dissatisfaction, and misuse of the technology (Rogers, 2003).

Table 7

<table>
<thead>
<tr>
<th>Technologies</th>
<th>Machipanda</th>
<th>Study location</th>
<th>Vanduzi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ever used</td>
<td>Using 2004-05</td>
<td>Ever used</td>
</tr>
<tr>
<td>Hybrid maize SC 513</td>
<td>88% (105)</td>
<td>37.7% (45)</td>
<td>28% (48)</td>
</tr>
<tr>
<td>Fertilizers (NPK/urea)</td>
<td>87% (102)</td>
<td>33.3% (39)</td>
<td>33% (48)</td>
</tr>
</tbody>
</table>

Reasons for Discontinuance of SC513, NPK and Urea

The reasons for discontinuance of SC513, NPK and urea, were also explored. The discontinuance of improved maize SC513 was mainly due to dissatisfaction with husk cover, susceptibility to storage insects, and replacement of hybrid variety SC513 with OPV and local maize varieties. The discontinuance of fertilizers was, mainly, due to lack of money to purchase NPK and urea.

The reasons for discontinuance have important implications for maize breeders and social scientists. Breeders need to improve the husk cover and enhance resistance to storage insects to make the hybrid variety SC513 attractive to farmers. Social researchers need to investigate ways by which farmers can be provided with fertilizers at accessible costs including provision of fertilizer on credit basis.

Factors Associated with Adoption of Improved Maize SC513, NPK and Urea Fertilizers

Tables 8, 9 and 10 present the maximum likelihood estimates of the logistic models for factors associated with adoption of SC513, NPK and urea.
Table 8
*Maximum Likelihood Estimates of Logistic Model for Factors Affecting Adoption of SC513*

<table>
<thead>
<tr>
<th>Variables</th>
<th>$\beta$</th>
<th>S.E.</th>
<th>Wald</th>
<th>Sig.</th>
<th>Exp($\beta$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agro-ecological zone</td>
<td>2.51</td>
<td>.512</td>
<td>24.0</td>
<td>.000</td>
<td>12.2</td>
</tr>
<tr>
<td>Knowledge of advantages and disadvantages of SC513</td>
<td>1.99</td>
<td>.732</td>
<td>7.40</td>
<td>.007</td>
<td>7.32</td>
</tr>
<tr>
<td>Attitude toward marketability of produce from SC513</td>
<td>-.497</td>
<td>.234</td>
<td>4.50</td>
<td>.034</td>
<td>.608</td>
</tr>
<tr>
<td>Attitude toward traits of SC513</td>
<td>-.812</td>
<td>.228</td>
<td>12.6</td>
<td>.000</td>
<td>.444</td>
</tr>
<tr>
<td>Constant</td>
<td>-.704</td>
<td>1.33</td>
<td>.279</td>
<td>.598</td>
<td>.495</td>
</tr>
<tr>
<td><em>Likelihood ratio chi-square df(10)</em></td>
<td>87.03</td>
<td></td>
<td></td>
<td>.000</td>
<td></td>
</tr>
</tbody>
</table>

Table 9
*Maximum Likelihood Estimates of Logistic Model for Factors Affecting Adoption of NPK*

<table>
<thead>
<tr>
<th>Variables</th>
<th>$\beta$</th>
<th>S.E.</th>
<th>Wald</th>
<th>Sig.</th>
<th>Exp($\beta$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agro-ecological zone</td>
<td>.794</td>
<td>.392</td>
<td>4.10</td>
<td>.043</td>
<td>2.21</td>
</tr>
<tr>
<td>Knowledge of application methods for NPK</td>
<td>2.61</td>
<td>.753</td>
<td>12.0</td>
<td>.001</td>
<td>13.6</td>
</tr>
<tr>
<td>Information sources on NPK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market (1)</td>
<td>.154</td>
<td>.442</td>
<td>.122</td>
<td>.727</td>
<td>1.17</td>
</tr>
<tr>
<td>Extension (2)</td>
<td>1.57</td>
<td>.430</td>
<td>13.3</td>
<td>.000</td>
<td>4.81</td>
</tr>
<tr>
<td>Constant</td>
<td>-4.32</td>
<td>1.11</td>
<td>15.1</td>
<td>.000</td>
<td>.013</td>
</tr>
<tr>
<td><em>Likelihood ratio chi-square df(8)</em></td>
<td>64.3</td>
<td></td>
<td></td>
<td>.000</td>
<td></td>
</tr>
</tbody>
</table>

Table 10
*Maximum Likelihood Estimates of Logistic Model for Factors Affecting Adoption of Urea*

<table>
<thead>
<tr>
<th>Variables</th>
<th>$\beta$</th>
<th>S.E.</th>
<th>Wald</th>
<th>Sig.</th>
<th>Exp($\beta$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agro-ecological zone</td>
<td>1.43</td>
<td>.369</td>
<td>14.9</td>
<td>.000</td>
<td>4.16</td>
</tr>
<tr>
<td>Knowledge of application methods for urea</td>
<td>2.05</td>
<td>.521</td>
<td>15.5</td>
<td>.000</td>
<td>7.74</td>
</tr>
<tr>
<td>Information sources on urea</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market (1)</td>
<td>-.211</td>
<td>.418</td>
<td>.256</td>
<td>.613</td>
<td>.810</td>
</tr>
<tr>
<td>Extension (2)</td>
<td>1.23</td>
<td>.434</td>
<td>8.01</td>
<td>.005</td>
<td>3.41</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.86</td>
<td>.964</td>
<td>8.81</td>
<td>.003</td>
<td>.057</td>
</tr>
<tr>
<td><em>Likelihood ratio chi-square df(8)</em></td>
<td>81.6</td>
<td></td>
<td></td>
<td>.000</td>
<td></td>
</tr>
</tbody>
</table>
The fit of the models was satisfactory. The estimated coefficients for the likelihood ratio chi-square were significant (P<.001), with chi-square values of 87.0, 64.3, and 81.6. The models accounted (R^2_{Logistic}) for 39, 24 and 27 percent of the variation between adopters and non-adopters of SC513, NPK, and Urea respectively.

As expected, the agro–ecological zone and how-to knowledge were positively (P<.05) associated with the adoption of improved maize variety SC513, NPK, and urea fertilizers. Being in the highlands increased the probability of adoption of the three technologies, by a factor of 12, 2 and 4 respectively. These results can be related to the effect of high annual rainfall in the highlands of Machipanda. This argument is supported by other studies (Kaliba et al., 2000; Hintze et al., 2003). Hybrid maize might be more adaptable to the highlands of Machipanda than to the lowlands of Vanduzi. Likewise, fertilizer use is expected to be higher in highlands where rainfall is relatively higher than lowlands.

Feeling knowledgeable about advantages and disadvantages of improved maize and about application of chemical fertilizers increased the probability of adoption of the three technologies, by a factor of 7, 14, and 8. Positive association between knowledge of fertilizer application and adoption of fertilizer was also mentioned by Rogers and Havens (1961). These researchers found that knowledge of fertilizer (i.e. how to use fertilizer, and what nutrients the crop needs) acted as an intervening variable, between “attitude toward fertilizer” and the “use of fertilizer.” CIMMYT (1993) also highlights the importance of basic computation skills for proper use of fertilizers.

Extension was a significant factor (P<.05) for adoption of fertilizers. The probability of adoption of NPK and urea, for farmers who learned about these technologies from extension services, increased 5 and 3 times more than the probability of adoption by farmers who learned from neighbors. Other studies had found positive relationships between extension and chemical fertilizers (Abebaw & Belay, 2001; Kaliba et al., 2000). The results indicate that strengthening the provision of information on the use of fertilizers through extension (i.e. results from demonstration plots, individual or group meetings) may improve the levels of adoption of chemical fertilizers in Machipanda and Vanduzi. Moreover, given the relevant role played by extension in the adoption of chemical fertilizers, one option would be to concentrate extension resources to train farmers in the optimal use of fertilizers. Another option would be to promote vocational training on improved maize varieties technology, including chemical fertilizers, in the rural schools. For improved maize variety, contrary to what was expected, extension had no significant effect on adoption of SC513. As a source of information, extension had a positive but insignificant impact on the adoption decisions of SC513. It is plausible that all sources of information (market, neighbors, extension, and market) provide farmers with useful information.

Farmers’ attitudes were significant factors of adoption of improved maize. As expected, holding negative attitudes toward traits of SC513 and negative attitudes toward the marketability of produce from SC513 had a significant (P<.05) negative effect on the logarithm of the odds of adoption. Other studies found that farmers’ perceptions of production characteristics (yield, maturity rate, drought resistance, insect resistance lodging resistance, grain weight) determine variety selection and adoption (Hintze et al., 2003). These results imply that researchers should continue and strengthen research on production characteristics of improved maize varieties, and public extension services as well as the private sector (seed companies, wholesalers...
and retailers) should emphasize messages on the production characteristics of the improved maize varieties, including seed quality, drought tolerance and maize meal quality. Positive attitudes toward selling grain and fresh maize of SC513 were also a significant factor of adoption. This association indicates that farmers obtain some surplus from SC513 that can be used for household income. Thus, in addition to production characteristics, and benefits associated with improved maize varieties, extension messages should provide information on prices and demand for it. Breeders should develop maize varieties for which output is marketable. The private sector should provide farmers with marketing information.

Overall the three most important factors associated with adoption of improved maize SC513, in decreasing order were: agro ecological region, attitude toward production traits of improved maize SC513, and knowledge about advantages and disadvantages of improved maize varieties. Extension on NPK and urea, knowledge about fertilizer application, and agro-ecological conditions had significant influence on adoption of chemical fertilizers.

**Conclusion**

This study showed that, in general, farmers in Machipanda and Vanduzi do support the use of improved maize varieties and chemical fertilizers, but attitude strength varied according to sources of information. In the lowlands farmers who learned about fertilizers from extension had stronger positive attitudes than farmers who learned about fertilizers from neighbors. Different patterns of adoption were found in this study. The number of farmers using improved maize SC513 was higher than the number of farmers using NPK and urea for maize production. For each of the three technologies the rate of usage differed between the highlands and lowlands. The increase was more rapid in highlands than in lowlands. Hence these findings call attention to the evaluation of the suitability and accessibility of improved maize production technology in a particular agro-ecological zone.

Regarding factors of adoption, this study has confirmed earlier research which showed that adoption of improved maize varieties and chemical fertilizers technologies, is influenced by agro ecological conditions, attitude toward production traits and marketability of improved maize, how-to-knowldege to apply the technology, and the role of extension in dissemination of improved technology. Therefore, these factors should be considered when planning, implementing and evaluating extension programs for dissemination of improved maize varieties and chemical fertilizers. Farmers’ characteristics such as age, level of formal education, and family size did not influence significantly the adoption of improved maize variety SC513 and chemical fertilizers NPK and urea, in the highlands of Machipanda and lowlands of Vanduzi in the Manica District.

**Acknowledgments**

Cavane is grateful to the Ford Foundation and the Department of Community, Agriculture, Recreation and Resource Studies at Michigan State University for providing financial support for the PhD dissertation, from which this paper is based. Donovan acknowledges support provided by the United States Agency for International Development (USAID) in Maputo. Opinions expressed in this document are the authors’ responsibility and do not reflect the official position of the Ford Foundation, MSU nor of USAID.
References


An Examination of Trinidad Extension Officers’ Behavioral Beliefs and Intent to Participate in an International Extension Experience

Amy Harder
University of Florida
amharder@ufl.edu

Alexa J. Lamm
University of Florida
alamm@ufl.edu

Wayne Ganpat
University of the West Indies, St. Augustine
Trinidad and Tobago
Wayne.Ganpat@sta.uwi.edu

James R. Lindner
Texas A&M University
j-lindner@tamu.edu

Abstract

Participation in an international extension experience empowers extension professionals to meet the needs of diverse clientele in an increasingly global world. A survey of governmental extension workers in Trinidad was conducted to understand how their behavioral beliefs about an international extension experience influenced their intention to participate in such an experience. Behavioral beliefs can be positively or negatively modified based on an individual’s perceptions of the components (time, location, activities) of a specific international extension experience, so manipulating the components should cause corresponding changes in behavioral beliefs and ultimately intent to participate. This study found positive behavioral beliefs about international extension experience participation are held by Trinidadian extension officers. They are willing to travel to a wide variety of locations and are most interested in acquiring hands-on experience and working one-on-one with another extension professional. The most desirable locations and activities should be integrated into international extension experiences in order to positively influence behavioral beliefs, and thereby intent to participate. Future research is needed to more closely examine the impact of participation on extension officers in Trinidad.

Keywords: extension, training and development, human resource development, professional development
Introduction & Theoretical/Conceptual Framework

Professionals with an international perspective are becoming increasingly more important as globalization expands (Zhai & Scheer, 2002). In order to address the information needs of diverse, globally competent clientele, extension professionals must have a multi-cultural skill set designed to work with diverse audiences (Ludwig & McGirr, 2003). International experiences provide food and agricultural scientists with a breadth of knowledge and skills considered critical to their future success within a global agricultural industry (Zhai & Scheer, 2002). The development of international education initiatives empowers extension professionals to become global citizens, bridging the cultural gaps of their international awareness (McGowan, 2007; Place, Vergot, Dragon, & Hightower, 2008).

International experiences have been shown to positively impact learning. Smith, Jayaratne, Moore, Kistler, and Smith (2010) found extension professionals with international experience were significantly more likely to have a global mindset. “A new appreciation for extension’s role in international development” (Place et al., 2008, p. 8) was reported by extension professionals as a direct result of their first-hand international experience in Latin America. Suarez (2003) found that immersion in a foreign country assisted individuals in developing a sense of cultural awareness and an increased sensitivity to the needs of diverse audiences.

The involvement of extension professionals in international extension experiences (IEEs) also has the potential to positively impact their clientele. Research has shown that most people have limited opportunities for direct experience with countries and cultures other than their own (Ludwig, 1994). This is especially true in Trinidad where 35% of farming is subsistence level (Maximay, 2005); subsistence farmers are even less likely to have the means required for direct international experiences yet stand much to gain from exposure to global markets. An alternative way to develop global competence in place-bound extension audiences is through vicarious exposure based on the international experiences of globally-competent extension professionals. This study is part of an effort to understand how extension professionals worldwide view participating in international extension experiences.

Ajzen’s (1991) theory of planned behavior was used as the theoretical framework for this study. Ajzen postulated human behavior is guided by behavioral, normative, and control beliefs. Behavioral beliefs represent how likely an individual is to engage in a specific behavior, including their assessment of the specific behavior (Ajzen, 2002). An individual’s behavioral beliefs are caused by holding either a favorable or unfavorable attitude towards the behavior in question. Normative beliefs are tied to the individual’s perception of what other important individuals or groups believe or expect in regards to the specific behavior. The subjective norm an individual creates around a specific behavior, and how much weight they put into the subjective norm they have created, has a direct influence on their normative beliefs (Ajzen, 2002). Control beliefs represent the pros and cons the individual associates with the specific behavior and their perceived power over how positive or negative those influences may be as a result of engaging in the behavior (Ajzen, 2002). An individual’s control beliefs directly influence their perceived behavioral control related to engaging in the behavior.

By manipulating any or all of these three beliefs, an individual’s intention can be modified; increasing the probability the individual will perform the desired behavior (Francis et al., 2004). This study examined behavioral belief influences on intention in relation to participating in an international
extension experience. Whether or not an individual will engage in a specific behavior is believed to be directly tied to behavioral beliefs (Ajzen, 2002). Therefore, those with the most positive behavioral beliefs towards international extension experiences are most likely to form an intention to participate (Ajzen, 1991).

Previous literature has shown that extension professionals who have been involved in international extension initiatives believe they are positive experiences (Crago, 1998; Lev, 2001; Place, 1998; Place, Vergot, & Dragon, 2005; Richardson & Woods, 1991). In addition, the more time an extension professional spends abroad has been directly associated with an enhanced sense of concern for people in all parts of the world, increased appreciation for diversity, and an appreciation for the interconnectedness of people around the world (Gillian, 1995; Hett, 1993). However, the amount of time away from family and work has been found to be a major barrier to extension professionals engaging in international experiences (Lamm & Harder, 2010; Wingenbach, Chmielewski, Smith, Piña, & Hamilton, 2006). Due to a need to keep time away from home at a minimum, short-term international experiences are becoming more common (Festervand & Tillery, 2001; Paus & Robinson, 2008). Despite these challenges, extension systems around the world are expressing a need for the globalization of national agricultural extension systems (Qamar, 2002) and a trend towards international experiences can be noticed across the globe (Smith et al., 2010).

When studying location preferences for international extension experiences, Lamm and Harder (2010) found those areas of the world needing the most assistance (e.g. Africa, Middle East) were the locations U.S. extension professionals were most afraid to travel to. While no other studies of extension professionals were found which examined location preferences, Evans, Finch, Toncar, and Reid (2008) found Italy, England, France, China, Germany, Australia, Japan, and Ireland were the locations identified by U.S. students as most desirable for study tours. Students were not interested in traveling to developing countries (Evans et al., 2008). A gap in the literature exists with regard to where individuals in developing countries, such as Trinidad and Tobago, are interested in traveling academically or professionally.

Through an examination of the types of activities participants of international experiences perceived as valuable Place et al. (2008) found first-hand experience was essential. Participants reported their direct engagement with Latin Americans while traveling abroad was what built their credibility with diverse clientele upon their return home (Place et al., 2008). Participants of international experiences also reported immersion (an experiential learning technique) as one of the most valuable parts of their experience. Participants engaged in an international experience focused on bilingualism and enhanced multiculturalism found immersion was a powerful learning tool that allowed them to rely on their background experiences when working with others (Howard, Sugarman, & Christian, 2003). In addition, Myles and Cheng (2003) found that participants willing to embrace communication with their hosts adapted more easily to their environment, resulting in a higher level of foreign language skills and knowledge of the culture, than their counterparts that chose not to embrace interactions with their hosts.

