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The Role of Agriculture Training Centers in Promoting Sustainable Rural Development in Kenya

Mary Wairimu Njine*

Ministry of Agriculture Mathira East Sub County P.O Box 1 Karatina. Code 10101, Kenya

Agriculture continues to be Sub-Saharan Africa's dominant economic activity, accounting for 40% of gross domestic product (GDP), 15% of exports, and 60%-80% of employment. In Kenya, agriculture directly contributes 26% to the annual GDP and indirectly contributes another 25%. The sector accounts for 65% of Kenya's total exports and more than 70% employment in rural areas. Therefore, the agricultural sector is not only the driver of Kenya's economy, but also the means of livelihood for the majority of Kenyans. The goals for sustainable rural development in Kenya must aim at achieving food security, raised incomes, a clean environment, and lead to poverty reduction. One way to achieve sustainable development is through structural or organizational policies or actions aimed at transforming institutions towards becoming more responsive and sensitive to local needs and aspirations. The purpose of this study was to examine how Agriculture training centers ATCs have assisted in promoting sustainable rural development by disseminating information and knowledge, assisting farmers and other stakeholders in accessing farm inputs promoting public–private partnerships, and promoting climate change mitigation activities. A survey was carried out in Nyeri County by use of two structured questioners, one targeting farmers and one targeting extension agents. Results indicated that (ATCs) play a key role in disseminating knowledge, technologies, and agricultural information, as well as in linking farmers with other stakeholders in the Agricultural sector. However the ATCS should invest more in ICT infrastructure to be able to reach more farmers and stakeholders more effectively.

Key words: Agricultural training centers, sustainable development, Kenya

Introduction

Sustainable development in Kenya

Agriculture continues to be Sub-Saharan Africa's dominant economic activity, accounting for 40% of gross domestic product (GDP), 15% of exports, and 60%-80% of employment. Agriculture is the mainstay of the Kenyan economy, directly contributing 26% of annual GDP and indirectly contributing another 25%. It accounts for 65% of total exports and more than 70% of employment in rural areas (Government of Kenya, 2010). The agricultural sector is not only the driver of the Kenyan economy, but also the means of livelihood for the majority of Kenyans.

Sustainable development is defined as social and economic advancement that ensures that people live a healthy and productive life, but that does not compromise the ability of future generations to meet their own needs (WCED, 1987). The concept envisions a society in which people, especially the poor, can build a future that is more prosperous, more just, and more secure based on policies that sustain and expand the environmental resource base.

The goals for sustainable development in rural Kenya include achieving food security, raised incomes, a clean environment, and reduced poverty. To achieve these goals, local communities need assistance to change from an attitude of dependency in order to create a greater sense of dignity and self-worth. Economic sustainability depends on strengthening people's ability to identify, procure, and use available resources, whether human or material (both local and external), without creating dependency. Environmental sustainability entails the sustainable use of resources, while also de-

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* Corresponding author: Ministry of Agriculture Mathira East Sub County P.O Box 1 Karatina. Code 10101, Kenya.
Tel: +254721265872, E-mail: njinem@yahoo.com

veloping the ability to generate, exploit, and replenish resources in such a way as to ensure an adequate resource base to meet the needs of the present generation without compromising the survival of future generations. Among other issues, this includes mitigation of climate change.

One way to achieve sustainable development is through structural or organizational policies or actions aimed at transforming institutions towards becoming more responsive and sensitive to local needs and aspirations. These policies encourage people to deal with the root causes of problems, not just the symptoms. They include sharing information within local organizations, thereby empowering communities. Examples of information flow include sharing of technology, market information, and input sources. Organizational sustainability includes collaboration and networking to empower members of the community with contacts and linkages with others with similar goals and vision.

Agriculture training centers (ATCs) in Kenya play a key role in disseminating knowledge, technologies, and agricultural information, as well as in linking farmers with other stakeholders in the economy. ATCs are critical change agents required in transforming traditional subsistence farming to modern commercial agriculture to promote household food security, improve income, and reduce poverty. ATC frequently offer in-service training to public sector employees, training to farmers, and short courses on demand to others in the public or private sectors.

