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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

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Abstract

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Keywords

Extension; Farming; Post-conflict; Sierra Leone; Technological Innovations

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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

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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.

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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. 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: United Nations [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 the 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. Moreover, both farmers and the TAEC's staff (i.e., "change agents"; see Rogers, 2003) had 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 instrument was 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 instrument to ensure its content validity. The instrument was 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 all 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 the 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)

	Strongly agree		Agree		Indifferent		Disagree		Strongly disagree	
Statement about Impact	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
High adoption and use of TAEC technologies	61	82.4	13	17.6	0	0.0	0	0.0	0	0.0
Greater farmer confidence	57	77.0	13	17.6	4	5.4	0	0.0	0	0.0
Increased interest of farmer to engage in farming	54	73.0	15	20.3	5	6.8	0	0.0	0	0.0
Reduced drudgery	53	71.6	17	23.0	3	4.1	1	1.4	0	0.0
More food production	51	68.9	22	29.7	0	0.0	1	1.4	0	0.0
Good farmer-TAEC relationship	51	68.9	23	31.1	0	0.0	0	0.0	0	0.0
Increased agricultural activities	46	62.2	25	33.8	2	2.7	1	1.4	0	0.0
Improved quality of production	41	55.4	25	33.8	8	10.8	0	0.0	0	0.0
Improved financial status of farmer	39	52.7	21	28.4	14	18.9	0	0.0	0	0.0

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)

	Strongly agree		Agree		Indifferent		Disagree		Strongly disagree	
Statement about Problems	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
Decreased access to loans	47	63.5	24	32.4	3	4.1	0	0.0	0	0.0
Lesser networking between farming villages	38	51.4	22	29.7	3	4.1	7	9.5	4	5.4
Lack of maintenance facilities	32	43.2	42	56.8	0	0.0	0	0.0	0	0.0
Inadequate training programs	25	33.8	31	41.9	12	16.2	4	5.4	2	2.7
Incompetent TAEC Extension agents	21	28.4	21	28.4	13	17.6	8	10.8	11	14.9
Poor financial status of farmers	18	24.3	21	28.4	7	9.5	11	14.9	17	23.0
Low income of farmers due the use of TAEC technologies	4	5.4	10	13.5	5	6.8	30	40.5	25	33.8
Inefficiency of TAEC technologies	1	1.4	0	0.0	6	8.1	31	41.9	36	48.7

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

Approximately three-fourth 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 the diffusion of 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)

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

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)

	Strongly agree		Agree		Indifferent		Disagree		Strongly disagree	
Statements about Solutions	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
Good farmer-TAEC relationship	69	93.2	5	6.8	0	0.0	0	0.0	0	0.0
Encourage greater networking between farming villages	66	89.2	8	10.8	0	0.0	0	0.0	0	0.0
Increase access to loans	59	79.7	14	18.9	1	1.4	0	0.0	0	0.0
Increase level of sensitization through education and extension programs	52	70.3	20	27.0	2	2.7	0	0.0	0	0.0
Increase the supply of TAEC technologies	49	66.2	25	33.8	0	0.0	0	0.0	0	0.0
Timely supply of TAEC technologies	47	63.5	26	35.1	1	1.4	0	0.0	0	0.0
Provide maintenance facilities for farmers	42	56.8	29	39.2	3	4.1	0	0.0	0	0.0
Reduce the cost of TAEC technologies	41	55.4	28	37.8	5	6.8	0	0.0	0	0.0
Train TAEC Extension agents	40	54.1	25	33.8	9	12.2	0	0.0	0	0.0
Provide training programs for farmers	32	43.2	25	33.8	17	23.0	0	0.0	0	0.0

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 the Ways to Improve the Centre's Technologies, Tikonko Chiefdom, Sierra Leone (*N* = 18)

	Strongly agree		Agree		Indifferent		Disagree		Strongly disagree	
Statements about Solutions	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
Improve the conditions of service for TAEC staff	18	100.0	0	0.0	0	0.0	0	0.0	0	0.0
Increase donor funding	16	88.9	2	11.1	0	0.0	0	0.0	0	0.0
Increase access to loans	15	83.3	3	16.7	0	0.0	0	0.0	0	0.0
Increase level of sensitization through education and extension programs	14	77.8	4	22.2	0	0.0	0	0.0	0	0.0
Increase the supply of raw materials	14	77.8	4	22.2	0	0.0	0	0.0	0	0.0
Good farmer-TAEC relationship	12	66.7	3	16.7	3	16.7	0	0.0	0	0.0
Increase the level of production of TAEC technologies	10	55.6	8	44.4	0	0.0	0	0.0	0	0.0
Employ additional TAEC workers	7	38.9	9	50.0	2	11.1	0	0.0	0	0.0
Train TAEC Extension agents	7	38.9	9	50.0	2	11.1	0	0.0	0	0.0
Encourage greater networking between farming villages	6	33.3	7	38.9	5	27.8	0	0.0	0	0.0

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 the adoption of TAEC's technologies. Loans may be used generally to purchase items needed for a successful farm operation such as livestock, farm equipment, feed, seed, fuel, farm 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 that 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 who

were 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 (Rogers, 2003) eventually.

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 readily accepted the TAEC's technologies, an indication that 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 widely practiced in many west African nations. This circumstance attributes 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 remains 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, brutal 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 the following 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

Creswell, J. W. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

Food and Agriculture Organization (FAO). (2010). Sierra Leone. Retrieved from http://webcache.googleusercontent.com/search?q=cache:tpkcYmCICg8J:www.fao.org/isfp/country-information/sierra-leone/ru/+FAO+Sierra+Leone+2008&cd=1&hl=en&ct=clnk&gl=us

Gordon, E. (1967). *Intermediate technology in west Africa*. World Crops for the Northern United States: World Crops, U.S.A.

Harrison, P. (1980). *The third world tomorrow*. Harmondsworth, UK: Penguin.

International Fund for Agricultural Development (IFAD). (2007, February 13). Rural poverty in Sierra Leone. *Rural Poverty Portal*. Retrieved from http://www.ruralpovertyportal.org/web/guest/country/home/tags/sierra%20leone

Jequier, N., & Blanc, G. (1983). *The world of appropriate technology*. Paris, France: Organization for Economic Cooperation and Development.

Kawa, K. (1992). *Tikonko agricultural extension centre.* Evaluation Report. Bo, Sierra Leone: Tikonko Agricultural Extension Centre.

Moriba, S. (2002). *Impact, problems, and improvement of appropriate technologies of the Tikonko agricultural extension centre.* (Unpublished master's thesis). Njala University, Bo, Sierra Leone.

Navarro., M. (2008). On the path to sustainable agricultural development: Enhancing extension agents' contribution. *The International Journal of Environmental, Cultural, Economic and Social Sustainability, 4*(3), 71-78.

Oleas, C., Dooley, K. E., Shinn, G. E., & Giusti, C. (2010). A case study of the diffusion of agricultural innovations in Chimaltenango, Guatemala. *Journal of International Agricultural and Extension Education, 17*(2), 33-44. Retrieved from http://www.aiaee.org/attachments/477_Oleas.pdf

Pineiro, M. E. (1989). *Generation and transfer of technologies for poor*