A conceptual framework of this study is presented in Figure 1. According to Ajzen (2002), normative, behavioral, and control beliefs influence intent to act. Of these, behavioral beliefs are the easiest for an extension organization to influence. Behavioral beliefs can be positively or negatively modified based on an individual’s perceptions of the components
(time, location, activities) of a specific IEE, so manipulating the components should cause corresponding changes in behavioral beliefs and ultimately intent to participate.

![Flow chart illustrating the influence of international extension experience preferences on behavioral beliefs and intent to participate.](image)

**Figure 1.** Flow chart illustrating the influence of international extension experience preferences on behavioral beliefs and intent to participate.

**Purpose and Objectives**
The purpose of this study was to understand how Trinidad extension officers’ behavioral beliefs about an international extension experience (IEE) influenced their intentions to participate in an IEE. Specifically, the objectives were to:

1. Determine extension officers’ perceptions of the importance of an IEE as a component of their work and their interest in participating in an IEE.
2. Describe extension officers’ time, location, and activity preferences for participation in an IEE.
3. Determine if differences existed in extension officers’ time, location, and activity preferences for participation by their beliefs of the importance of an IEE.

**Methods**
All public Extension officers in Trinidad were the subjects of this inquiry. The national extension system in Trinidad is comprised of the Government-led (state) extension and state-assisted extension services. Government extension officers work directly with farmers, conduct agricultural education, and participate in additional regulatory functions. The percentage of each type of work done varies depending on where the officers work. State-assisted extension organizations perform specialized extension services, such as cocoa production assistance, marketing, and agribusiness development. Together, the government-led and state-assisted extension systems comprise approximately 150 Extension officers. Private extension is small in size and was not considered for this study.

The survey instrument used for the study was originally developed by Rieger (n.d.) to measure undergraduate students’ interest in participating in a study abroad experience. The instrument was then adapted by Lamm and Harder (2010) to fit the professional context of the U.S. Cooperative Extension system. The instrument was reviewed and further revisions were made based on input from two contextual experts asked to evaluate the instrument’s validity. Permission to conduct the study was granted by the Director of Extension Services in the Ministry of Agriculture following a formal written request.
The instrument contained two sections and demographics items. Participants were asked to indicate their opinion regarding participation in an IEE as a component of their work by selecting if an IEE was not, slightly, somewhat, or very important. Participants were also asked to indicate if they were interested, not interested, or had already participated in an IEE.

The extension officers’ preferences for IEEs were measured in the second section. Participants were asked to indicate the number of weeks they would prefer to spend on an IEE. Next, participants were asked to rate the appeal of 22 locations using a four point scale (1 = Very Unappealing, 2 = Somewhat Unappealing, 3 = Somewhat Appealing, 4 = Very Appealing). The United Nation’s (2010) listing and definitions of geographical sub-regions were used for this study. Participants were provided with a Web site address to consult if they needed more information on the countries included in each sub-region. Finally, participants were asked to rate the level of personal importance of six formal and six informal IEE activities using a four point scale (1 = Very Unimportant, 2 = Somewhat Unimportant, 3 = Somewhat Important, 4 = Very Important). The reliability of the formal activities and informal activities constructs were calculated ex post facto using Cronbach’s alpha coefficient at r = .91 and r = .85, respectively.

Data was collected in person during August 2010 by one of the authors who visited all extension offices on the day of the week that all extension officers are required to be in office. A short oral presentation was conducted to introduce the International Extension Experiences (IEE) topic. At the conclusion of the presentation the paper questionnaire was distributed to the Extension officers present. The instruments were completed without difficulty in about 15 minutes and were collected at the same time. Forms were left with supervisors for completion by absentee staff at the earliest opportunity. Some were completed and returned. Follow-up telephone calls were made to get all completed; however, this did not yield much improvement. A total of 110 completed forms were collected and coded for data analysis, resulting in a 73.33% response rate. To control for nonresponse error, respondents’ personal characteristics were compared with known characteristics of the population (Miller & Smith, 1983) using a Chi-Square test. Respondents’ characteristics were not significantly different from that of the population and were considered representative of the population.

Participants were asked to identify their gender, age, educational level, and tenure of employment in a demographics section of the questionnaire. The respondents for this study tended to be male (n = 70, 63.10%), in their twenties (n = 46, 41.40%), and had completed secondary level education and diploma level training in agriculture (n = 51, 45.90%) or a bachelor’s degree (n = 45, 40.50%). The average length of employment tenure was ten years (M = 9.99, SD = 9.01) but there was considerable variation with a skew towards employees with five years of experience or fewer (n = 46, 41.40%). Participants were not asked to identify their race/ethnicity in this survey due to the complex nature of these topics (Birth, 2008; Eriksen, 1992) in Trinidad and Tobago. Although race/ethnicity questions were not included in the survey, Trinidad and Tobago’s population is largely composed of Indian (40.00%), African (37.50%), and mixed (20.50%) ethnic groups (Central Intelligence Agency, 2010). It can be assumed that the majority of respondents for this study have ties to one or more of these groups.

Descriptive statistics were calculated for the first two objectives. The third objective used t-tests to determine if significant differences existed in IEE preferences based on behavioral beliefs.
According to the Theory of Planned Behavior (Ajzen, 1991), individuals with the most positive behavioral beliefs are more likely to have an intention to act than their counterparts. Therefore respondents were categorized into two groups based on their behavioral beliefs for the purpose of the objective. The first group consisted of the respondents who indicated that an IEE was a “very important” component of their work while the second group consisted of the respondents who indicated an IEE was “somewhat important.” Respondents who felt an IEE was “slightly” or “not at all” important were excluded from analysis due to their negligible numbers. An *ex post facto* examination of the data revealed little variation in respondents’ level of interest in IEE participation, so this variable was not considered during the categorization. Cohen’s interpretation of effect sizes was used to evaluate the strength of association between the variables (Cohen, 1988; Cohen, 1992). Results from *t*-tests were interpreted by defining small, medium, and large effect sizes at the .20, .50, and .80 levels, respectively (Cohen, 1988).

**Findings/Results**

**Objective 1: Importance and Interest**

Respondents indicated their opinions regarding interest in IEE participation and the perceived importance of an IEE as a component of their work in extension. The majority (*n* = 104, 93.70%) of respondents expressed personal interest in participating in an IEE. Only seven respondents (6.30%) were not interested.

Table 1 displays respondents’ perceptions of the importance of an IEE as a component of their work in extension. The majority (*n* = 78, 70.30%) of respondents believed IEEs were a very important component of their work. Only two respondents (1.80%) thought IEEs were not at all important.

<table>
<thead>
<tr>
<th>Statement</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is very important.</td>
<td>78</td>
<td>70.30</td>
</tr>
<tr>
<td>It is somewhat important.</td>
<td>28</td>
<td>25.20</td>
</tr>
<tr>
<td>It is slightly important.</td>
<td>3</td>
<td>2.70</td>
</tr>
<tr>
<td>It is not at all important.</td>
<td>2</td>
<td>1.80</td>
</tr>
</tbody>
</table>

*Note. N = 111. a Group 1 respondents. b Group 2 respondents.*

**Objective 2: IEE Preferences**

Respondents indicated their preference for the number of weeks that they would like to spend on an IEE. Responses ranged from less than a week (*n* = 2, 1.80%) to over a year (*n* = 1, .90%). The mode response to the number of weeks the respondents would like to spend on an IEE was four weeks (*n* = 24, 21.8%), with 52.70% (*n* = 58) preferring to spend four weeks or less on an IEE. Only 9.10% (*n* = 13) of the respondents wanted an IEE lasting sixteen weeks or more.

Respondents rated the appeal of 22 selected locations (see Table 2). Respondents rated each location as somewhat appealing with the exception of Micronesia (*M* = 2.43, *SD* = .99), which was rated as somewhat unappealing. The sub-region of Australia and New Zealand (*M* = 3.44, *SD* = .88) was considered to be the most appealing of the selection locations, followed closely by Central America (*M* = 3.43, *SD* = .86) and South America (*M* = 3.42, *SD* = .78).
Table 2

Respondents’ Perceptions of Selected Locations by Individual Response Item

<table>
<thead>
<tr>
<th>Location Items</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia and New Zealand</td>
<td>110</td>
<td>3.44</td>
<td>.88</td>
</tr>
<tr>
<td>Central America</td>
<td>111</td>
<td>3.43</td>
<td>.86</td>
</tr>
<tr>
<td>South America</td>
<td>110</td>
<td>3.42</td>
<td>.78</td>
</tr>
<tr>
<td>Caribbean (excluding Trinidad &amp; Tobago)</td>
<td>111</td>
<td>3.39</td>
<td>.92</td>
</tr>
<tr>
<td>Europe</td>
<td>110</td>
<td>3.35</td>
<td>.88</td>
</tr>
<tr>
<td>Northern America</td>
<td>109</td>
<td>3.16</td>
<td>1.00</td>
</tr>
<tr>
<td>India</td>
<td>110</td>
<td>3.06</td>
<td>.98</td>
</tr>
<tr>
<td>Any developed country</td>
<td>104</td>
<td>3.02</td>
<td>1.00</td>
</tr>
<tr>
<td>Any developing country</td>
<td>105</td>
<td>2.98</td>
<td>1.04</td>
</tr>
<tr>
<td>Central Asia</td>
<td>109</td>
<td>2.94</td>
<td>.96</td>
</tr>
<tr>
<td>Eastern Asia</td>
<td>109</td>
<td>2.82</td>
<td>.98</td>
</tr>
<tr>
<td>Southern Africa</td>
<td>109</td>
<td>2.80</td>
<td>1.01</td>
</tr>
<tr>
<td>Southern Asia (excluding India)</td>
<td>108</td>
<td>2.71</td>
<td>1.02</td>
</tr>
<tr>
<td>Western Asia</td>
<td>107</td>
<td>2.70</td>
<td>.99</td>
</tr>
<tr>
<td>Western Africa</td>
<td>109</td>
<td>2.67</td>
<td>1.02</td>
</tr>
<tr>
<td>South-Eastern Asia</td>
<td>108</td>
<td>2.67</td>
<td>1.00</td>
</tr>
<tr>
<td>Northern Africa</td>
<td>110</td>
<td>2.60</td>
<td>1.00</td>
</tr>
<tr>
<td>Eastern Africa</td>
<td>110</td>
<td>2.59</td>
<td>1.05</td>
</tr>
<tr>
<td>Polynesia</td>
<td>104</td>
<td>2.56</td>
<td>.99</td>
</tr>
<tr>
<td>Middle Africa</td>
<td>110</td>
<td>2.56</td>
<td>1.02</td>
</tr>
<tr>
<td>Melanesia</td>
<td>108</td>
<td>2.54</td>
<td>1.04</td>
</tr>
<tr>
<td>Micronesia</td>
<td>104</td>
<td>2.43</td>
<td>.99</td>
</tr>
</tbody>
</table>

Note. Scale: 1 = Very Unappealing, 2 = Somewhat Unappealing, 3 = Somewhat Appealing, 4 = Very Appealing.

Respondents rated the importance of 12 formal and informal activities known to be typical components of an IEE (see Table 3). Respondents felt acquiring hands-on experience and skills ($M = 3.67$, $SD = .85$), and working one-on-one with an extension professional were very important activities ($M = 3.65$, $SD = .82$). The remaining ten activities were perceived by the respondents to be somewhat important, with free time apart from the group receiving the least favorable perception ($M = 2.83$, $SD = .95$).
Table 3
Perceptions of the Importance of IEE Activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Type</th>
<th>n</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquiring hands-on experience and skills</td>
<td>Formal</td>
<td>111</td>
<td>3.67</td>
<td>.85</td>
</tr>
<tr>
<td>Work one-on-one with an extension professional</td>
<td>Formal</td>
<td>111</td>
<td>3.65</td>
<td>.82</td>
</tr>
<tr>
<td>In-field lectures and labs</td>
<td>Formal</td>
<td>105</td>
<td>3.49</td>
<td>.83</td>
</tr>
<tr>
<td>Socializing with extension professionals or citizens of host country</td>
<td>Informal</td>
<td>111</td>
<td>3.48</td>
<td>.88</td>
</tr>
<tr>
<td>Traveling in country (i.e. visiting more than just one area)</td>
<td>Informal</td>
<td>109</td>
<td>3.45</td>
<td>.83</td>
</tr>
<tr>
<td>Participating in ongoing field research or performing your own research project</td>
<td>Formal</td>
<td>111</td>
<td>3.31</td>
<td>.98</td>
</tr>
<tr>
<td>Attending classes at foreign universities</td>
<td>Formal</td>
<td>110</td>
<td>3.17</td>
<td>.86</td>
</tr>
<tr>
<td>Speaking and learning host country language</td>
<td>Informal</td>
<td>111</td>
<td>3.17</td>
<td>.90</td>
</tr>
<tr>
<td>Staying with host family (i.e. learning about a different culture)</td>
<td>Informal</td>
<td>107</td>
<td>3.14</td>
<td>.91</td>
</tr>
<tr>
<td>Earning academic credit through courses at foreign universities</td>
<td>Formal</td>
<td>111</td>
<td>3.09</td>
<td>1.00</td>
</tr>
<tr>
<td>Sightseeing – museums, historical, archaeological sites</td>
<td>Informal</td>
<td>111</td>
<td>3.03</td>
<td>.89</td>
</tr>
<tr>
<td>Free time to do what you apart from group</td>
<td>Informal</td>
<td>111</td>
<td>2.83</td>
<td>.95</td>
</tr>
</tbody>
</table>

Note. Scale: 1 = Very Unimportant, 2 = Somewhat Unimportant, 3 = Somewhat Important, 4 = Very Important.

Objective 3: Differences in Travel Preferences by Behavioral Beliefs

There were no significant differences in respondents’ time or location preferences when comparing respondents who felt IEEs to be very important versus respondents who felt IEEs were somewhat important. However, significant differences did exist when comparing the two groups’ preferences for activities when grouped as formal and informal activity constructs. As shown in Table 4, significant differences existed between respondents based on their perceptions of the importance of informal activities, \( t(100) = 2.71, p < .05 \). The effect size was medium (\( d = .64 \)), respectively. Respondents who felt IEEs were very important had significantly more positive perceptions of the importance of informal activities during an IEE.

Table 4
Comparison of Respondents’ Perceptions by Activity Construct

<table>
<thead>
<tr>
<th>Construct by Group</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formal Activities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Important</td>
<td>74</td>
<td>3.48</td>
<td>.69</td>
<td>2.07</td>
<td>.05</td>
</tr>
<tr>
<td>Somewhat Important</td>
<td>25</td>
<td>3.15</td>
<td>.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Informal Activities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Important</td>
<td>75</td>
<td>3.29</td>
<td>.60</td>
<td>2.71</td>
<td>* .01</td>
</tr>
<tr>
<td>Somewhat Important</td>
<td>26</td>
<td>2.88</td>
<td>.67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Scale: 1 = Very Unimportant, 2 = Somewhat Unimportant, 3 = Somewhat Important, 4 = Very Important.

* \( p < .05 \)
An individual item analysis of perceptions of informal activities also revealed significant differences between respondents based on their views of IEE importance (see Table 5). Perceptions of staying with a host family were significantly different, $t(101) = 3.72, p < .05$. The effect size was large ($d = .81$). Perceptions of speaking and learning a host country language were significantly different, $t(105) = 3.66, p < .05$. The effect size was medium ($d = .76$).

Table 5
Comparision of Respondents’ Perceptions by Informal Activity

<table>
<thead>
<tr>
<th>Activity by Group</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staying with host family</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Important</td>
<td>75</td>
<td>3.33</td>
<td>.83</td>
<td>3.72</td>
<td>*.01</td>
</tr>
<tr>
<td>Somewhat Important</td>
<td>27</td>
<td>2.63</td>
<td>.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speaking and learning host country language</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Important</td>
<td>78</td>
<td>3.36</td>
<td>.79</td>
<td>3.66</td>
<td>*.01</td>
</tr>
<tr>
<td>Somewhat Important</td>
<td>28</td>
<td>2.68</td>
<td>.98</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. Scale: 1 = Very Unimportant, 2 = Somewhat Unimportant, 3 = Somewhat Important, 4 = Very Important.*

*p < .05

**Conclusion, Implications, and Recommendations**

Viewed in the context of Ajzen’s (2002) theory of planned behavior, the findings from this study imply positive behavioral beliefs about IEE participation are held by Trinidad extension officers. The Trinidad extension officers were open to traveling almost anywhere which opposes Lamm and Harder’s (2010) findings regarding U.S. extension agents’ preferences for locations of IEEs. Trinidad extension officers’ willingness to travel increases their opportunities to be exposed to many cultures. The diversity of races and ethnic groups that comprise the population of Trinidad and Tobago, or its status as a developing rather than a developed country, may help explain the officers’ openness to traveling to a variety of international locations.

Lamm and Harder (2010) suggested marketing preferred locations for IEEs to U.S. extension agents to increase the likelihood of participation. Given the widespread enthusiasm for traveling nearly anywhere in the world that was expressed by the Trinidad extension officers, it may be more useful to highlight destinations that have something specific to offer. One example would be to encourage Trinidad extension officers to seek out IEEs that would allow them to learn about a different type of extension model. Trinidad and Tobago uses a Ministry-based model for extension, so it may be very informative for its officers to learn about more participatory or market-driven extension approaches or to understand the linkages involved in a University-based extension system. Even visiting Australia and New Zealand, which were perceived as the most appealing locations, could prove beneficial as a case study example of how public extension systems transitioned to private delivery. The lessons learned from IEEs that are intentionally focused on learning about a different extension models may be applied to strengthen practices at home in Trinidad.