In Kenya, the Ministry of Agriculture is usually responsible for agricultural training programs. ATCs are part of extension services and operate under the National Agricultural Sector Extension Policy within the Ministry. ATCs are headed by a principal, whose deputy is the training coordinator. The principal and his or her team carry out the day-to-day activities of the ATC. Various technical committees, composed of the district specialists and other stakeholders, are chaired by district agricultural officers and oversee the implementation of programs. The training coordinator is in charge of the school and the farm manager heads the farm activities. Other staffs include an agro-processing officer, a home economics officer, a livestock officer, a crop officer, and support staff (clerks, drivers, housekeepers, etc.).

ATCs were created in Kenya in the 1950s after the launch of the Synerton plan, which called for intensification of African agriculture (MOA, 2011). These centers have played a major role in the development of both livestock and crop production in the country. Currently there are 27 ATCs located in different agro-ecological zones.

In this paper, I examine how ATCs have assisted in promoting sustainable rural development by disseminating information and knowledge, assisting farmers and other stakeholders in accessing farm inputs, assisting in the use of information and communication technologies (ICT), promoting public–private partnerships, and promoting climate change mitigation activities.

Development of public–private partnerships

Partnership and collaboration provide potential benefits for rural development. By jointly harnessing each member's respective skills, expertise, and experience, partners can accomplish more than individuals acting alone (Olala *et al*., 2010). Partnerships are built to achieve better products or similar products at a lower cost or in less time. Partnerships allow various teams to come together to address complex and difficult issues that no single organization or person can handle on their own. Such partnerships have had a high degree of success and can facilitate the uptake of new technology (Government of Kenya, 2010).

The private sector can contribute significantly to the development and growth of the agricultural sector by providing physical and social infrastructure, as well as production, processing, marketing, and financial services. For this reason, ATCs are encouraged to involve private stakeholders in some of their activities, such as in the marketing and processing of farm produce and the leasing of facilities. Other areas in which ATCs have partnered with other stakeholders include the holding of field days and the establishment of business incubation centers.

Incubation centers nurture entrepreneurs for periods varying from 6 months to 2 years by providing working space, technology and machinery, and information or training to help entrepreneurs produce various value-added products. After the incubation period expires, the entrepreneurs move to their own premises. By that time, it is assumed that they will have procured the technology and machinery required to continue production at the same or a higher scale. The incubation center concept has taken root in many East Asian countries, and centers have contributed in the

development of many entrepreneurs, especially in manufacturing and agro-processing. Incubation centers were introduced in Kenyan ATCs in 2009 with a focus on agro-processing (MOA, 2011).

ATCs also collaborate with research organizations and other stakeholders involved in technology testing and farm trials. As partnerships can be very costly if not well managed, it is important to adopt partnerships derived from best practices that deliver technology products to end users.

Knowledge, information and communication technology

Information technologies offer agricultural industries the opportunity to increase information flow to all industry participants at a decreased cost. The agricultural extension mechanism is becoming more dependent on ICT to provide appropriate and location-specific technologies for extension services and to expand the agricultural research and education system (Kashem *et al*., 2010). ICT can play a critical role in many areas, including crop forecasting, input management, command area management, catchment management, land and water resources development, natural disaster management, fisheries management, hill area development, and postharvest management (Zahedi and Zahedi, 2012).

Kenya lacks appropriate policy and infrastructure for ICT and knowledge management (Government of Kenya, 2012). Most of the available knowledge is disseminated through scientific forums such as conferences and journals, and indigenous and traditional technical knowledge is underused because of the absence of appropriate mechanisms to identify, document, protect, manage, and use knowledge effectively. The wealth of knowledge and technology in the public domain that is easily accessible through the Internet is underused. Currently, information is disseminated to end users through the conventional linear method used in extension service. This model has limitations, especially as there is only 1 extension worker for every 1000 farmers in most parts of the country.

Agricultural decisions on timely land preparation, planting, weeding, irrigation, harvesting, storage, and marketing have always been central concerns to agricultural stakeholders. The use of ICT, especially mobile telephones, can improve the way farmers in rural areas receive, exchange, and manipulate information. Although a variety of innovations that integrate ICT into the dissemination of agricultural information to farmers have been developed at local, national, and regional levels, more appropriate formats and user-friendly methods of sharing knowledge with stakeholders need to be developed.