Alternatively, Trinidad extension officers may find value in seeking out
countries for IEEs that are using an innovative approach to address shared issues, particularly within the Caribbean region. Trinidad extension officers should also consider opportunities for advancing program expertise, acquiring language skills, and/or developing collaborative relationships with international extension colleagues when selecting an IEE destination. Being intentional about the reasons for the IEE from the outset may lead to a more valuable experience for the participants, and in turn, for their clientele.

Participants overwhelmingly indicated that IEEs were a very important component of their jobs. IEEs have been linked with enhanced professional development for extension agents (Smith et al., 2001) and an increased ability to effectively serve clientele (Ludwig, 1994). While IEEs are seen as “vacations” by critics, this research suggests that extension officers perceive IEEs to be much more formally linked to their job performance and are most interested in activities that allow them to advance their knowledge and skills in job-related areas. All participants indicated that IEEs were a very important means of formally acquiring hands-on experiences and skills and working one-on-one with extension professionals. Participants who thought IEEs were a very important component of their work were statistically more likely to want to stay with a host family and learn the language, which implies a belief that understanding other cultures is linked with job performance. Leisure and tourism activities such as sightseeing and free time were seen as less important.

An implication exists that extension officers’ primary motive for participation in IEEs is linked to the direct benefits they receive in terms of professional development and their abilities to better meet their clientele’s needs. Consistent with previous research (Howard et al., 2003; Myles & Cheng, 2003; Place et al., 2008), participants recognize the value of first-hand, immersive experiences when engaging internationally. Ajzen’s (1991) theory of planned behavior indicates positively manipulating behavioral beliefs can lead to intent to participate, so organizations interested in hosting Trinidad extension officers should plan and market IEEs that focus on gaining hands-on experience and interacting with other extension professionals. An IEE that includes job shadowing would be ideal. Impact statements of the IEEs should be developed and participants should share their experiences with colleagues and clientele alike to demonstrate the benefits of IEEs for the extension organization and its clientele.

Additional research should be conducted to see if the developed versus developing country influence is true worldwide given the activity preference differences noted between U.S. and Trinidad extension agents when participating in IEEs. Continuing this line of research, by examining extension agents’ perceptions of IEEs in other countries around the world, will assist those creating IEEs in tailoring them to suit their target audience’s specific needs. Lastly, research looking at participants’ perceptions using a prereflection/reflection design should be conducted to look at the actual impact of IEEs on extension agents. A targeted prereflection/reflection design would offer a perspective on how specific activities extension agents engaged in while on an IEE altered their cultural perspectives, adding to their effectiveness on the job.
References


Rural Development Centers (Farm Stores) in Afghanistan, Do They Work? The Business Owners’ Perspectives

Tim Kock
Louis Berger Group
USAID-Inma Agribusiness Program
Baghdad Iraq
tk.kock@gmail.com

Jerry Turnbull
Louis Berger Group

Abstract

Afghanistan is a country yearning for development and the agricultural sector needs to lead the way. The need for agricultural-based businesses was evident throughout the country, rural areas depended businesses that could supply the needed inputs required in agricultural production. This experimental case study describes the yearlong results the USAID funded VEGA P2K development program, the program designed and implemented 12 rural development centers (farm stores) built in Afghanistan during 2009. These businesses provided inputs, credit, wholesaler markets, equipment rental and extension services to farmers. Business owners indicated that all of the aspects of the stores were beneficial to the rural people of Afghanistan.

Keywords: Afghanistan, agriculture, business development and extension
Introduction

Afghanistan is a country ripe for development; after years of war, the country and its people are in the process of building its future, thus allowing for many different development alternatives. Small business opportunities in all sectors are plausible means of sustainable development, but the agricultural sector leads the way. According to the Food and Agriculture Organization (FAO) of the United Nations (2005) and the United States Agency for International Development (USAID, 2007), millions of Afghans derived their livelihoods from agriculture. Therefore, the country’s economy is hinged on agriculture. Toness (2001) suggested agriculture is the center of developing countries; it is the core for sustainable development. Kock, Harder, and Saisi (2010) proposed agriculture is the life-blood of Afghanistan because the economy is dependent on agriculture. According to the World Bank (2005) agriculture accounted for over 50% of the gross national product and the majority of the domestic workforce is employed in the agricultural sector.

The need for agricultural based businesses was evident throughout the country, more so in rural areas where agricultural inputs were badly needed. Shleifer (1998) stated “the private entrepreneurship remains the locomotive for progress” (p. 138). According to USAID (2006) businesses that improve agricultural inputs and animal production are being supported by international donors. However, Afghanistan lacks the infrastructure to support ease of movement and shipping of agricultural products or commodities (USAID, 2009). Therefore, opportunities for rural people to have access agricultural inputs (i.e. education, seed, fertilizer, crop protection products, equipment, and credit) and a place to sell their commodities (i.e. grains, livestock, forage, and fruits) are vital for their livelihoods.

Other regions of the world have had success in establishing rural development centers. According to Androulidakis, Freeman, Bicoku, Peqini, Agolli, and Korra (2002), Albanian farmers benefited from fertilizer and agribusiness dealers (farm stores) created by the International Fertilizer Development Center (IFDC). Albania farmers faced many of the same problems as Afghanistan, lack of trading centers, transportation, educational opportunities, and credit. That program implemented by IFDC worked to create sustainable businesses where farmers would have access to the necessities for agricultural production. The Citizens’ Network for Foreign Affairs (CNFA, 2004) postulated Moldova’s farmers and agriculture sector benefited greatly from the creation of rural development centers because people had easier access to resources in their villages. Therefore, this paper evaluates the development and value of rural development centers (farm stores) in southeastern Afghanistan.

The Program

The USAID funded VEGA, P2K (Volunteers for Economic Growth and Agriculture, Paktika, Paktia, and Khost Provinces) farm store project was designed to create sustainable agricultural businesses in rural areas of southeastern Afghanistan (VEGA, 2009). The VEGA consortium (ACDI/VOCA, CNFA, Winrock International, and the Grand Council of Kuchis) teamed with local business owners and communities members to establish rural agricultural centers (farm stores) to supply inputs, education, equipment rentals, and credit to rural people and farmers. These types of businesses have been successful in curbing farmer losses (Deininger, 1997). Natsios (2005) suggested creating local partnerships with stakeholders increases sustainability of development projects. The stores were designed to be a one-stop center for the farmers’ agricultural needs. This
development project was partially funded by the USAID and private sector funding provided by local business owners.

The program adapted for Afghanistan was designed to follow the concept developed by CNFA in 2004 and provide private sector business owners startup funds to create rural-based agricultural business centers. According to CNFA (2004) the key component of the farm store concept was to enhance the agricultural infrastructure in developing countries, providing avenues for farmers to purchase quality inputs and services. The VEGA farm stores program provided inputs (i.e. seed, fertilizer, equipment rental, extension, purchasing of commodities, and credit) to Afghan people. Twelve farm stores were created representing 12 districts: three located in Paktika, three located in Paktia, and six located in the Khost provinces. Two stores served as feeder stores to the smaller village-based stores, to serve as the warehouse for goods. As a condition for receiving startup funds, owners agreed to provide farmers free educational programs (similar to extension) centered on relevant agricultural practices.

**Conceptual Framework**

According to Natsios (2005) the USAID has highlighted nine principles for development, which were adapted from the Nine Principals of War. The agency uses these principals as a guide to design development projects throughout the world. They act as a beacon to for understanding, application and assessment of development projects. Natsios continued, the principals are not a blueprint for development, but a reference for sustainable development. The principals help formalize and strengthen while articulating to others steps for positive development. Furthermore, Natsios (2005) indicated USAID has been on the front lines of development throughout the world, and no other agency has been through a greater amount of internal review and these principals are the result of that review.

This review has led USAID to implement a framework when implementing development. The principles of reconstruction and development entail the ability to create ownership of the people, build capacity in the country, create sustainable programs, selectivity of needs for benefactors, assessment of the needs in the regions, create measurable results, build partnerships within the country, be flexible and adapt to changes as they arise, and build accountability and transparency in the programs (Natsios, 2005).

**Purpose and Research Questions**

The purpose of this descriptive study was twofold: 1) to gain a better understanding of the issues facing rural Afghans, 2) and determine if the stores were beneficial to the areas. Four basic questions guided the development of the survey instrument: 1) How did respondents earn an income before owning a farm store, 2) was the farm store owner willing to invest personal funds in the store, 3) what sectors of the farm store were important to the customers, and 4) was owning a store beneficial for the respondents and their families?

**Methods and Data Sources**

The 12 benefactors for the program were vetted through extensive interviews regarding agricultural knowledge and financial ability for business ownership. Therefore, owners needed to be members of the communities where the farm stores were located. To ensure backing from community elders; participants needed to be in good standing within their communities. Local VEGA employees worked with elders to create a list of possible participants. The survey instrument was created by local employees and expatriate management staff for the VEGA project. Using local employees in the design of the instrument...
ensured the questions would be answered and insured no questions would offend the local tribal cultures deemed important to the areas.

The pre-farm store survey was implemented to the 12 owners between February and April 2009, and the post-farm store survey was implemented in November of the same year. The instrument was written in English and translated to Pashtun, the native language for southeastern Afghanistan. Because of the high illiteracy rate in Afghanistan, estimated between 70% - 90% (USAID, 2006), VEGA staff members read each question to the participants. However, because of extreme security issues in the region, travel was limited to certain areas and three surveys were conducted via phone and not in person. The response rate was 100% for both pre- and post-surveys. Using a five point Likert-type scale, store owners were asked 25 questions regarding operations, services, and economic benefits. The questionnaires were analyzed using descriptive statistics, comparing the differences between pre- and post-store ownership.

Findings

Pre-farm Store Ownership Data

Data derived from the pre-farm store survey indicated the majority of respondents family income was over 10,000 USD, and the respondents spent 10-20 hours working as an employee for someone else. For the construct of pre-farm store ownership, 75% stated owning a farm store would be very important, and 83% would be willing to invest 25,000 USD or more of their own money to open a store. As for perceived difficulties with owning a store, almost half (47%) believed providing services to farmers would be the most difficult aspect, while only 25% felt making a profit would be most difficult. When asked how many employees and the number of hours those employees would work, data indicated farm store owners employed 5 – 15 full time employees.

Half (50%) of the respondents indicated sales between 0 -15,000 USD for the projected first year sales for the store, and the other half (50%) indicated projected sales over 15,000 USD. Moreover, data indicated almost half of the potential store owners (N = 12) perceived they would generate 1,000 or more customers in the first year (see Figure 1).

Figure 1. Perceived number of potential customers for first year of business.
When asked which goods or services offered at the new store would be most important, over half (83%) of potential owners indicated equipment rental followed by seed and fertilizer sales (75%). Data also indicated new business owners perceived they would need training in technical agriculture and business management to effectively operate a store. When asked the level of importance for different attributes of farm store services, 75% indicated seed/fertilizer would be very important, 66% indicated purchasing farmer produce was important, 83% indicated equipment rental would be very important, 58% perceived Extension services would be very important, 66% indicated having access to credit would be very important, and 75% indicated providing credit to farmers would be important (see Table 1).

<table>
<thead>
<tr>
<th>No</th>
<th>Somewhat</th>
<th>Important</th>
<th>Very important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed/fertilizer</td>
<td>3</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Purchase farmer produce</td>
<td>8</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Equipment rental</td>
<td>1</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Extension services</td>
<td>5</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Owner access to credit</td>
<td>2</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Farmer access to credit</td>
<td>3</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

When asked about other possible support participants (owners) would receive from VEGA, 100% of the store owners indicated education would be very important. To gain a better understanding of the participants, a series of demographic questions were asked. When respondents were asked how owning a farm store may benefit their families, 75% indicated it would increase their income. Additionally, data demonstrated almost half of the respondents had 16 or more people in their families, with 91% indicated their children attended school daily, and 66% indicated owning a store would make it easier for their children to attend school. When asked about dietary habits, 100% indicated their family ate three meals per day; however, 84% consumed rice/vegetables daily, while only 16% of the families consumed meat products daily.

**Post-farm Store Ownership Data**

In November, the post-farm store survey was conducted using the identical methods as indicated for the pre-farm store survey. This allowed most farm stores to operate for almost a year, while a few had only operated for about six months. Data indicated the actual family income for participants ranged around 5,000 USD, and 66% of the store owners worked 40 hours or more at their shops. When asked if owning a farm store was still important to them, 50% indicated important, while 50% indicated very important. When asked about their actual financial investment, 58% indicated they invested 25,000 – 50,000 USD in their farm stores. They also indicated they employed 0 – 10 employees full time, with 75% stating annual sales around 10,000 USD. Data also exposed approximately 500 to 1000 customers visited the stores over the course of the year.

Furthermore, the study collected data regarding which attributes of the farm store were the most important for the customers, with 42% suggested equipment rentals were most important. All respondents also indicated they needed more training.
regarding business management and technical agriculture. In the post-farm store survey store owners were asked the level of importance for different attributes of farm store services, with 66% indicating seed/fertilizer was important, 50% indicating purchasing farmer produce was very important, 58% indicating equipment rental was important, 75% perceived extension services to be very important, 75% indicated having access to credit was important, and 58% indicated providing credit to farmers was important (see Table 2).

Table 2
Post Farm Store Ownership Survey, Level of Importance for Selected Store Services

<table>
<thead>
<tr>
<th>Service</th>
<th>No</th>
<th>Somewhat</th>
<th>Important</th>
<th>Very important</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seed/fertilizer</td>
<td>8</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase farmer produce</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Equipment rental</td>
<td>7</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Extension services</td>
<td>3</td>
<td></td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Owner access to credit</td>
<td>9</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Farmer access to credit</td>
<td>2</td>
<td>7</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

When asked about the educational support owners received from VEGA, 50% of the participants indicated education was important. However, 41% indicated the educational support was very important. Delving further, a series of demographic questions were asked. The respondents were asked how owning a farm store benefitted their families, with 50% indicated a better community image, while 25% purposed increase in time spent with family. Additionally, the data reported over half of the respondents had family size of six to fifteen members, with 58% indicated their children attended school on a regular basis. When respondents were asked if owning a farm store helped to send their children to school, 66% responded somewhat. Moreover, respondents were asked questions regarding their dietary habits, with 100% indicated their family continued to eat three meals per day; however 83% consumed meat as a staple in their diets.

Comparison of Pre & Post Farm Store Owners’ Responses

The pre-farm store survey data indicated there was a decline in the respondents’ family incomes. The majority of pre-farm store respondents (58%) stated their family incomes was over 10,000 USD, however, post-harvest survey data gleaned 58% of the respondents’ family incomes were around 5,000 USD; a substantial change in incomes. The data also indicated store owners worked more hours after opening a farm store than they perceived they would before the stores were opened. Before owning a store, 66% of respondents perceived they would work between 10 – 20 hours at the store, but after opening the shops respondents reported working 40 hours or more. When asked in the pre-store ownership survey if owning a store was important, 75% indicated it was very important, however, the data from the post-store survey indicated only 50% perceived it was very important.

When asked about their willingness to invest in the store, 33% indicated they were willing to invest 25,000 – 50,000 USD, however, data for actual financial investment for the respondents indicated 58% invested 25,000 – 50,000 USD of their own money in the stores. Furthermore, 50% of the respondents also indicated in the pre-store ownership survey they assumed they
would generate first year sales between 15,000 USD or more; however, post ownership data indicated 75% of respondents’ actual first years sales were around 10,000 USD. As for pre- and post-numbers of customers, 100% of the respondents indicated 500 or more customers the first year (see Figure 2).

Figure 2. Comparison of respondents for pre-survey and post-survey for store customers.

A comparison of pre- and post-farm store survey data regarding the level of importance for different attributes of farm store services indicated changes in perceptions of several functions of the stores. There was a substantial significant change regarding importance of seed/fertilizer sales, a positive change in purchasing farmer produce, an ample change in equipment rental, a slight positive change in extension services, a sizeable change regarding the store owner’s availability to credit, and extensive change in credit to farmers (see Table 3).

Table 3
Comparison of Pre & Post Ownership Survey, Level of Importance for Selected Store Services

<table>
<thead>
<tr>
<th>Service</th>
<th>PRE N=12</th>
<th>POST N=12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed/fertilizer</td>
<td>3 f SW 9 f</td>
<td>8 f SW 4 f</td>
</tr>
<tr>
<td>Purchase produce</td>
<td>1 f SW 3 f</td>
<td>2 f SW 6 f</td>
</tr>
<tr>
<td>Equipment rental</td>
<td>1 f SW 10 f</td>
<td>7 f SW 5 f</td>
</tr>
<tr>
<td>Extension services</td>
<td>5 f SW 7 f</td>
<td>3 f SW 9 f</td>
</tr>
<tr>
<td>Owner credit</td>
<td>2 f SW 8 f</td>
<td>9 f SW 3 f</td>
</tr>
<tr>
<td>Farmer credit</td>
<td>3 f SW 9 f</td>
<td>2 f SW 7 f</td>
</tr>
</tbody>
</table>

Note: N = No, SW = Somewhat, I = Important, VI = Very Important

When comparing the remainder of the data, respondent family sizes decreased, family incomes decreased, community image increased, and dietary habits of the families changed. They consumed more protein in their diets. Because of the world economic crisis and hard economic times facing all donor nations, the VEGA project was terminated early; therefore, the researchers asked respondents if the early termination of the VEGA project was harmful for their businesses. All respondents indicated the shutdown was very harmful to their businesses.

Conclusions and Recommendations
This study examined outcomes of a rural development center (farm store) program, and determined which aspects of the program were beneficial to the owners
and farmers. Recipients were selected for this program through extensive interviews, local perceptions of the participants, and regional aspects based on needs of the communities. No stores were identical in their makeup because the stores supplied goods and services needed by people and farmers in those specific regions. The nine principles of development illustrated selectivity, assessment and flexibility as means to maximize effectiveness. Respondents actually invested between 25,000 and 50,000 USD in their farm stores, which supports Natsios (2005) who stated ownership is an aspect of development. This is critical because when people or communities perceive they own the development, the possibility of sustainability increases. Respondents also indicated the educational programs implemented through the VEGA program were beneficial to them. Additionally, Natsios (2005) defined capacity building as the transfer of knowledge to individuals, which in turn enhances the long-term ability of the recipients.