Access to farm inputs

Higher agricultural productivity is a precondition for growth and development in most African countries, and increasing yields is the key to raising incomes in rural areas. Because of continued increases in population and land subdivision and the effects of climate change, traditional methods of farming can no longer support the population. Advanced agricultural education is needed to help farmers produce high-value crops and transform their farms to be globally competitive and more innovative. Agricultural education must also be coupled with increased availability of good-quality farm inputs. The slow growth in the use of agricultural inputs in Sub-Saharan Africa has resulted in missed opportunities to increase Africa's agricultural production, productivity, household incomes, and welfare. Fertilizer use in this area is the lowest in the world (about 93 kg/ha) at less than 10% of the global mean (IFDC, 2006).

High costs and adulteration of farm inputs have been identified as major constraints in agricultural development in Kenya (Government of Kenya, 2010). To increase agricultural productivity and improve their farming businesses, farmers must have access to inputs such as fertilizer, agrochemicals, and seeds. Annual fertilizer demand increased from 329,449 t in '2002−03' to 410,214 t in '2006−07', and production of certified seeds for various crops increased from 12,998 t in 2002 to 34,682 t in 2006. The volume of imported seed increased from 1217 t to 4773 t over the same period. These inputs are distributed through a wide range of stockers and merchants all over the country. In addition, some agricultural cooperatives and commodity boards supply inputs to their members (MOA, 2010). The use of improved seed has, however, remained low because of poor distribution systems and a monopoly of the seed supply by the Kenya Seed Company, which concentrates its operations in high-rainfall areas. The use of fertilizer is low because of its high cost, which is attributed to the high cost of transportation and the distribution system. Fertilizer use in Kenya is about one-third of the level used in India and one-quarter of the level used in Indonesia. In addition,

only about a quarter of the farmers use manure to improve soil fertility (MOA, 2012).

As a result of an increased demand for clean planting materials, ATCs have begun providing these materials, especially those not provided by seed companies. The materials include propagation materials for cassava, sweet potatoes, cowpeas, sorghum, and beans. In addition, livestock breeding is also practiced. ATCs have also been contracted to produce certified bean seed by the Kenya Seed Company.

Climate change mitigation

There is a strong scientific consensus that the global climate is changing and that human activity contributes significantly to this change. Climate change mitigation refers to efforts to reduce or prevent emission of greenhouse gases.

Current farming methods are depleting Earth's resources and producing alarming quantities of greenhouse gases. Agriculture operations currently produce 13% of human-based global greenhouse gas emissions for farmers to participate in sustainable development; they first need information about climate change and the effect of climatic fluctuations on local communities. This information should enhance farmers' ability to adopt methods and develop local actions plans that respond to and mitigate climate change. Farmers need more resilient production systems and to improve land husbandry and forestry management practices to help reduce greenhouse gas emissions. Governments and local institutions also need to increase their involvement in promoting the use of renewable energy and of technologies that minimize energy use. These efforts should result in more sustainable production, adequate and equitable food security and nutrition, and sufficient income despite climate change.

The aim of this study was to examine how ATCs have assisted in promoting sustainable rural development by disseminating information and knowledge, assisting farmers and other stakeholders in accessing farm inputs, assisting in the use of information and communication technologies (ICT), promoting public–private partnerships, and promoting climate change mitigation activities.

Materials and Methods

Study area

This study focused on Wambugu ATC, situated 5 km from Nyeri town which is at the central region of Kenya at longitude 36" east and between the equator and latitude 0.38," south. It covers an area of 50.8 ha, is at an altitude of 1761 m, and is within agro-ecological zone UM_3. The catchment areas of the ATC include all of Nyeri County, which consists of seven sub-counties covering an area of 3,337.1 km^2, and has a population of 693,558. The center also serves parts of Laikipia, Muranga, Kirinyaga and Meru Counties.

The ATC has two interdependent sections—the school and the farm. The school comprises the training facilities, including classrooms, conference rooms, hostels, a dining hall, and a kitchen. The objectives of the school are the provision of training facilities, the organization of training sessions and courses for farmers and other stakeholders, the improvement of farmers' knowledge, attitudes, and skills, and enhancement of their receptiveness to emerging skills and technologies. The ATC charges fees for accommodation, and it also receives funds from the government. The farm comprises two sections—demonstration plots of various crops and animal enterprises. The primary crop activities include providing propagation materials for potatoes, sweet potatoes, and cassava and also producing clean bean seed for distribution to farmers. Horticultural and fodder crops are also grown. Livestock include dairy cows, dairy goats, local poultry, and rabbits.