Store owners perceived all functions of the stores as either important or very important. This supports research conducted by CNFA (2004) where the researchers indicated all aspects of the rural development centers were a benefit to rural Moldovan people. However, at the end of one year of operation major changes included the level of perceived importance for seed/fertilizer sales, rental of equipment, extension services, and credit for both owners and farmers. The year-end results indicated there was a level of sustainability in the program.

Seed/fertilizer sales were a staple for stores; however, after one year of operation many owners indicated it was very important. Farmers could purchase those inputs from other sources if needed. As for equipment rental, less than half of the respondents indicated equipment rental was very important. One possibility for the difference could have been the VEGA program was shut down early because of the world economic crises and farm stores did not receive the equipment that was originally planned for each store. The importance of extension services increased over the year as owners realized the value of providing farmers with information as a valuable asset to the store. Research conducted by Androulidakis et al., (2002) found agro-dealers providing extension services to farmers enhanced the capacity of the businesses. This finding is supported by Swanson and Samy (2002) who suggested private sector extension has become important for the transfer of knowledge and training of farmers. Private sector extension services are important avenues for technological change and are vital for agricultural growth (FAO, 2009; Mellor and Ranade, 2002).

Another important sector for each store was credit, specifically financial credit for the owners and the ability to provide financial credit to the farmers. Respondents perceived credit to be important for their businesses. Research conducted by Kelly, Akinwumi, Adesina, and Gordon (2003) found credit was important for agro-dealers to restock inventory and increase other aspects of the stores. Credit allowed dealers to rely more on themselves than donors for financial needs. Those researchers also extrapolated that supplying credit to farmers increased demand of inputs, effectively increasing sales for the store.

Respondents of the program also indicated a positive change in community image; they were respected by others for owning a store, being a business owner benefited their families. They also indicated the size of their families decreased as a result of owning a business. One possibility for this may be that store owners moved into their shops and no longer live in extended family units, a common practice in afghan culture. Respondents also indicated a change in their dietary staples as demonstrated by
after owning a store; respondents consumed more meat (protein) products. However, their incomes decreased after owning a store. This may be a result of moving their immediate families to their stores and not counting the incomes of members of their extended families. The results from the program indicated the program had aspects of sustainability and outcomes that benefited the recipients and their families. Therefore, the researchers would suggest when designing, implementing, and evaluating development projects it is critical to understand the principles for development and to use these principles as a map when in the field. Furthermore, programs need to fit the local communities and be profitable for the recipients. Understanding those principles may be beneficial for the implementer and recipients of the project. According to Kock and Edwards (2007), established, successful programs should be studied when creating similar programs. These benchmarks will afford effective planning for future programs as well as possible improvements to existing programs.

Implications
Donors want a return on their investment. This return can be measured by the results or outcomes of a program. Therefore, understanding positive steps for creating those results is important. Programs need to generate incomes for recipients and benefit communities, thereby improving the return on the investment in development. According to Natsios (2005) seasoned development agencies have incorporated the principles into their programs. Implementing programs built on ownership, capacity building, selectivity, partnerships, and flexibility increases the likelihood for sustainability. CNFA (2010) postulated the Afghanistan Farm Service Alliance (AFSA) project established seven privately owned farm stores, which opened in 2006-2007 provided $8.6 million worth of inputs to 20,000 rural Afghan farmers. Moreover, Natsios concluded development programs will not be sustainable if local communities and people do not believe they have ownership. This can be true for the individual, community, and country where development is concerned. Only time will tell if the businesses described in this study are sustainable.

References


Diffusion of Technologies by the Tikonko Agricultural Extension Centre (TAEC) to Farmers of the Tikonko Chiefdom in Sierra Leone: Impacts, Problems, Proposed Solutions, and an Updated Outlook

Samba Moriba  
Oklahoma State University  
moriba@okstate.edu

Joseph B. A. Kandeh  
Njala University, Sierra Leone  
kandeh288@yahoo.com

M. Craig Edwards  
Oklahoma State University  
craig.edwards@okstate.edu

Abstract

Sierra Leone is a west African nation with about two-thirds of its population engaged in agriculture but it cannot feed itself. The country’s agricultural activities were disrupted by a decade-long Civil War that created a great need for improved farming technologies. The Tikonko Agricultural Extension Centre (TAEC) operates in the Tikonko Chiefdom to assist local farmers in improving food production through the fabrication of farm tools to be adopted and used by farmers. This study was conducted to investigate the impacts of the TAEC’s technologies on farmers and their communities in the Tikonko Chiefdom and identify problems and solutions associated with the technologies and their diffusion. The target population included farmers (N = 318) who used TAEC’s technologies and TAEC staff (N = 18) who were involved in the diffusion process. A majority of the farmers adopted and used TAEC’s technologies readily, which they perceived had considerable impact on their farming practices and communities. The relevance of TAEC’s technologies to farmers in Tikonko Chiefdom was also evident. However, the participating farmers and TAEC staff encountered numerous problems. A majority agreed that the diffusion and adoption process could be improved by increasing the farmers’ access to loans. Providing appropriate technologies that can be adopted by low income farmers stands to increase their productivity and self-reliance while improving their nations’ food security. It is undeniable that technologies contributing to food sufficiency and alleviating poverty are needed throughout the developing world; policymakers must be reminded of this condition continually.

Keywords: Extension, farming; post-conflict, Sierra Leone, technological innovations
Introduction

Sierra Leone is a west African coastal state that is classified as one of the world’s “least developed” countries by the United Nations (United Nations [UN], 2009). Its population is growing at a high annual rate but per capita income is low making Sierra Leone one of the poorest countries in the world (United Nations Development Programme [UNDP], 2010). The proportion of Sierra Leone’s natural resources that percolates down to the general population is very small making living conditions extremely difficult; its infant mortality rate is one of the highest in the world (Thuriaux, 2010; UN, 2008). The roads are in very poor condition, preventing farmers from bringing their products to the market. Human resource development has been neglected for many years with schools and hospitals lacking even the most basic supplies.

Agriculture was the largest sector of Sierra Leone’s economy, contributing 80% to the country’s Gross Domestic Product (GDP) and 30% of its export earnings (Food and Agriculture Organization [FAO], 2010), before a brutal Civil War.

The majority of Sierra Leoneans live in rural areas and about two-thirds are engaged in agriculture and related activities for their livelihoods (FAO, 2010; International Fund for Agricultural Development [IFAD], 2007). Therefore, the importance of agriculture to the national economy regarding income and employment opportunities is evident. Sierra Leone is endowed with substantial wealth in terms of cultivable land and natural resources. However, the distribution of income is markedly uneven and the vast majority of the population is estimated to live in absolute poverty (UNDP, 2010). Moreover, Sierra Leone is recovering from a decade-long Civil War that disrupted its agricultural activities, thus, creating a great need for improved farming technologies.

A policy objective of the Sierra Leone government is to encourage increased efficiency in the production of food crops and livestock. So, it is necessary to empower farmers by providing them with technologies that will foster self-reliance and development (Moriba, 2002). The Tikonko Agricultural Extension Centre (TAEC) was established purposely to achieve such a goal in the Tikonko Chiefdom (an administrative unit of the Bo District). The TAEC operates in the Chiefdom to assist local farmers in improving food production (Kawa, 1992). The Centre established a Small Farm Equipment Production Unit to fabricate and repair farm tools to be adopted and used by farmers.

Theoretical/Conceptual Framework

The manufacturing of new technologies intended for adoption and use by farmers is supported by diffusion of innovations theory, as posited by Everett M. Rogers (2003). Rogers theorized that information about a new idea (i.e., an innovation) is spread among the people of a society through various communication channels, including mass media and interpersonal relationships. This posit takes into account the potential adopters’ perceptions of relative advantage over the existing idea or practice and its compatibility with their needs, values, and societal norms (Rogers, 2003). Rogers stated that, “relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes” (p. 15). For example, farmers may perceive the TAEC-produced technologies as having greater relative advantage because imported farm tools are much more expensive than locally produced tools. On the other hand, the new technologies were simple and easy to use so they were compatible with the farmers’ past experiences and values. According to Rogers (2003), “the compatibility of an innovation, as perceived by members of a social system, is positively related to its rate of adoption” (p. 249).
The diffusion of innovations theory also takes into consideration concerns of potential adopters during the implementation stage of the innovation-decision process regarding operational problems they may encounter, and how to solve them (Rogers, 2003). Navarro (2008) argued that failing to begin with the potential adopters in mind can lead to failure of the “technology transfer” process. She emphasized the need for “co-creation of knowledge” (Navarro, 2008, p. 72) in which change agents and potential adopters collaborate. “Farmers [i.e., potential adopters] need to be active participants of the development and diffusion of innovations to make adoption happen” (Oleas, Dooley, Shinn, & Giusti, 2010, p. 34). Further, Pineiro (1989) asserted that the disappointing result of many projects was due to inappropriateness of technology, failure to adapt to local farming patterns, scarcity of resources, and/or inadequate small-scale production systems.

The new technology also must be appropriate for the farmers and the environment. Harrison (1980) pointed out that appropriate technology means any technology which makes the most economical use of a country’s natural resources and its relative proportions of capital, labor and skills; it fosters attainment of national and social goals. So, facilitating the adoption of appropriate technologies encourages the right choice of technology, and not simply letting commercial entities make that decision for potential adopters indirectly by what they decide to sell. According to the United Nations Industrial Development Organization (UNIDO) (1979), the concept of appropriate technology is viewed as the technology mix contributing most to economic, social, and environmental objectives relative to resource endowments and conditions of application in a particular country.

Appropriate technology is a dynamic and flexible concept, which must be responsive to varying conditions and changing situations depending on the country and its different social systems. Jequier and Blanc (1983) asserted that appropriate technology is recognized as the generic term for a wide range of technologies characterized by low investment cost per workplace, low capital investment per unit output, organizational simplicity, sparing use of resources, low cost of final product, and/or high potential for employment. Gordon (1967) argued for the introduction of simple machines into the non-industrial community, where adopters can improve their indigenous methods. The technology can be regarded consequently as an intermediate stage between a subsistence and an industrialized economy.

The TAEC’s role in assisting farmers of the Tikonko Chiefdom to improve their food production capacity has been a concern of Sierra Leone’s Ministry of Agriculture and Forestry, the Methodist Church of Sierra Leone (the primary donor to the Centre in the past), the management of the TAEC, and the farming community (Moriba, 2002). Moreover, skeptics from several quarters, especially donors, had questioned the relevance of the TAEC’s technologies given to farmers vis-à-vis the benefits gained.

Both farmers and the TAEC’s staff (i.e., “change agents”; see Rogers, 2003) have experienced many problems, which affected the diffusion and adoption of the Centre’s technologies. These farmers and staff held views on how to improve the technologies and their diffusion. Thus, the need existed for a systematic inquiry regarding the impacts of TAEC-produced technologies, problems encountered, and solutions suggested by Tikonko farmers and the TAEC’s staff.

**Purpose and Objectives of the Study**

The purpose of this study was to investigate the impacts of the TAEC’s technologies on farmers and their communities in the Tikonko Chiefdom of
Sierra Leone as well as describe perceptions of farmers and TAEC’s staff on problems and solutions associated with the technologies and their diffusion. The specific objectives of the study were to 1) identify the types of TAEC-produced technologies used by farmers; 2) describe farmers’ perceptions of the impacts of the TAEC’s technologies on food production levels in the Tikonko Chiefdom; 3) determine problems encountered by farmers when adopting the TAEC’s technologies; 4) determine problems encountered by the TAEC’s staff when diffusing the Centre’s technologies; 5) compare perceptions of farmers and staff on ways to improve the TAEC’s technologies and their diffusion (i.e., “solutions” to problems); 6) provide an updated outlook on the Centre’s status nearly a decade after examining it originally.

**Methods and Data Sources**

This descriptive study was conducted in the Tikonko Chiefdom in the Southern Province of Sierra Leone during 2002. The Chiefdom has an estimated population of about 40,000 (Thomas, MacCormack, & Bangura, 2006). Tikonko is seven miles from Bo (the second largest city in Sierra Leone) and is where the TAEC is located presently. The Chiefdom has extensive parcels of land suitable for farming. The main occupations of the inhabitants of Tikonko are subsistence farming, petty trading, and diamond mining. “Shifting agriculture,” a system of cultivation that employs plot rotation in an effort to preserve soil fertility, is the technique practiced largely in the Tikonko Chiefdom (Moriba, 2002). Rice, cassava, sweet potato, maize (corn), oil palm, yam, and groundnut are among the crops grown in the Tikonko Chiefdom.

The target populations constituted 318 farmers who used the TAEC’s technologies and 18 TAEC staff who were involved in the diffusion process. Seventy-four farmers (n = 74) comprised a random sample whereas the TAEC staff members represented a census. A structured questionnaire with summated-rating scale items (Creswell, 2008) was used to collect data on the types of TAEC’s technologies farmers adopted and used, the farmers’ views regarding impacts of the Centre’s technologies on the farmers and their communities, as well as problems and solutions associated with the adoption and use of the Centre’s technologies in the Tikonko Chiefdom: 5 = (Strongly agree); 4 (Agree); 3 (Indifferent or neutral); 2 (Disagree); and 1 (Strongly disagree). A second questionnaire was used to collect data on the views of the Centre’s staff regarding problems and solutions associated with diffusion of the TAEC’s technologies.

The instruments were developed by the researchers based on observations, interviews during the study’s pilot-test, and review of the Centre’s official records. A panel of experts, which included faculty members of Njala University in Sierra Leone who had expertise in agriculture and rural development, reviewed the instruments to ensure its content validity. The instruments were pilot-tested with farmers in a neighboring chiefdom. None of the responses of farmers who participated in the pilot-test were included in the findings reported here. Because most of the farmer interviewees were illiterate, data were collected using a structured survey questionnaire that was completed through one-on-one, oral interviews of participants. All 74 farmers selected for participation in the study were interviewed. The lead researcher, a faculty member of Njala University, conducted the study’s interviews. The interviews were done during the months of February, March, and April in 2002. Data were analyzed descriptively by calculating the frequencies of participants’ responses as percentages.
Findings

Types of Technologies Diffused by the TAEC

The technologies diffused by the TAEC were organized in three categories: motorized machines, manually-operated machines, and blacksmith tools. Only one type of motorized machine was identified, i.e., grater machines. Of the farmers interviewed, 74.3% strongly agreed that they used the grater machines. The grater machines were used to scratch the tuberous root of cassava, a shrubby plant that is grown mainly in tropical regions. Both the tuberous root and leaves are eaten and it is a vital staple food for Sierra Leoneans, second only to rice.

Eight of the TAEC’s manually-operated machines were used by a large majority of the farmers in the Tikonko Chiefdom: threshing machines (95.9%) were used to remove rice grains from the stalks; winnowing machines (93.2%) for separating chaff from rice grains after it has been threshed from the straw; wheelbarrows (78.4%) for transportation purposes; shelling machines (74.3%) for shelling cashew nut and dried corn; seed mixers (70.3%) for mixing seeds before broadcasting; well pulleys (70.3%) to lift water from wells in sufficient quantity for many purposes, including irrigating gardens; jab planters (66.2%) for planting seeds in rows; and pressing machines (63.5%) for extracting oil from crushed palm fruit, coconut and groundnut. Approximately one-third or fewer farmers agreed that they used blacksmith blowers (36.5%), honey bee smokers (36.5%), or block-making machines (29.7%) (Table 1).

Four main TAEC-produced blacksmith tools were used by farmers in the Tikonko Chiefdom. Most of the farmers interviewed strongly agreed that they used cutlasses/machetes (94.6%), hoes (91.9%), hand trowels (82.4%), and hand forks (79.7%). These simple farm tools were used widely by farmers for land-clearing and cultivation activities.

Farmers’ Perceptions of the Impact of the TAEC’s Technologies

Regarding farmers’ perceptions about the impact of TAEC-produced technologies on their practices, a majority strongly agreed with most of the statements describing various impacts of these technologies on farming activities, their livelihoods generally, and their communities (see Table 1). A large majority of the farmers (82.4%) strongly agreed that they “adopted and used TAEC’s technologies” (see Table 1). Further, 77% of the farmers strongly agreed that use of the technologies diffused by the TAEC resulted in “greater farmer confidence,” and 17.6% agreed.

Moreover, most of the farmers strongly agreed with five statements that described the perceived impact of the TAEC’s technologies on them and their communities: “increased the interest of farmers to engage in farming” (73.0%); “reduced drudgery” (71.6); “more food production” (68.9%); “good farmer-TAEC relationship” (68.9%); “increased agricultural activities” (62.2%). Slightly more than one-half of the farmers strongly agreed with the statement that described the perceived impact of technologies diffused by the TAEC: “improved quality of production” (55.4%) (see Table 1).
Table 1

Farmers’ Perceptions of Selected Impacts of the TAEC’s Technologies on their Farming Practices and Communities, Tikonko Chiefdom, Sierra Leone (n = 74)

<table>
<thead>
<tr>
<th>Statement about Impact</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Indifferent</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>High adoption and use of TAEC technologies</td>
<td>61</td>
<td>82.4</td>
<td>13</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Greater farmer confidence</td>
<td>57</td>
<td>77.0</td>
<td>13</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Increased interest of farmer to engage in farming</td>
<td>54</td>
<td>73.0</td>
<td>15</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Reduced drudgery</td>
<td>53</td>
<td>71.6</td>
<td>17</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>More food production</td>
<td>51</td>
<td>68.9</td>
<td>22</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Good farmer-TAEC relationship</td>
<td>51</td>
<td>68.9</td>
<td>23</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Increased agricultural activities</td>
<td>46</td>
<td>62.2</td>
<td>25</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Improved quality of production</td>
<td>41</td>
<td>55.4</td>
<td>25</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Improved financial status of farmer.Units</td>
<td>39</td>
<td>52.7</td>
<td>21</td>
<td>14</td>
<td>0</td>
</tr>
</tbody>
</table>

Problems Encountered by Farmers when Adopting the TAEC’s Technologies

A majority of the participating farmers interviewed (63.6%) strongly agreed that “decreased access to loans” affected the diffusion of technologies produced by the TAEC (see Table 2). In terms of networking between farming villages, 51.4% of the farmers strongly agreed that “lesser networking between farming villages” was a problem associated with the diffusion process. One-third or more of the farmers also strongly agreed that two other problems were associated with the diffusion of TAEC’s technologies: “lack of maintenance facilities” (43.3%) and “inadequate training programs” (33.8%) (see Table 2).
Table 2
Views of Farmers on Problems Encountered when Adopting and Using the TAEC’s Technologies, Tikonko Chiefdom, Sierra Leone (n = 74)

<table>
<thead>
<tr>
<th>Statement about Problems</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Indifferent</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>%</td>
<td>f</td>
<td>%</td>
<td>f</td>
</tr>
<tr>
<td>Decreased access to loans</td>
<td>47</td>
<td>63.5</td>
<td>24</td>
<td>32.4</td>
<td>3</td>
</tr>
<tr>
<td>Lesser networking between farming villages</td>
<td>38</td>
<td>51.4</td>
<td>22</td>
<td>29.7</td>
<td>3</td>
</tr>
<tr>
<td>Lack of maintenance facilities</td>
<td>32</td>
<td>43.2</td>
<td>42</td>
<td>56.8</td>
<td>0</td>
</tr>
<tr>
<td>Inadequate training programs</td>
<td>25</td>
<td>33.8</td>
<td>31</td>
<td>41.9</td>
<td>12</td>
</tr>
<tr>
<td>Incompetent TAEC Extension agents</td>
<td>21</td>
<td>28.4</td>
<td>21</td>
<td>28.4</td>
<td>13</td>
</tr>
<tr>
<td>Poor financial status of farmers</td>
<td>18</td>
<td>24.3</td>
<td>21</td>
<td>28.4</td>
<td>7</td>
</tr>
<tr>
<td>Low income of farmers due to the use of TAEC technologies</td>
<td>4</td>
<td>5.4</td>
<td>10</td>
<td>13.5</td>
<td>5</td>
</tr>
<tr>
<td>Inefficiency of TAEC technologies</td>
<td>1</td>
<td>1.4</td>
<td>0</td>
<td>0.0</td>
<td>6</td>
</tr>
</tbody>
</table>

Problems Encountered by the TAEC’s Staff when Diffusing the Centre’s Technologies

Approximately three-fourths of the TAEC’s staff interviewed (77.8%) strongly agreed that the “lack of funding due to donor fatigue” was a problem associated with the diffusion of technologies produced by the Centre (see Table 3). Two-thirds (66.7%) of the TAEC’s staff strongly agreed that “poor conditions of service for staff” and “low supply of raw materials” were problems that affected the diffusion process. Roughly one-half of the participating TAEC staff also reported other problems were associated with diffusion of the Centre’s technologies: “decreased access to loans” (55.6%) and “TAEC’s inability to employ more workers” (44.4%) (see Table 3).
Table 3  
Views of the TAEC’s Staff on Problems Encountered Producing and Diffusing Technologies, Tikonko Chiefdom, Sierra Leone (n = 18)

<table>
<thead>
<tr>
<th>Statement about Problems</th>
<th>Strongly agree</th>
<th></th>
<th>Agree</th>
<th></th>
<th>Indifferent</th>
<th></th>
<th>Disagree</th>
<th></th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of funding due to donor fatigue</td>
<td>14</td>
<td>77.8%</td>
<td>4</td>
<td>22.2%</td>
<td>0</td>
<td>0.0%</td>
<td>0</td>
<td>0.0%</td>
<td>0</td>
</tr>
<tr>
<td>Poor conditions of service for TAEC staff</td>
<td>12</td>
<td>66.7%</td>
<td>6</td>
<td>33.3%</td>
<td>0</td>
<td>0.0%</td>
<td>0</td>
<td>0.0%</td>
<td>0</td>
</tr>
<tr>
<td>Low supply of raw materials</td>
<td>12</td>
<td>66.7%</td>
<td>6</td>
<td>33.3%</td>
<td>0</td>
<td>0.0%</td>
<td>0</td>
<td>0.0%</td>
<td>0</td>
</tr>
<tr>
<td>Decreased access to loans</td>
<td>10</td>
<td>55.6%</td>
<td>8</td>
<td>44.4%</td>
<td>0</td>
<td>0.0%</td>
<td>0</td>
<td>0.0%</td>
<td>0</td>
</tr>
<tr>
<td>TAEC’s inability to employ more workers</td>
<td>8</td>
<td>44.4%</td>
<td>6</td>
<td>33.3%</td>
<td>4</td>
<td>22.2%</td>
<td>0</td>
<td>0.0%</td>
<td>0</td>
</tr>
<tr>
<td>Lesser networking between farming villages</td>
<td>7</td>
<td>38.9%</td>
<td>7</td>
<td>38.9%</td>
<td>3</td>
<td>16.7%</td>
<td>1</td>
<td>5.6%</td>
<td>0</td>
</tr>
<tr>
<td>Lack of maintenance facilities</td>
<td>6</td>
<td>33.3%</td>
<td>9</td>
<td>50.0%</td>
<td>3</td>
<td>16.7%</td>
<td>0</td>
<td>0.0%</td>
<td>0</td>
</tr>
<tr>
<td>Inadequate training programs for TAEC staff</td>
<td>3</td>
<td>16.7%</td>
<td>3</td>
<td>16.7%</td>
<td>6</td>
<td>33.3%</td>
<td>5</td>
<td>27.8%</td>
<td>1</td>
</tr>
</tbody>
</table>

Perceptions of Farmers on Ways to Improve the TAEC’s Technologies and Their Diffusion

Regarding ways to improve the TAEC’s technologies (i.e., “solutions”), a majority of the participating farmers strongly agreed with nine statements: “good farmer-TAEC relationship” (93.2%); “encourage greater networking between farming villages” (89.2%); “increase access to loans” (79.7%); “increase level of sensitization through education and extension programs” (70.3%); “increase the supply of TAEC technologies” (66.2%); “timely supply of TAEC technologies” (63.5%); “provide maintenance facilities for farmers” (56.8%); “reduce the cost of TAEC technologies” (55.4%); and “train TAEC Extension agents” (54.1%) (see Table 4).
Table 4
Views of Farmers on Ways to Improve the TAEC’s Technologies, Tikonko Chiefdom, Sierra Leone \((n=74)\)

<table>
<thead>
<tr>
<th>Statements about Solutions</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Indifferent</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(f)</td>
<td>(%)</td>
<td>(f)</td>
<td>(%)</td>
<td>(f)</td>
</tr>
<tr>
<td>Good farmer-TAEC relationship</td>
<td>69</td>
<td>93.2</td>
<td>5</td>
<td>6.8</td>
<td>0</td>
</tr>
<tr>
<td>Encourage greater networking between farming villages</td>
<td>66</td>
<td>89.2</td>
<td>8</td>
<td>10.8</td>
<td>0</td>
</tr>
<tr>
<td>Increase access to loans</td>
<td>59</td>
<td>79.7</td>
<td>14</td>
<td>18.9</td>
<td>1</td>
</tr>
<tr>
<td>Increase level of sensitization through education and extension programs</td>
<td>52</td>
<td>70.3</td>
<td>20</td>
<td>27.0</td>
<td>2</td>
</tr>
<tr>
<td>Increase the supply of TAEC technologies</td>
<td>49</td>
<td>66.2</td>
<td>25</td>
<td>33.8</td>
<td>0</td>
</tr>
<tr>
<td>Timely supply of TAEC technologies</td>
<td>47</td>
<td>63.5</td>
<td>26</td>
<td>35.1</td>
<td>1</td>
</tr>
<tr>
<td>Provide maintenance facilities for farmers</td>
<td>42</td>
<td>56.8</td>
<td>29</td>
<td>39.2</td>
<td>3</td>
</tr>
<tr>
<td>Reduce the cost of TAEC technologies</td>
<td>41</td>
<td>55.4</td>
<td>28</td>
<td>37.8</td>
<td>5</td>
</tr>
<tr>
<td>Train TAEC Extension agents</td>
<td>40</td>
<td>54.1</td>
<td>25</td>
<td>33.8</td>
<td>9</td>
</tr>
<tr>
<td>Provide training programs for farmers</td>
<td>32</td>
<td>43.2</td>
<td>25</td>
<td>33.8</td>
<td>17</td>
</tr>
</tbody>
</table>

**Perceptions of Staff on Ways to Improve the TAEC’s Technologies and Their Diffusion**

A two-thirds majority or more of the TAEC staff interviewed *strongly agreed* with six statements regarding ways to improve the TAEC’s technologies: “improve the conditions of service for TAEC staff” (100%), “increase donor funding” (88.9%); “increase access to loans” (83.3%); “increase level of sensitization through education and extension programs” (77.8%); “increase the supply of raw materials” (77.8%); and “good farmer-TAEC relationship” (66.7%) (see Table 5).
Table 5

Views of the TAEC’s Staff on Ways to Improve the Centre’s Technologies, Tikonko Chiefdom, Sierra Leone (N = 18)

<table>
<thead>
<tr>
<th>Statements about Solutions</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Indifferent</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>%</td>
<td>f</td>
<td>%</td>
<td>f</td>
</tr>
<tr>
<td>Improve the conditions of</td>
<td>18</td>
<td>100.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>service for TAEC staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase donor funding</td>
<td>16</td>
<td>88.9</td>
<td>2</td>
<td>11.1</td>
<td>0</td>
</tr>
<tr>
<td>Increase access to loans</td>
<td>15</td>
<td>83.3</td>
<td>3</td>
<td>16.7</td>
<td>0</td>
</tr>
<tr>
<td>Increase level of</td>
<td>14</td>
<td>77.8</td>
<td>4</td>
<td>22.2</td>
<td>0</td>
</tr>
<tr>
<td>sensitization through</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>education and extension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>programs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase the supply of raw</td>
<td>14</td>
<td>77.8</td>
<td>4</td>
<td>22.2</td>
<td>0</td>
</tr>
<tr>
<td>materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good farmer-TAEC</td>
<td>12</td>
<td>66.7</td>
<td>3</td>
<td>16.7</td>
<td>3</td>
</tr>
<tr>
<td>relationship</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase the level of</td>
<td>10</td>
<td>55.6</td>
<td>8</td>
<td>44.4</td>
<td>0</td>
</tr>
<tr>
<td>production of TAEC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>technologies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employ additional TAEC</td>
<td>7</td>
<td>38.9</td>
<td>9</td>
<td>50.0</td>
<td>2</td>
</tr>
<tr>
<td>workers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Train TAEC Extension</td>
<td>7</td>
<td>38.9</td>
<td>9</td>
<td>50.0</td>
<td>2</td>
</tr>
<tr>
<td>agents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encourage greater</td>
<td>6</td>
<td>33.3</td>
<td>7</td>
<td>38.9</td>
<td>5</td>
</tr>
<tr>
<td>networking between</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>farming villages</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comparison of the Perceptions of Farmers and Staff on Ways to Improve the TAEC’s Technologies and Their Diffusion

An overwhelming majority of participating TAEC staff (83.32%) and farmers (79.7%) strongly agreed that the diffusion and adoption of TAEC’s technologies could be improved by increasing access to loans. Further, 93.2% of farmers and 66.7% of staff strongly agreed that another way to improve the diffusion process was by having a good farmer-TAEC relationship.

Conclusions, Discussion, and Implications

A majority of the farmers interviewed adopted and used the TAEC’s technologies readily. The adopters’ perceptions of relative advantage and compatibility, i.e., two significant perceived attributes of an innovation (Rogers, 2003),
may have fomented their perceptions. Moreover, most farmers agreed strongly that their introduction to and subsequent adoption of the TAEC’s technologies had considerable impact on their farming practices and communities. The relevance of the TAEC’s technologies to farmers in the Tikonko Chiefdom was evident.

The main thrust for diffusing technologies in a rural farming community is to empower the farmers to become self-reliant in food production and enhance economic growth in the community. Technologies suited for the locality may serve as a remedy for solving economic, social, and environmental problems (Harrison, 1980). The farmers interviewed perceived that the TAEC-produced technologies contributed to production increases. The TAEC-diffused technologies increased the interest of farmers to engage in farming, led to more food production, increased agricultural activities in the Tikonko Chiefdom generally, improved the quality of production, and also enhanced the financial status of the farmers interviewed (see Table 1).

Based on the farmers’ perceptions regarding the impact of TAEC-diffused technologies, a strong indication was expressed that they had very high appreciation for the technologies. A majority of the farmers who used the technologies perceived they realized a considerable increase in their level and quality of production. The main goal of the TAEC was to help farmers of the Tikonko Chiefdom raise their production capacity to attain food self-sufficiency as well as associated effects on the general vitality of their communities. That goal was achieved to a large extent as a result of the high rate of adoption and use of Centre-produced technologies by farmers of the Chiefdom (see Table 1).

A majority of the participating farmers encountered numerous problems, however, which affected adoption of the TAEC’s technologies. Loans may be used generally to purchase items needed for a successful farm operation such as livestock, equipment, feed, seed, fuel, chemicals, repairs, insurance, and other operating expenses. To get a “snapshot” of the availability of lending entities, farmers were asked whether access to credit was a problem associated with the adoption of technologies diffused by the TAEC. The farmers agreed that “decreased access” to loans was a major problem affecting their adoption of the Centre’s technologies (see Table 2).

When asked about networking, a majority of farmers interviewed indicated that lesser networking between farming villages was also a key problem impeding adoption of the TAEC’s technologies (see Table 2). Networking involves an association of farmers having a common interest, formed to provide mutual assistance, helpful information, or the like. Farming communities are usually rich and complex networks of social relationships through which their members communicate and share information (i.e., “personal communication network[s]” per Rogers, 2003, p. 338). Therefore, lesser networking between farming villages could render farmers less productive and reduce their success.

Participating farmers also identified the lack of maintenance facilities, inadequate training programs, incompetent TAEC Extension agents, low supply of the TAEC’s technologies, and poor financial status of farmers as problems associated with the adoption of technologies diffused by the Centre (see Table 2). These problems could be major obstacles to technology transfer, making it difficult to achieve the desired goal of stakeholders concerned with improving farming and attaining food security in developing countries such as Sierra Leone. The researchers could not provide an explanation for the farmers perceiving the TAEC Extension agents were incompetent. However, this viewpoint may
be associated with the finding that farmers perceived lesser networking existed between farming villages.

Change agents (i.e., TAEC staff) are crucial actors in the diffusion process because the change itself is assumed to be for the good of the adopters (Navarro, 2008; Rogers, 2003). All of the TAEC staff interviewed agreed that the diffusion of technologies produced by the Centre was affected by many problems. They reported that lack of funding due to “donor fatigue” was a problem hindering diffusion. The problem was especially serious in this study because the TAEC depended heavily on the goodwill of donors (Moriba, 2002). In addition, nearly two-thirds of the participating TAEC staff identified their poor conditions of service as a serious challenge to the diffusion process.

Both participating farmers and the TAEC staff interviewed suggested a number of ways to improve the technologies (i.e., “solutions to problems”). Navarro (2008) proposed that potential adopters of new technologies should be involved in the planning and implementation stages of the technology transfer process, which would result in the “co-creation of knowledge” (p. 72). Most of the farmers interviewed recommended several ways of improving the diffusion process: maintain good farmer-TAEC relationships, encourage greater networking between villages, increase their access to credit, and elevate their levels of sensitization through education and Extension programs. In the case of the TAEC staff, a majority suggested that improving the conditions of service for TAEC staff, increasing donor funding, increasing farmers’ access to loans, and maintaining good farmer-TAEC relationships could improve the diffusion process.

Irrespective of the source of the suggestions, i.e., whether made by farmers or TAEC staff members, on ways to improve the diffusion and adoption of TAEC technologies, some were similar. For example, both groups perceived that the diffusion and adoption of technologies could be improved by increasing access to loans and maintaining good farmer-TAEC relationships. In addition to purchasing items needed for a successful farm operations, loans can assist farmers in marketing their crops and, as a result, improve and stabilize farm income. On the other hand, a good relationship has desirable qualities such as support from both parties, a willingness to communicate, and an incentive to compromise. When these fundamental qualities are lacking, improving diffusion and adoption processes become challenging, which may lead to undesirable consequences eventually (Rogers, 2003).

The results of this study suggest that farmers in developing countries can improve their farming activities and contribute to their nations’ achieving food sufficiency and development if they are empowered properly. Too often, change agents try to diffuse new technologies into a farming community only to find that a relatively small percentage of farmers will actually adopt and use the technologies to any significant degree (Navarro, 2008; Rogers, 2003). Contrary to this viewpoint, the TAEC achieved high farmer usage of its technologies. The farmers accepted the TAEC’s technologies, an indication the Centre made considerable difference in the lives of farmers in the Tikonko Chiefdom by enhancing their agricultural production activities.

Although not exactly the type of sophisticated farm machines and equipment used by commercial farmers in the developed world, the technologies diffused by the TAEC boosted the confidence of the farmers interviewed. It was evident that the TAEC-produced technologies increased the farmers’ interest to engage in farming. Adopting and using a new technology may have motivated some farmers to cultivate more land. The impression of farmers may
have been that farming in the Tikonko Chiefdom was entering an era of renewal. Another positive outcome associated with a rising interest of farmers to engage in farming is that it may also create employment opportunities for others in their communities and thereby increase the income of those individuals.