Research objectives

The overall objective of the study was to identify the ways in which the Wambugu ATC has contributed towards sustainable development in Nyeri County. Specifically, how the ATC has (1) assisted in imparting information and knowledge on sustainable development, (2) assisted in the acquisition of farm inputs, (3) promoted public–private partnerships, and (4) contributed toward climate change mitigation.

Data collection

Data were collected through the use of two structured questionnaires, one for farmers and the other for extension officers. Twenty-two extension officers and twenty farmers from all seven sub-counties were randomly selected for the survey. The extension officers assisted in administering the farmers' questionnaires which targeted the head of the household or the wife whoever was managing the farm activities in the household.

Each questionnaire was divided into 6 main areas: a

personal profile of the respondent and his or her socioeconomic status (sex, education, farm size, and main enterprises); access to information and knowledge; access to farm inputs (seeds, planting materials, and animal breeds); access to and use of ICT the presence of public–private partnerships and climate change mitigation.

Discussions were also held with the principal of the Wambugu ATC and some of the officers, including the training officer, farm manager, and agro-processing officer.

The data were analyzed using SPSS software version seven. The tests were to determine the frequencies and percentages of the various variables.

Results and Discussion

Demographic and socioeconomic data

Seventy percent of the farmers were male, and all the farmers were 41 years of age or older. Eighteen (90%) of the farmers were married. Forty-five percent had primary education while 5% had not attended school. Five (25%) had college education as their highest level of education (certificate or diploma holders), 3 (15%) had received a secondary education, 1 (5%) had a university education (holders of bachelor's degree), and 1 (5%) had some adult education. Half of the farmers had households with 3 to 5 members, 6 (30%) had 6 or more household members, and the rest had 2 members. Sixteen of the farmers' main occupation was farming, 3 had some other type of informal employment, and 1 was engaged in business (Table 1). Almost all of the farmers (19) had less than 2 ha of land, with only 1 having more than 4 ha.

Table 1. Socioeconomic data for the farmers (n=20)

Category	Frequency	Percentage
Main occupation		
Farming	16	80.0
Formal employment	3	15.0
Informal employment	0	0.0
Business	1	5.0
Farm size		
<0.2 ha	0	0.0
0.2-1.0 ha	16	80.0
<1.0-2.0 ha	3	15.0
2.0<−4.0 ha	0	0.0
>4.0 ha	1	5.0

Twelve (54.5%) of the extension staff members were male and 10 (45.5%) were female. Most of the staff members (15, 68.2%) were 41 or more years old, and the rest (7, 31.8%) were 20 to 40 years old. Most were married (18, 81.8%) and 20 (90.9%) had a college education, 2 (9.0%) staff members had a pre-college education only.

Training at the ATC

Fifteen (75%) of the farmers had attended training at Wambugu ATC at least once, 5 had attended twice and 6 had attended more than twice (Table 2). Fourteen of the farmers who attended training indicated they attended for up to 3 days and 1 for more than 3 days. Farmers had been sponsored to attend by the government (50.0%), private companies (27.8%), and NGOs (11.1%).

Farmers most commonly learned about crops (10 farmers 19.6%) and livestock (8, 15.7%) They also learned about urban and peri-urban agriculture, tree nurseries, food processing, energy conservation, and marketing. The top 2 choices in technology adoption were also crops (5 farmers, 41.7%) and livestock (3, 25.0%). Other topics were farming as a business, food processing and, energy conservation. Fifteen (100.0 %) of the farmers found the training beneficial or very beneficial to their farming activities.

Most (81.8%) of the staff had also attended training at Wambugu ATC, most commonly for 3 days and below (Table 3). The government was the most common sponsor (15 members, 78.9%) followed by private companies (2) and NGOs (2). Farming as a business was the most common subject area (6 staff, 37.5 %), followed by crops (5, 31.3%), food processing (2, 12.5%), and livestock, urban and peri-urban agriculture, and soil and water conservation (1 each, 6.3%). Sixteen of the staff found the training beneficial or very beneficial.