Technological advances can have a dramatic effect on food production in a society, which, in turn, may lead to accelerated economic development more generally. In the Tikonko Chiefdom, the adoption and use of the TAEC-produced technologies by farmers resulted in more food production. Improving agricultural production by empowering farmers in the Tikonko Chiefdom is evidence of the impact such technologies could have on development if replicated in other parts of Sierra Leone and the region. When farmers in Tikonko harvested their crops in the past, many had to use almost all of their harvest for family consumption with little or nothing left to sell. This situation may have changed after farmers started using TAEC-produced technologies because most had increases in production, therefore, making it possible to sell some of their harvest.

A goal of most farmers is to improve their financial status. Many of the farmers interviewed perceived they had achieved that through the use of the tools and equipment manufactured by the TAEC. The entire process that led to the farmers’ improved financial status may have had a significant “multiplier effect.” From their adoption and use of the TAEC’s technologies, most of the farmers interviewed expressed greater confidence and interest in farming. That condition encouraged increased agricultural activities and more food was produced, which resulted ultimately in the improvement of the financial status of many farmers. This fundamental idea is vital in the diffusion of new technologies, i.e., adopters’ views regarding the relative advantage of an innovation vis-à-vis their existing practices and the long-term continuance of their adoption behaviors (Rogers, 2003).

**Recommendations, Educational Importance, and Application**

It is recommended that increased support be given to the TAEC. This would enable its staff to produce more farm tools and equipment for their clientele. Producing more farm tools and equipment would ensure adequate availability of these technologies for farmers’ use thereby motivating them to cultivate more farm land as well as increase their appreciation for farming and their ability to be productive. Further, with additional resources, the TAEC could improve the quality, efficiency, and appropriateness of its technologies. This would encourage farmers to eliminate the use of crude farm tools and intensify their use of the TAEC-produced technologies.

Subsistence agriculture, a farming system in which farmers grow only enough food to feed their family with little or none remaining to sell for income generation, is practiced widely in many west African nations. This circumstance is due frequently to the lack of appropriate technologies (Moriba, 2002) available for use by farmers. Therefore, important lessons from this study could be learned by other developing countries with agrarian economies also struggling to eradicate poverty, especially those nations that may be dealing with the aftermath of civil conflict. Providing appropriate technologies that can be adopted by low income farmers stands to increase their productivity and self-reliance while improving the food security of their nations. It is undeniable that technologies contributing to food sufficiency and alleviating poverty are needed in much of the world.

Further, it is recommended that attention be given to problems of diffusing the TAEC-produced technologies by increasing support to the Centre. In this way,
the Centre could improve its production of farm tools. Suggestions made by both groups on ways to address problems of diffusing the technologies may be crucial to enhancing transfer in the future.

Recommendations for Further Research

The following recommendations may be useful for further research: 1) examine the farmers’ individual performances with regards to income earned in relation to their adoption and use of the TAEC-produced technologies; 2) assess the impact of the other units of the TAEC, i.e., the Farm Unit and the Integrated Health and Agricultural Program Unit, on the farming communities in the Tikonko Chiefdom; 3) investigate the managerial policies governing the operations of the TAEC and identify the strengths and weaknesses of the Centre. This would enable the Centre’s managers to take actions toward a desired future and may create rationale for additional resources to support the Centre’s work; and 4) investigate the qualifications and level of competence of the TAEC’s educators.

An Updated Outlook of the TAEC in Sierra Leone

Because the abovementioned results were found and interpreted in the early part of the last decade, the researchers determined it was important to inquire about, and describe, an “updated outlook” of the Centre. Therefore, a survey questionnaire was administered to assess the present status of the TAEC and its operations. A member of the Centre’s management staff (personal communication, November 5, 2010) completed the questionnaire and the results revealed that the Centre had deteriorated in both its structure and operations following the researchers’ initial study. (To reduce the likelihood of the collaborating TAEC staff person experiencing negative consequences associated with the Centre’s updated outlook assessment, that individual’s identity remained confidential.) The Centre had only eight workers with five machines used for production purposes compared to 18 workers and 10 machines in 2002. The number of technologies produced by the Centre had declined by more than 40%.

Regarding the Centre’s operational policies, the respondent indicated “unfavorable” regarding employees’ compensation, capacity building, promotions, retention capacity, resource management, and benefits. Financial support, management, accountability, and input-output policies were also rated “unfavorable.” More still, material resource control and distribution, production requirements, income generation transactions, production sustainability, state regulations, as well as taxes and social security also received “unfavorable” ratings. Marketing products was the only policy item that received a “favorable” rating.

Overall, the TAEC is in a poor state and, therefore, the need exists for urgent action to resuscitate the Centre. The Centre had been highly donor-driven, making it vulnerable at a time when donor support has dwindled considerably in the past few years. The situation was exacerbated by the country’s slow economic recovery process after its 11-year, Civil War. Both the TAEC staff and farmers in the Tikonko Chiefdom have been unable to overcome many of the problems inhibiting the diffusion and adoption of the Centre’s technologies (see Tables 2 & 3). The Centre’s management staff made this statement to justify the need for additional resources to operate the Centre:

Tikonko Agricultural Extension Centre has been serving this community for a long time and has established beneficial relationship[s] in terms of good work and purpose. Therefore, we need to further the operations of the Centre, without which even the present low level of
service and equipment and machines we manufacture for the community would be lost. This would further deepen the poor economic agricultural activities. There is no doubt that with additional resources to be accessed for operating the Centre, there would be [an] improved food security situation. (personal communication, November 5, 2010)

The adoption of TAEC’s technologies by farmers in the Tikonko Chiefdom had considerable impact on their farming practices and communities, which is evidence of the relevance of the TAEC’s activities. However, both farmers and the TAEC staff encountered drawbacks during the technology-transfer process that threatens the sustained existence of the Centre. Urgent actions must be taken to prevent the TAEC from collapsing and for it to continue empowering farmers to become self-reliant in food production and enhance economic growth in their communities. First, the TAEC’s management team should prepare a report for the appropriate government authorities informing them of the Centre’s situation and the need for direct government intervention. Second, staff of the TAEC and its stakeholders should prepare a funding proposal for potential donors as a way of raising funds to revitalize the Centre. Third, an advisory or advocacy board, comprised of farmers, community leaders, and policymakers, should be formed to provide guidance, expertise, and consultation in examining and understanding the causes of the current state of affairs and make recommendations regarding policies and practices aimed at reinvigorating the TAEC.

References


Blurring Cultural Boundary between Scientists and Farmers in the Philippines
Through a Mediated Bilateral Model

Eric P. Palacpac
Philippine Carabao Center
ericclap@gmail.com

Abstract

A model utilizing a science-society communication framework was developed to analyze through a case study approach the innovation transmission and adoption mechanisms under the dairy buffalo project being implemented by the Philippine Carabao Centre (PCC) in the province of Nueva Ecija. Called a “Mediated Bilateral Model,” Center it first depicted the unique features of cultural spaces occupied by the farmers, the PCC scientists, and the PCC field technicians. The basic distinguishing feature is the “scripts” of the interacting actors, which constitute the contexts in which their meaning-making and decision-making activities take place. These contextual factors contribute to the shaping of the actors’ distinct frames of reference, which influence their viewpoints or how they interpret meanings. Unmediated and unilateral performance of scripts by scientists was evident in the introductory Technical Training sessions given to farmers. This has resulted in boundary demarcation and in low or non-adoption of particular innovations. Boundary blurring was made possible through a mediated performance of scientific scripts whereby the field technicians, as hybrid actors, engaged in negotiations with the farmers during field visits. These were anchored on joint inscriptions of scientific and farmers’ cultural scripts to what become “interface instruments”, which resulted in integrative agreements regarding the performance or adoption of specific innovations.

Key Words: boundary, script, communication, negotiation, buffalo, adoption of innovation
**Introduction and Conceptual Framework**

The agricultural sector in the Philippines is a significant contributor to its economy and has continued providing employment for millions of its people. Its improvement relies on the application of science and technology through the government’s research and development (R&D) programmes. However, the success of agricultural R&D in the country leaves much to be desired. Medrano (2003) argued that Filipino scientists have generated a number of potentially significant agricultural technologies but these have not effectively reached the farmers. Even if they did, the role of farmers is limited to being passive recipients of these innovations. Worst still, many technologies are not adopted at all. Such are indications of a troubled relationship owing to the fact that scientists and farmers belong to two incongruent worlds, surrounded and protected by a socio-cultural boundary that stabilizes their respective attributes. Misunderstandings are thus common occurrences during their intersection.

Although sociological studies have paid great attention to the characteristics of potentially adopting farmers and flows of information to them, their influence peaked as long ago as the 1960s, suffering from an over-emphasis on empirical case studies and exploratory regression analysis, to the detriment of formal models with good explanatory power (Ruttan, 1996). Economic models have become increasingly dominant, but suffer from a supply-side focus which treats farmers as passive participants (Marra, Pannell, & Abadi Ghadim, 2003). The need for new analytical approaches has recently been recognised, for example, by the construction of a comprehensive model that attempts to combine the best of the sociological and economic approaches (Abadi Ghadim & Pannell, 1999).

This paper takes an entirely new approach to the problem, by applying and extending the fruits of the recent upsurge of research into science-society communication, thereby advancing both fields. It proposes a Mediated Bilateral Model in portraying and analyzing how boundary negotiation is carried out in ways that go beyond traditional adoption and extension approaches. It initially described the main elements of the model followed by its application to a case study in the Philippines, i.e., the dairy buffalo project being implemented by the Philippine Carabao Centre (PCC), a government agency attached to the Department of Agriculture.

**Actors and their Cultural Spaces**

The basic problem of agricultural extension is represented here by a Mediated Bilateral Model involving a scientist and a farmer, with the possibility of “intermediaries” represented by extension agents. By involving two actors, and two-way communication between them, the model represents an alternative to the comprehensive adoption model of Abadi Ghadim and Pannell (1999) in overcoming the limitations of economic models, which focus on scientists and technologies, and sociological models, which focus on farmers and communication but are insufficiently rigorous.

The scientists and farmers are conceived here in a generic manner, which provides a far more sophisticated portrait of farmers, in particular, compared with previous ones that focused only on their human capital (Schultz, 1975) or perceptions of profitability and risk (Just & Zilberman, 1983).

Both scientists and farmers occupy a distinct societal or cultural space. In other words, they are “situated agents” (Scoones & Thompson, 1994). They are “agents” as they are actively engaged in generating, acquiring, and classifying knowledge. Also, their activities are “situated” as these take place in specific contexts, which, in turn,
characterize their respective cultural spaces. In emphasizing the contextuality and distinctiveness of these cultural spaces, the current model nonetheless pursues the idea that cultural boundaries are malleable.

**The Boundary between Science and Society**

While Gieryn (1999) argued that maintaining the boundary between scientific space and societal space is essential for maintaining the integrity of the former, in this new model, this requirement is extended to other social groups, too, so that science no longer has a privileged position. In short, farmers, like scientists, can also perform “boundary work”. The new model thus transcends the dichotomy of demarcated and blurred boundary models of Felt (2003) and Nowotny (1993), respectively. These are insufficiently nuanced to describe reality, too limited even when judged on their own terms, and generally take too much for granted. In this model, the character of the interface is, like all other aspects of relationship among the actors involved, open for negotiation and change.

**Communication and Negotiations across the Boundary**

Communication between scientists and farmers is viewed in this model as a two-way, negotiated process. For too long, science-society communication and adoption of agricultural technology have been viewed as a one-way process that relies on educating a scientifically illiterate public (Russell, Ison, Gamble, & Williams, 1989; Nowotny, 1993). This orientation still persists in some economic models, and models of communication from scientists to society, but fortunately has disappeared in others (e.g., Cash, Clark, Alcock, Dickson, Eckley, Guston, Jager, & Mitchell, 2003; Halfmann, 2003).

Negotiation is premised on the assumption that farmers and scientists have divergent interests and perceptions as influenced by their differing scripts. “Scripts” are the distinctive behavioural patterns and cultural models that became internalized and as such commonly observed or shared by or among actors in a cultural space (Silvasti, 2003). In other words, “scripts” represent the “standard operating procedures” (Dougherty, 2002) akin to “rules of the games” or mental maps that direct the individuals on how to “feel, think, and behave in particular situations” (Wiederman, 2005, p. 496). Scripts, as reinforced by values, beliefs, capital, previous experiences, and anticipation of future events constitute the “frame of reference” of each actor.

As an illustration, the scientist’s frame about agriculture is “out of time” as they conduct their activities under experimental controls in which temporal and spatial realities are “frozen” (Richards, 1993). For scientists, what matters is “replication and comparison” for validating their theories and for fulfilling the expectations of their peers (e.g., publication of a scholarly research). In contrast, the frames and practices of farmers are deeply “embedded in particular agro-ecological and socio-cultural contexts” (Scoones & Thompson, 1994, p. 20). For them, what matters is how to fit optimally the available resources and innovations to actual and ever changing circumstances in the farm.

The different interpretations of meanings of an agricultural innovation as may be influenced by varying frames of reference resonate with one of the important elements of social constructivism, namely, “interpretative flexibility” (Pinch & Bijker, 1987). But prior to the meaning of an innovation being stabilized, the divergence in meaning interpretations by farmers and scientists could spawn misunderstandings or conflicts when they interact. Likewise, both actors could engage in strategic actions reflected in terms of adopting certain “modes” or “styles” in relation to conflict situations. These could be in the forms of avoidance, competition, compromise,
accommodation, or collaboration (Tubbs & Moss, 2003).

While farmers and scientists may adopt one or combination of such “styles”, the current model builds more on the concept of “negotiation” as a strategy in dealing with conflict situations. “Negotiation” is a joint decision-making process, combining “the conflicting points of view into a single decision” (Zartman, 1978, p. 70). Viewed this way, “collaboration” could be an aim or an outcome of negotiation. To achieve its purpose, negotiation necessitates a “reframing” process whereby disputing actors develop a “new way of interpreting or understanding” the conflict situation and a “new way of appraising” the other party in such a situation (Gray, 2003, p. 32). In essence, reframing assumes that the frames of actors, while important in providing the context for their interpretations of meanings, are not fixed and hence can be challenged by other viewpoints (Weber & Word, 2001). It aims ultimately to evolve a common frame of reference that will be shared by the negotiating actors.

Besides settlement of possible disputes, negotiation involves making deals which provide opportunities for joint benefits or gains. In other words, it is a “zero-plus” game where the scientist and the farmer jointly create strategies to “enlarge the pie” towards achieving “win-win” situations (Raiffa, Richardson, & Metcalfe, 2002). The surplus value that was jointly created in integrative negotiations is more advantageous than the outcomes achieved in distributive negotiations or those pursued by either actor in isolation (Kickert & Koppenjan, 1997).

The nature of the scripts will be a main subject of negotiation between the two actors as they are expressions of their cultural spaces. This joint inscription model challenges the basis of “standardized packages” (Fujimura, 1992) and cognitive deficit model that have held sway in science communication studies for too long (Ziman, 1992). It also represents an advance over the lay-expertise model (Gregory & Miller, 1998), which can be criticized as privileging local knowledge over science (Lewenstein, 2003) and for being too applied in focus.

The meaning of “interface instrument”, the term used here in lieu of standardized package and in emphasizing joint inscription, is determined directly by scientists and farmers through negotiation. For an effective negotiation to take place, scientists and farmers are assumed to have adequate “cultural literacy” (Schirato & Yell, 2000) about each other’s scripts. Familiarities in both scripts imply that “blurring” of socio-cultural boundaries can occur both ways, i.e., when scientists communicate to farmers and when farmers communicate to scientists. Both scripts inscribed in the interface instruments are considered parts of interpretative backdrops of effective scientist-farmer communication. Conversely, lack of mutual cultural literacy results in ineffective negotiations and adoption.

The Role of Intermediaries

While negotiation between scientists and farmers can possibly proceed in a direct manner, the new model recognizes that these two actors are heterophilous individuals (Rogers, 2002). As a result, scientists may have inadequate cultural literacy in relation to the scripts of farmers, and vice versa. Negotiations premised on lack of mutual cultural literacy demarcates rather than blurs boundaries. More significantly, reframing can be a difficult process if left to the two actors alone. As such, the role of intermediaries is crucial in mediating the negotiation process. Intermediaries are individuals who sit between two divergent worlds and are familiar with the scripts of both worlds. They can be classified as “hybrid actors” in that they have acquired or developed adequate cultural literacy in both science and farming and can facilitate
meaningful negotiation between the two distinct cultures.

By incorporating intermediary actors, the model fills in the gap associated with the neglect of conceptualization of agricultural extension agents (Fulton, Fulton, Tabart, Ball, Champion, Weatherly, & Heinjus, 2003). While the latter have been traditionally regarded as the main intermediaries in agricultural extension, their role has been previously limited by the one-way paradigm, i.e., as carriers of pre-packaged information or innovations from the scientists to the farmers. In contrast, the new model considers the intermediaries as boundary-spanning individuals who can negotiate meanings and nurture mutual understanding between the scientists and the farmers. They convey contextual information in both directions, fulfilling the roles of communication, translation, and mediation identified as necessary for a two-way “boundary management” by Cash et al. (2003).

The interface instrument is the product of this meaningful negotiation and at the same time the means utilized by the intermediaries to facilitate communication between the two actors. In fulfilling their roles, the intermediaries are also portrayed in a more active way. Instead of just being neutral actors facilitating the communication process, they help in framing and reframing the issues for the two interacting actors towards win-win situations or resolution of possible conflicts (Gray, 2003). Likewise, they possess certain attributes and resources that allow them to also engage in strategic actions required in forging sustainable agreements (Leeuwis, 2000). Ultimately, what is negotiated among the various actors in agricultural extension, and other instances of science-society communication, is “meaning” (Felt, 2003). This implies that offering a “single statement of fact” to actors which hold varying frames will be inadequate as it will likely elicit questions and qualifications (Weber & Word, 2001, p. 493).