Access to farm inputs

Nine (47.4%) of the farmers acquired planting technologies and the same number acquired livestock technologies (Table 4). More than half of the farmers indicated that the farm inputs had assisted them to a high extent. Planting materials or seeds and cuttings were most commonly reported to be accessed (19 members, 61.3%) followed by livestock breeds (9) and tools and equipment (3).

Table 2. Farmer training at the ATC (n=15)

Category	Frequency	Percentage
Number of times attended training at Wambugu ATC		
Once	4	26.6
Twice	5	33.3
More than twice	6	40.0
Course duration		
0-3 days	14	93.3
<3-7 days	1	6.6
>7 days	0	0.0
Sponsors of the training		
Government	9	60.0
Private company	5	33.3
NGO	2	13.3
Other	2	13.3
Type of information acquired		
Crops	10	66.7
Livestock	8	53.3
Urban and peri-urban agriculture	4	26.6
Food processing	3	20.0
Farming as a business	2	13.3
Tree nursery	4	26.6
Energy conservation	3	20.0
Soil and water conservation	0	0.0
Marketing	2	13.3
Early warning on migratory pests	0	0.0
Other	0	0.0
Technology adopted		
Crops	5	33.3
Livestock	3	20.0
Food processing	1	12.0
Farming as a business	2	13.3
Energy conservation	1	6.7
Rating of the benefit of the training		
Very beneficial	9	60.0
Beneficial	6	40.0
Fairly beneficial	0	0.0
Not beneficial	0	0.0

Private-public partnerships

Ten (31.3.0%) of the farmers had interacted with government service providers, 9 (28.1%) with farm input suppliers, 5 (15.6%) with researchers, 4 (12.6%) with marketers, breeders respectively (Table 5). More than half of the farmers (66.6%) found that these interactions improved their food security and income generation to a high or extremely high extent.

Eleven (28.8%) extension staff members had interacted with government service providers through the ATC, the same number had interacted with farm input suppliers (Table 6). Seven (17.6%) interacted with marketers and breeders, and 3 (7.9%) with researchers. A large majority (83.4%) of the staff indicated that these interactions improved their work to a high or extremely high extent.

Table 3. Staff training at ATC (n=18)

Category	Frequency	Percentage
Extension staff had attended training at ATC		
Yes	18	81.8
No	4	18.2
Course duration		
0–3 days	12	66.7
<3–7 days	4	22.2
>7 days	2	11.1
Sponsors of the training		
Government	15	78.9
Private company	2	10.5
NGO	2	10.5
Other	0	0.0
Subject areas of the training*		
Crops	5	31.3
Livestock	1	6.3
Urban and peri-urban agriculture	1	6.3
Food processing	2	12.5
Farming as a business	6	37.5
Tree nursery	0	0.0
Energy conservation	0	0.0
Soil and water conservation	1	6.5
Marketing	0	0.0
Early warning on migratory pests	0	0.0
Others	0	0.0
Rating of the benefit of the training		
Very beneficial	10	55.6
Beneficial	6	33.3
Fairly beneficial	2	11.1
Not beneficial	0	0.0

Climate change mitigation

Eleven (44%) of the farmers were able to acquire information on energy conservation technologies, 7 (28%) on (improved energy-saving stove, solar energy, and biogas, and 6 (24%) on agro-forestry (Table 7). More than half (66.7%) indicated that access to the information helped them improve their livelihood to a high extent.

As did the farmers, extension staff most commonly acquired information on energy conservation technologies (14, 30.4%), followed improved energy saving stove, solar energy and biogas, and weather (12 each, 26.1%), and agro-forestry (8, 17.4%) (Table 8). Almost all (20, 90.9%) indicated that access to the information and technologies assisted them in improving their work to a high or extremely high extent.

Information communication technology

Nine (45.0%) of the farmers had not accessed information via ICT, and 8 (40.0%) had accessed information via ICT (Table 9). Of the latter, 6 (66.7%) accessed information on training, 2 (22.2%) on available technologies, and 1 (11.1%) on farm inputs.