**Statement of the Problem**

The main premise of this paper is that direct communication between scientists and farmers is often ineffective, leading to limited or non-adoptions of agricultural innovations. How then can this concern be addressed?

**Purpose**

This paper aims to offer explanations as to how intermediaries facilitate communicative processes towards improved transmission and adoption of agricultural innovations.

**Objectives**

1. Gain new insights into the adoption of agricultural innovations by interpreting it within the framework of science-society communication;
2. Devise a conceptual model of the adoption of agricultural innovation using a science-society communication methodology; and
3. Test the model in the Philippines by using it to interpret the effectiveness of innovation adoption as may be influenced by two-way communication and by the degree to which it represents a negotiation of contextual meaning.

**Methods**

The empirical evidences or application of the Mediated Bilateral Model were derived from a fieldwork conducted by the author in the province of Nueva Ecija, Philippines from July 2007 to February 2008. A case study approach was applied, utilizing mostly qualitative data from direct observations and face-to-face individual interviews with sample informants of farmers (N=38), PCC scientists (N=5), and PCC field technicians (N=4) who are
involved in a dairy buffalo project introduced by the PCC in the province.

Results and Discussions

Actors and Scripts

The farmer-informants are situated in a cultural space characterized by constant struggle and uncertainties towards earning a livelihood, which is constrained by limited resources and other external conditions in the farm. Their scripts are manifested through the “traditional” and mostly “unwritten” rules and conventions governing smallholder crop and livestock production including access to and optimization of all possible resources and support services. These scripts are reinforced by values and beliefs that they associate with farming, which they consider not only a source of livelihood but “a way of life”. While some of them have earned higher education, their human capital is largely informed by practical experience, gained from many years of tending the soil and as handed down, through an oral culture, by their parents who are farmers themselves.

Unlike the farmers, the PCC scientists are in a cultural space that allows for a regular source of income (salary) and additional benefits, as guaranteed by their civil service eligibilities and security of tenure. They are housed in modern buildings and provided with material resources to facilitate the performance of their jobs. However, they also thrive on the rudiments of a bureaucratic organization. Thus, they are bound to observe “formal” or “written” scripts in performing both scientific and administrative tasks. As scientists, they perform their jobs objectively as prescribed by the “scientific method”, their technical backgrounds, and their terms of reference. Their human capital is largely theoretical in nature, i.e., rooted in higher levels of formal education in their respective disciplines. The application of their theoretical knowledge, however, is generally confined to controlled conditions in experimental farms or laboratories as they seldom go out and interact with the farmers.

While sharing the same “physical” space with the scientists, the field technicians (FTs) of PCC are “hybrid” actors as they are “culturally” situated at the “interface” of science and farming. Thus, while they may be governed by the same scripts and share the same material resources with the scientists, they have also developed adequate levels of literacy about the scripts of the farmers brought about by their frequent interactions with them. Their human capital is therefore a mixture of theoretical and practical knowledge on the scripts of both cultural spaces.

Non-Mediated Performance of Scientific Scripts

Content of Technical Trainings by Scientists. As one of the requirements of the dairy buffalo project, farmers participate in formal Technical Trainings on improved practices in animal feeding, health, and reproduction prior to the awarding of the buffalo as a “soft loan”. These training sessions, which are free of charge, serve as the main interface between farmers and PCC scientists. A typical session runs for two days and is held at one of the lecture rooms of the PCC headquarters. It has a classic “teacher-student” set-up, i.e., the PCC scientists stand in front of the farmer-trainees and deliver one to two-hour lectures utilizing Power Point presentations. Practical sessions or technology demos, when applicable, sometimes accompany the formal lectures.

Dominant-Passive Communication in Technical Trainings. Since most farmers only know about raising native carabaos for farm work, the training session is a venue where the scientists impart new information about a different type of buffalo that requires a different type of husbandry practices. Yet, it also allows the scientists to assert their expertise on a particular topic,
i.e., their scientific script, by showing and justifying to the farmers that a certain innovation or technology works, theoretically speaking, with support from their on-station experience or research findings. Thus, the training session is a venue for a direct manifestation of usually uncontested “boundary work” (Gieryn, 1999) by the PCC scientists. In such a situation, there is no “negotiation of meaning” because of the unidirectional flow of information from the scientists to the farmers. As a result, the cultural boundary of the scientists, as “knowledge experts”, is demarcated further.

Nonetheless, the farmers did not mention any conflict with the scientists during the sessions. This is rooted in their high levels of trust and regard to the PCC scientists. Many of them also stated, “The scientists will not teach something that is wrong or detrimental to their welfare.” Such passive behavior of farmers also demonstrates a natural inclination of a “guest” to behave in accordance with the culture or standards of a “host” in the process of acculturation. It is also uncommon for the farmers to contest what the scientists are saying during the lectures as they themselves acknowledged that scientists occupy a “higher knowledge plane”. Such a scenario could also be indicative of “accommodation” (Tubbs & Moss, 2003), a mode adopted by the farmers in managing their relationship with the scientists. By “giving in” to what the scientists say in the lectures, the farmers contribute to a “smooth flow” of lecture presentations. Yet, it does not strengthen the relationship and instead contributes to the creation of a boundary between the two actors.

More importantly, while the farmers may attend the training sessions with a genuine intention of learning something new, they are also there to fulfill an obligation and at the same time pursue a major purpose, i.e., to obtain a dairy buffalo from the PCC. Thus, such encounters could also be manifestations of personal interests from both actors, dictated or influenced by their respective scripts. While scientists may utilize the sessions as a platform to assert their scientific script by selling the idea of improved practices in dairy buffalo, the farmers are satisfying their own cultural script, i.e., maximizing all available resources for farm survival and for increasing income by acquiring the buffalo.

**Mediated Performance of Scientific Scripts**

**Two-Way Communications between FTs and Farmers.**

Communications between FTs and farmers are entirely different in character from those with scientists. They are bidirectional instead of unidirectional, the farmers are active instead of passive, and the two actors negotiate with one another. This results in a mediated performance of scientific scripts, which enables farmers to add their cultural scripts to the final interface instrument.

The FTs visit the farmers to provide extension services and “field coaching”. These visits, done almost daily from 1999 to 2006, allowed the FTs to be acquainted with the scripts of the farmers. As an outcome of these frequent visits and interaction, the farmers became very comfortable with the FTs, treating them not as visitors but as close colleagues. There is a visible camaraderie between the two types of actor, e.g., they would often exchange “light talks” even when discussing problems about the buffalos. Thus, the FTs depart from the traditional portrayal of an agricultural extensionist who conducts field visits just to “deliver pre-packaged technologies” to the farmers.

It is not surprising that the FTs are the first people that farmers look for and consult with when they visit the PCC. At times, they also ask the FTs to accompany them when they like to consult with a particular scientist, as they are apprehensive
to do so directly, and expect the FTs to mediate on their behalf. This the FTs can do because they can speak the “language” of both actors.

The FTs have now become lecturers in the Technical Trainings, too. Initially, they only acted as support staff but they soon began to give talks themselves. These elicit active participation from farmers because the FTs know almost every farmer, and are familiar with their “language” and farm situations. They often inject humor into their presentations by using anecdotes, which they know the farmers can relate to. In contrast, when scientists “take the stage”, their lectures are more formal and the audience more subdued. Some scientists routinely ask FTs to act as facilitators to put a particular point across because they “connect” more easily with farmers.

**Delivered Innovations.** During their field visits, the FTs are expected to follow through with farmers the implementation of innovations to which they were introduced in the training sessions. Some of these innovations are “delivered”, e.g., animal health services such as vaccination and vitamin administration, as these do not require much activity on the part of the farmers, other than helping in restraining the animals. As a result, practically all the farmer-informants are “adopting” these innovations.

**Negotiations.** What FTs actually do in the case of other innovations, however, is to engage in negotiations to adapt the said innovations to field conditions. As an example, in feeding management, the script of the scientists requires keeping the dairy buffalo under complete confinement and feeding it with “cut-and-carried” grasses, a practice called “zero grazing” or “stall feeding”. Knowing that farmers have limited landholding, this does away with helping in restraining the animals. As a result, practically all the farmer-informants are “adopting” these innovations.

Grasses like Napier and forage corn, which contain more dry matter than native grasses. Because of the minimal movement while on confinement, the animal is expected to conserve its energy and use it for milk production. Feeding with legumes, concentrates, and mineral supplements are also recommended.

Instead of doing this feeding practice, the FTs discovered that farmers were bringing buffalos to a communal pasture at certain times of the day, and tethering them so they would graze in a particular area, just as they used to do with native buffalos in the past. The animal is then confined and handfed with Napier, mixed forages (native grasses, weeds, shrubs), or rice straw. Thus, the farmers are practicing their script on semi-intensive feeding using locally available feed resources instead of the more intensive feeding that was recommended.

The response of the FTs was to let the farmers continue this practice, in return for their agreement that the buffalo be dewormed regularly, as it can be infested with helminths while grazing in the field. Farmers have to sacrifice a little for this. They need to pay for the anthelmintics. There is also a withdrawal period, i.e., the farmers must discard the milk from the dewormed buffalo for three consecutive days for safety reasons. Because this deprives them of income from milk for three days, a few farmers refused to let their buffalos be dewormed, but the majority recognized the long-term benefits of deworming and agreed. It is therefore now part of the regular routine of the FTs to deworm buffalos every three months.

Another example is in the area of reproduction management. Proper and early detection of heat, i.e., a period when animals are sexually receptive, facilitates the matter. Simple heat detection practices include looking for physical and behavioral signs exhibited by the buffalo, e.g., clear, mucous discharge from its reproductive organ, loss
of appetite, and uneasiness. In-heat buffalos are bred via artificial insemination (A.I.) by a skilled technician. It offers many advantages, e.g., allows the use of semen from superior bulls, permits the insemination of more buffalos, prevents the spread of reproductive diseases as the semen is pre-evaluated in the laboratory, among others.

Adoption of A.I. is only about 65%. Other farmers prefer natural mating as it has a relatively higher success rate. Recognizing the advantages and disadvantages of both approaches, the FTs negotiated with the farmers a revised arrangement whereby they utilize A.I. first but if the buffalos do not get pregnant after three successive inseminations, they will use a bull for natural mating. This “clean-up bull” is made available via the PCC’s Bull Loan Program. To increase efficiency, the FTs and farmers agreed to establish a “night corral”, wherein a breeding bull and female buffalos are put together overnight. This has resulted in a high conception rate.

The FTs provided feedbacks to the scientists about the foregoing field circumstances and agreements. In response, the scientist supported the joint decisions made and adjusted the contents of their subsequent lectures accordingly.

The “negotiated” practices on feeding management and reproduction management serve as interface instruments toward the coordination of activities of the two divergent actors. “Coordination” in this case represents the other type of “boundary work” that departs from “demarcation” (Halffman, 2003).

Conclusions

The Mediated Bilateral Model offers a novel way of portraying and interpreting the dynamics of transmission and adoption of agricultural innovations. It differs from the existing boundary-organization model (Guston, 2001) in allowing scientists to communicate with farmers both directly and indirectly, via intermediary actors, in this case, the FTs. In both routes, farmers have potential to offer feedback, as in the boundary-organization model. Yet only the mediated route offers the possibility of negotiations, with intermediaries. This research shows that farmers are merely passive recipients of scientific scripts on the direct route from scientists during the formal lectures. However, they also performed their own version of “boundary work” when they resorted to their traditional scripts in raising buffalos. Nonetheless, on the indirect route, they can actively negotiate with intermediaries a mixture of scientific scripts and their own scripts which is more meaningful to them and which they are happy to incorporate into their livelihoods. The feedback from intermediaries to scientists can also cause the latter to change their own scripts.

A further advance in the Mediated Bilateral Model is that, in contrast to the boundary-organization model in which the scripts transferred and translated from scientists to end-users are purely textual, in the new model they can include “performed scripts”, too. Scientists have their own performed scripts, in the lectures, which they deliver to farmers. Meanwhile, the farmers are expected to translate these into daily actions, which in this case, refer to how they raise their dairy buffalos.

Successful negotiations and actual performance of joint agreements among the farmers, the FTs, and the scientists are manifestations of blurring of cultural boundary that initially separated them. The processes involved are iterative because of the tendency of some actors to deviate from the joint agreement.

References


Silvasti, T. (2003). The cultural model of the “Good Farmer” and the environmental question in Finland. Agriculture and Human Values, 20, 143-150.


Recommended Competencies Needed for Teaching in International Extension Settings

Robert Strong  
Texas A&M University  
r-strong@tamu.edu

Amy Harder  
University of Florida  
amharder@ufl.edu

Abstract

Agricultural extension plays a significant role in the global production and supply of food. A problem with extension services in developing countries is the lack of an adequate balance between the technical and professional competencies of personnel. The purpose of this study was to explore the professional competencies needed by U.S. extension agents to teach adults in international settings. The conceptual framework for this study was constructed on the knowledge domains that doctoral students should acquire before teaching internationally. Twelve internationally experienced U.S. extension agents were purposively selected to participate in the study based on their regional supervisor’s recommendation of program excellence. Change strategies, program evaluation methods, learning principles, and organizational development were identified by the agents as professional competencies needed before teaching internationally. Extension administrators and professional development specialists should ensure mechanisms are in place for current and future agricultural extension agents to acquire these competencies. U.S. agricultural extension agents could be mentored by agents proficient in the identified professional competencies before teaching globally. Enrolling in a doctoral program is an avenue for extension agents to acquire the professional competencies associated with teaching adults in international settings. Preparing current and future U.S. extension agents in the identified professional competencies could enhance global agricultural extension programs.

Keywords: professional competencies, agricultural extension agents, professional development
Introduction

Agricultural extension’s goals play an integral part in global food safety and production (Sundermeier, 2006). Educating farmers is the most important aspect of an extension agent’s responsibilities in international environments (Tladi, 2004). Extension personnel are needed in developing countries in order to provide information to increase crop production via training and educational programs (Jiggins, Samanta, & Olawoye, 1996). From a humanitarian perspective, extension agents should consider teaching internationally because “extension services have the potential to improve agricultural productivity and increase farmers’ incomes, especially in developing economies where more than 90 percent of the world’s nearly one million extension personnel are located,” (Anderson & Feder, 2004, p. 41). Benefits for extension agents include opportunities for careers and experiences abroad, gaining ideas from other systems, and an increased ability to educate clients on international concerns (Blake, 2005).

Shinn et al. (2009) said “international agricultural and extension education is intended to develop agricultural leadership and to help people to identify and use knowledge to help themselves” (p. 83). Highly competent extension personnel produce positive results from consumers of extension information. Clients may increase adoption rates when extension personnel provide practical information, utilize adequate technology, and give sound advice.

Etling and Radhakrishna (1998) indicated extension in developing countries struggle with a lack of balance between the technical and professional competencies of personnel. The failure to cultivate professional competencies in extension agents is a weakness of extension systems in developing countries (Pezeshki-Raad, Yoder, & Diamond, 1994). One solution for bridging the gap while developing countries work to build the capacity of their own extension personnel is utilized by such organizations as ACDI/VOCA, USAID, and USDA to bring in experienced extension professionals from established systems, like in the United States. For this system to be beneficial, the visiting U.S. extension professionals must be prepared to teach internationally.

According to Ludwig (1999), enthusiastic extension workers that have global knowledge and technical skills are well suited to effectively spread knowledge internationally. Extension agents must be knowledgeable about the specific culture and social norms of the people with whom they work. Harder, Place, and Sheer (2010) identified cultural sensitivity as a core professional competency needed in entry-level extension educators. There is a positive correlation between cultural competency and the effectiveness of education programs (Tiraieyari, 2009). Despite the general support for cultural competency, further research is needed to generalize the agricultural and extension education professional competencies needed to teach cross-culturally (Lindner, Dooley, & Wingenbach, 2003).

According to Seivers, Graham, and Conklin (2007), extension agent is the term used to identify county extension professionals in the U.S. Literature has linked reasons associated with individual and organizational improvement when extension agents participate in teaching experiences globally. Selby et al. (2005) indicated U.S. extension agents may gain from the educational experience of global teaching opportunities, learn new markets for agribusinesses, and how better to sustain environmental resources. U.S. Extension should continue to broaden its influential capacity in global communities in order to be a successful organization in the future (Bates, 2006).
Conceptual Framework

There is a lack of information available on the competencies needed by U.S. extension professionals wishing to work internationally. However, Shinn et al. (2009) identified the knowledge domains that agricultural and extension education doctoral students should acquire before teaching in international settings. Shinn et al. used the Delphi method to examine a panel of 15 international scholars’ beliefs of the knowledge domains needed in international agricultural and extension education. The Delphi technique is a method to collect data from respondents in a discipline of expertise (Hsu & Sanford, 2007).

Respondents representing five United Nations Regions provided the researchers with 126 knowledge objects for doctoral students studying international agricultural and extension education. Shinn et al. (2009) utilized literature and common principles to categorize the 126 knowledge objects into 12 exclusive knowledge domains. Doctoral students need competencies such as agricultural/rural development; agricultural/biophysical systems; change and technology adoption; delivery strategies; human resource development; instructional design/curriculum development; learning theory; organizational development; philosophy, history, and policy planning; needs assessment; evaluation; research methods and tools; and scholarship and communications in order to teach in international settings (Shinn et al.).

The knowledge domains identified by Shinn et al. (2009) formed the conceptual framework that guided the research questions to determine the knowledge domains that U.S. extension professionals should possess to teach agricultural extension education programs internationally. Figure 1 illustrates the knowledge domains identified by Shinn et al.

![Diagram of knowledge domains](image)

**Figure 1.** Shinn et al.’s (2009) conceptual framework of knowledge domains needed in agricultural and extension education.
Purpose and Objectives

The purpose of this study was to explore the professional competencies needed by U.S. extension agents to teach adults in international settings. More specifically, the study’s objectives were to: (a) describe the professional competencies that agricultural extension agents should possess prior to teaching adults globally, and (b) describe the professional competencies that combine to form knowledge domains of agricultural extension agents as global nonformal educators.

Methods

A fundamental qualitative research design (Dooley, 2007) was implemented for this study. Twelve agricultural extension agents with previous experience teaching agricultural and extension education in international settings were purposively recommended as participants to the researchers by their Florida District Extension Director. Purposeful sampling enables the researcher to amplify the capacity of data achieved from the context (Lincoln & Guba, 1985). Seven of the respondents were women and five respondents were men. Five of the respondents were environmental horticulturalists, three worked primarily with livestock programs, and three agents were responsible for small fruit and vegetable programs. Names were altered to address confidentiality of respondents (Denzin & Lincoln, 2008).

A semi-structured interview guide was utilized to convey the research questions to the participants (Denzin & Lincoln, 2008). The semi-structured interview provided opportunities for participants to explore their thoughts and responses to the research questions. This type of semi-structure uncovers participants’ reactions to the broader issues raised by the researcher (Lincoln & Guba, 1985). The interviews were conducted between January and March 2010 and lasted approximately sixty minutes each. Interviews took place at regional county extension offices near each participant’s location. Data from the interviews were recorded on audio recorders and hand written notes.

Dooley (2007) identified trustworthiness as the level of confidence that the findings represent the respondents and context of the study. Addressing trustworthiness gives the data credibility, generalizability, dependability, transferability, and confirmability to the population and study’s context (Lincoln & Guba, 1985). Triangulation and member checks are techniques to earn trustworthiness (Dooley, 2007). The data was triangulated through Trustworthiness was achieved through triangulating the data from each of the twelve participant interviews and observations, and member checks with each participant.

Denzin and Lincoln (2008) defined member checks as the approach to summarize the information received and solicit agreement from the participants. Member checks were conducted by the researchers as each participant was emailed a transcript of their comments for verification. Each participant (n = 12) emailed their verification of the information they provided during data collection before the researchers analyzed the data.

An audit trail is a set of records from the data collection experience (Denzin & Lincoln, 2008). Lincoln and Guba (1985) indicated the benefits of an audit trail are to organize, connect, cross-reference, and assign priorities to the data. Videotapes, audio recordings, index cards, field notes, and survey results are examples of records that may be included in an audit trail (Dooley, 2007). In this study, the audit trail was composed of electronically recorded data and field notes. The researchers utilized the recorded data and field notes to consolidate, link, and designate important themes in the dataset.
The data analysis approach utilized by the researchers was the constant comparative method. The constant comparative method enables researchers to identify units of data that will construct overall categories for the distinguished themes (Glaser, 1978). Moghaddam (2006) suggested researchers using the constant comparative method may implement selective coding to analyze data. Selective coding is the process of choosing the central category and validating its association to other categories in the dataset (Glaser, 2002). Common themes and similar findings in the data were uncovered with selective coding through implementing the constant comparative method. Due to the qualitative landscape of this study, results should not be generalized beyond the population in this study.

Results

Several key findings emerged from the interviews with agricultural extension agents who had taught in international settings. Change strategies, program evaluation methods, learning principles, and understanding organizational development were identified by seasoned Florida extension agents as professional competencies that agents need before travelling abroad to educate adults. The results were separated in order to highlight each recommended competency to possess before teaching adults in international settings.

Change Strategies

Nine of the twelve participants indicated change strategies were an important professional competency for U.S. extension agents to possess when teaching globally. Nancy said, “I felt I could have done a better job in helping to change adult’s behavior.” Changing behaviors is a part of what we do as nonformal teachers.” Madeline included:

In my role as an environmental educator in Florida, I know that changing my student’s behavior is hard due to costs, perceptions, and time. I never dreamed it would have been even more difficult to do the same in Thailand. Having better relationships with opinion leaders in Thailand before arriving, would have made my job easier, as an educator, to get participants to change their behavior over the long-term. I was only there for ten days, so I know the relationship with my Thai change agents is important in hindsight. They live and work among the people every day, unlike me.

Participants indicated having a review on change strategies would have been helpful before they taught adults in international settings. Susan said, “Learning to determine if people changed their behavior was harder internationally for me.” John stated; “Having a review on how to get people to change their behavior would have been an asset for me.” Karen added:

I never really understood the barriers to implement what I was teaching to my students in Costa Rica until I got back to Florida. When my supervisor wanted me to report on my experience, the primary thing I remember was not being confident in understanding how to change my students’ behaviors in Costa Rica. The more I thought about it I evaluated my ability to change student behaviors in [County]. The conclusion I came to was I needed to learn more about
changing behaviors if I go and teach students in Costa Rica again. I hope to do it again, I loved it!

Other participants detailed their opinions of change strategies further. Scott added, “A major part of being an extension agent is getting people to change their behaviors. I believe changing farmer’s behaviors is something we should be able to do.” Jenny included, “Regardless of program, understanding how to change agriculture producers’ behaviors is an area each agent should know.” Anthony added:

I went to Haiti to teach a program about goat production. People were grateful I was there to help them. I did receive some resistance from farmers when I taught deworming and castrating goats. Leaders in the community did not want to change those current methods of goat production. After I informed them how they and their community could make more money from their goats, they became more interested in my information. Understanding and knowing how to get people to change their production methods is a challenge and should be an area of expertise that extension agents have before teaching in other countries and in their county.

Agents explained their challenges with changing participant behaviors in international settings. John stated, “Most agents have experienced difficulty in teaching producers to change their behavior. I think training and experience on changing farmer’s behaviors will help extension agents before they teach internationally.” Phillip added, “As an extension agent internationally, we have to know how to get adults to change current practices for the better. It was the primary part of my job in Costa Rica.” Connie said:

I was so excited when I got to South Africa. I wanted to do this and do that but after a couple of days I was frustrated. People in my program and the agency liaison to an extent, were resistant to spraying coffee plants for insects and diseases differently in order to avoid personal illnesses. They had been taught to spray chemicals on crops a certain way for generations. What I was presenting and demonstrating did not resonate to the extent I would have liked. I believe I could have been better prepared to teach those villagers to spray chemicals in a manner to reduce personal risk. Getting people to change is challenging but as extension professionals that is a part of our job.

Evaluating Methods

Nine extension agents indicated program evaluation methods would be a necessary professional competency to possess when teaching adults globally. Phillip noted, “I could always be better at evaluation but what little I know helped me describe my time on a grant report.” Anthony said, “I am required to report evaluations every year but a focused training on evaluation would have better prepared me before I went to India.” Nancy added, “I am so thankful I understood evaluation strategies before I went to teach outside the U.S. I could have struggled at times to interpret some of the
results of my teaching. The agency that funded my experience wanted detailed results. Evaluation is very important to understand and apply when you teach internationally. Participants explained their perceived importance of evaluating programs. Agents described their perceptions of evaluation methods further. Connie said, “In Extension, evaluations are important no matter where or who you are teaching. I think it can be more difficult in another country because once you get home you get into your daily life routine.” John included, “I cannot imagine not mentioning the word evaluation when talking about extension work.” Anthony added, I am a County Extension Director and occasionally meet with our county administrator to discuss our budget. My county administrator wanted me to report the accomplishments I had made while teaching in India. She was primarily interested because the county pays a large portion of my salary and I could have been using that time to teach local citizens. It is hard to report your accomplishments without doing an evaluation. I learned that being able to report what I had done in India was not only important to administrators at the University of Florida but also to my county administrators.

Extension agents described the value of evaluations to their professional development. Joseph added, “Evaluations help us to provide a better product to our international audience. I believe conducting evaluations of programs is major part of working internationally.” Jenny included, Providing results from evaluations is becoming more and more important these days. I do not think that will change. We should view program evaluations abroad as valuable as we do in the U.S. I know being prepared to evaluate my teaching in an international setting is very important to me as a professional and the agencies funding my time and expenses to teach adults outside of the U.S.

Other participants revealed the competency of understanding how to conduct evaluations internationally is important to the extension profession. Joseph included, “Agents should know different methods to evaluate their programs before teaching internationally.” Anthony added, “Understanding how to evaluate programs is a competency extension agents need.” Madeline said, “We need to know when new evaluation methods are available. This will keep us aware of the latest techniques to evaluate programs globally.” Phillip included, Legislators want more and more information that international educational programs are making a positive impact. The team I was a part of had to prepare a detailed written report of our accomplishments and deliver a presentation to the funding agency in D.C. Detailed evaluations are beneficial for extension agents who
conduct educational programs outside the U.S. as budgets get more restrictive. These experiences have taught me knowing evaluation methods are a competency extension agents should have to teach abroad.

Learning Principles

Eight of the twelve extension agents indicated understanding learning principles and how to apply those techniques was as a professional competency needed to teach adults globally. Phillip said, “Knowing how to teach adults differently than youth is important. Adult’s motives, experiences, and the ability to be in charge of their learning is different than youth.” Karen included, “I really enjoyed teaching adults and my experience in Costa Rica but I believe there is more I could have known about teaching them.” Overall, I could have prepared myself better as an educator before teaching abroad.” Joseph added:

I witnessed the value of understanding adult needs and how I could tailor my instruction to meet those needs. The ability to be flexible in terms of delivering content to the audience is key, and something that should be on the forefront of our minds. I think knowing how to teach adults is a foundation that should be included in each agent’s international or domestic teaching toolbox.

Agents provided their opinions regarding the usefulness of learning principles as a professional competency for international extension work. Connie said, “We do not teach internationally very long, and we have to use our time wisely. Knowing how to teach to meet adult’s needs in a short amount of time is important.” Scott included, “Adults want to know how information can help them and if they can apply it to what they do every day. Understanding how to teach adults is very important to know before going to work in an international environment.” Kristy added, “An extension agent should understand how adults learn before planning lesson plans that will be used in an international setting.” John said:

I have taught livestock production programs internationally. My audiences are adults who are concerned about how to earn more money from their animals. I try to provide practical research based information they can implement to meet their goals. Most of my audiences are full-time producers with various levels of experience in animal industries. It is important that I offer information that will directly relate to their operation and help them enhance profitability. Providing information in a way that a farmer needs is a skill educators can learn.

Other participants shared their beliefs of understanding adult learning principles is a professional competency needed by extension agents before teaching internationally. Madeline added, “Adult learning methods are important to understand to be a more effective nonformal international educator. Agents should make sure they understand those methods before teaching abroad.” Anthony said, “International environments can be diverse and challenging. The one true constant is that we are teaching adults. It is very important that agents understand how adults learn before they prepare an international teaching experience.” Susan added,
I enjoy teaching adults but it can be a challenge. Adults want to know how the content will help them better their life. There are more opportunities to impact people internationally versus what we do in Florida but we have to know how to teach adults to maximize that potential impact.

Organizational Development

Six respondents identified developing a comprehension of organizational development as a professional competency to acquire before teaching adults globally. Connie included, “One professional competency should be understanding organizational development. Agents will be more effective as educators when they comprehend the organizational development of the institution or agency involved in the collaboration.” Kristy said, “When teaching internationally, it is important to know how you plan to develop personnel within organization. You want to understand how you can help your in-country partner agency achieve their organizational goals.” Phillip added, I value my time in educating farmers and cooperatives in Costa Rica, and helping them develop the ability to be self-sustaining. A year after I went to Costa Rica, I went back to conduct a follow-up training. I received a lot of positive feedback about the gardening techniques I had taught previously. The agency I had worked with was teaching more farmers in more communities innovative approaches to gardening. My work helped the agency achieve their goal of promoting sustainable gardening practices, and further developed the ability of the agency to serve the people.

Extension agents further described their opinions of international organizational development as a professional competency needed before teaching globally. Anthony said, “I consider it a professional competency to help develop the reach of the international organization partner. This tells me my time and work was worth the effort in Haiti.” Scott included, “To me, assisting an international organization is very important because they work with locals every day. If we can help develop those organizations, they can educate more farmers with effective methods in the future.” Madeline added, Understanding how you can help develop an international organization should be a requirement of extension agents before going to teach internationally. We have a portfolio full of successful production techniques and methods, and the ability to collaborate with peers. When we work to expand the outreach of organizations on the ground, we have can affect more people within the country and the organization as a whole. My limited experiences have taught me to develop the local organizations and help them develop local farmers.

Conclusions

Change strategies, program evaluation methods, learning principles, and organizational development were identified by seasoned Florida extension agents as professional competencies that agents need before preparing to work in an international extension setting. The competencies
identified by the participants in this study were also identified in Shinn et al.’s (2009) study on competencies needed by doctoral students. The results from this study suggest the identified professional competencies (change strategies, evaluation methods, learning principles, and organizational development) are important characteristics needed by U.S. extension agents in order to teach adults globally. The four knowledge domains identified in this study for U.S. extension agents are consistent with four of the twelve knowledge domains found in the conceptual framework by Shinn et al. for doctoral students. Although the qualitative nature of this study prevents the results from being generalized, they do help to validate the importance of the competencies identified by Shinn et al.

**Recommendations & Implications**

U.S. extension agents wishing to work internationally may find it beneficial to enhance their competencies in the areas of change strategies, learning principles, evaluation methods, and organizational development before teaching in international settings in order to be the most effective adult educators. Training programs and field work could be enhanced if individuals develop these skill sets and competencies. The competencies identified in this study could be acquired from a formal class on each of the competencies or professional development training regarding each of the competencies.

Finding a mentor who has worked internationally and is proficient in the identified professional competencies is recommended before agents teach globally. Mentoring can provide less seasoned extension agents support in situations not yet experienced (Kutilek & Earnest, 2001). Place and Bailey (2010) indicated extension mentors assisted mentees in becoming successful extension agents. It seems probable that extension agents who seek to develop their professional competence prior to working internationally will be more prepared to positively impact their new global environments. Extension administrators could identify and recommend high quality extension agents with experience in teaching globally to mentor agents desiring to teach in international settings. Florida Extension has a mentoring program that could connect agents to an international teaching mentor.

Future research should examine the effect of recommended professional teaching, evaluation, behavior change and organizational development competencies in international extension settings on global food production and safety. As one of the participants shared, time is limited because U.S. extension agents do not work in international locations very long. Another participant revealed her supervisor was concerned about the time she spent teaching international audiences and not citizens in her local community. This underscores the importance of proficiently preparing U.S. extension agents to teach adults, evaluate their efforts, promote behavior change, and understand how to develop the international organization before agents leave the U.S. Developing an understanding regarding the effect of professional competencies on global food production and safety, may save international organizations and U.S. extension systems time and money and lead to the acquisition of shared goals.

The U.S. Cooperative Extension system is in a position to aid developing countries by sharing its human resources until those countries reach self-sufficiency. Preparing U.S. agents to teach internationally based on research is a positive step toward being able to enhance international extension programs. The acquisition of change strategies, evaluation methods, learning principles, and organizational development as professional competencies may help U.S. extension agents to be more effective in increasing the adoption rates of learners in international environments.
settings, and may better enable them to develop capacity within international extension systems. It should be noted that competencies identified in this study are not unique to working in international settings; they have been identified as important for U.S. extension work as well (Cooper & Graham, 2001; Harder, Place, & Scheer, 2010; Schwarz & Gibson, 2010). Training current and future U.S. extension agents in the identified professional competencies could enhance global agricultural extension programs.

References


Manuscript Submission Guidelines

The JIAEE is the official refereed journal of the Association for International Agricultural and Extension Education (AIAEE).

General Requirements
Microsoft Word files only may be submitted. All manuscripts must indicate the type of article—Feature; Tools of the Profession or Book Review—on the title page of the manuscript. All manuscripts must be submitted online at http://jiae.expressacademic.org. Manuscripts cannot be published or be under consideration for publication in another journal. The Journal of International Agricultural and Extension Education (JIAEE) follows the standards set forth in the Publication Manual of the American Psychology Association (6th ed.). Online manuscript submission guidelines are posted at http://www.aiae.org/guidelines.html. Authors must follow these formatting requirements prior to submitting manuscripts to the JIAEE.

Feature Articles
A title page with manuscript title, authors’ names, institutions, complete addresses, telephone and fax numbers, and e-mail addresses is required. The manuscript must include an Abstract (a succinct idea of the article’s content) not exceeding 250 words, followed by 5-7 Keywords (selected from a list of topics available on the submission log on page), Introduction, Theoretical/Conceptual/Operational Framework, Purpose and Objectives, Methods, Findings/Results, Conclusion, Recommendations/Implications, and References, or similar appropriate headings. There is no fee charged for submitting a feature article. Feature Articles cannot be longer than 20 double-spaced (12 point font) pages (not including the title page) with one-inch margins on all sides.

Commentary Articles (Invited only)
Commentary Article manuscripts are submitted online. A title page with manuscript title, authors’ names, institutions, complete addresses, telephone and fax numbers, and e-mail addresses is required. The article must include an Abstract not exceeding 250 words. Please include 5-7 Keywords (selected from a list of topics available on the submission log on page) to describe your manuscript. Commentary Articles should be no longer than eight double-spaced (12 point font) pages (not including the title page) with one-inch margins on all sides.

Tools of the Profession and Book Review Articles
Tools of the Profession Article manuscripts are submitted online. A title page with manuscript title, authors’ names, institutions, complete addresses, telephone and fax numbers, and e-mail addresses is required. Please include Keywords (about seven) to describe the manuscript. Tools of the Profession Articles should be no longer than four double-spaced (12 point font) pages (not including the title page) with one-inch margins on all sides.

Page Fees
There is no submission charge for the manuscript, but there will be a $10.00/publication page ($20.00 for non AIAEE members) fee assessed to the lead author if accepted for publication after the peer review process.