Staff members used ICT at a higher rate (63.6%) than farmers (Table 10). Staff members most commonly accessed information on training (12, 52.1%), followed by available technologies (6, 26.1%), inputs available (4, 17.4%), and marketing (1, 4.3%).

Table 4. Access to farm inputs by farmers and Extension staff

Category	Frequency	Percentage
Types of farm inputs farmers accessed from the ATC		
Planting materials—seeds and cuttings	9	50.0
Livestock breeds	9	50.0
Tools and equipment	0	0.0
Rating of how farm inputs assisted farmers in improving their farming (n=15)		
Extremely high	0	0.0
High	11	73.3
Medium	3	20.0
Low	1	6.7
Types of farming technologies extension staff accessed		
Planting materials—seeds and cuttings	19	61.3
Livestock breeds	9	29.0
Tools and equipment	3	9.7
None	0	0.0

Table 5. Farmers' private–public partnerships (n=20)

Category	Frequency	Percentage
Stakeholders accessed by farmers through the ATC*		
Farm input suppliers	9	28.1
Government service providers	10	31.3
Marketers	4	12.5
Breeders	4	12.5
Researchers	5	15.6
Rating of how the interaction improved food security and income generation		
Extremely high	1	6.6
High	9	60.6
Medium	5	33.3
Low	0	0.0
Very low	0	0.0

Conclusions and recommendations

ATCs play multiple roles in promoting sustainable rural development, including training on various technologies related to climate change mitigation, agro-processing, and soil and water conservation. They also assist farmers by multiplying up propagation materials and breeding stock. However, ATCs need to seek more funding and to invest in ICT infrastructure to be able to reach more farmers effectively. Collaboration with private or public institutions with greater capacities in the use of ICT would be helpful to give farmers information on marketing, the availability of farm inputs, new research findings, and climate data. Because extension staff members play a major role in the dissemination of improved technologies, ATCs should also increase training for staff and farmers. As the price of inputs increases with distance to markets, and as long distances to markets disconnect villagers from the input supply chain (Chianu *et al*., 2008), ATCs should offer soil analyses facilities and improve access to affordable fertilizers by stocking government-subsidized fertilizers to reduce the barriers imposed by distance.

Table 6. Extension staff private-public partnerships (n=22)

Category	Frequency	Percentage
Stakeholders that extension staff accessed		
Farm input suppliers	11	28.2
Government service providers	11	28.2
Marketers	7	17.9
Breeders	7	17.9
Researchers	3	7.9
Rating of how the interaction improved the staff's work		
Extremely high	3	16.7
High	12	66.7
Medium	3	16.7
Low	0	0.0

Table 7. Farmers' climate change mitigation (n=20)

Category	Frequency	Percentage
Climate change mitigation information farmers accessed through the ATC		
Rainfall and temperatures	1	4.0
Agro-forestry trees	6	24
Energy conservation technologies	11	44
Improved stove, solar energy, and biogas	7	28
Rating of how access of information improved livelihoods		
Extremely high	0	0.0
High	10	66.7
Medium	4	26.7
Low	1	6.7

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Table 8. Extension staff climate change mitigation (n=22)

Category	Frequency	Percentage
Climate change mitigation information accessed by ATC staff		
Rainfall and temperatures	12	23.5
Agro-forestry trees	8	15.7
Energy conservation technologies	14	27.5
Improved stove solar energy and biogas	12	23.5
Rating of how access helped the staff improve their work		
Extremely high	8	36.4
High	12	54.5
Medium	1	4.5
Low	0	0.0
Very low	0	0.0

Table 9. Farmers' information communication technology (n=20)

Category	Frequency	Percentage
Farmers access to ATC information through ICT		
No response	3	15.0
Yes	8	40.0
No	9	45.0
Type of ATC information accessed by farmers though ICT		
Invitation to training	6	66.7
Available technologies	2	22.2
Marketing	0	0.0
Inputs available	1	11.1

Table 10. Extension staff information communication technology (n=22)

Category	Frequency	Percentage
Staff access to ATC information through ICT		
Yes	14	63.6
No	8	36.4
Type of ATC information accessed by staff though ICT		
Invitation to training	12	52.1
Available technologies	6	26.0
Marketing	1	4.3
Inputs available	4	17.4

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