ACCESS AND USE OF INFORMATION BY SMALL HOLDER TEA FARMERS IN BURETI DISTRICT, KENYA

ROSEPHY CHEPTOO KOSKEI

A Thesis Submitted to the Graduate School in Partial Fulfillment for the Requirements of the Award of a Master of Science Degree in Agricultural Information and Communication Management (AICM) of Egerton University

EGERTON UNIVERSITY

OCTOBER, 2012

DECLARATION AND RECOMMENDATION

Declaration

I hereby declare that this is my original work and has not been presented in this or any other university for the award of a degree, diploma or certificate.

Rosephy Cheptoo Koskei

KM18/2504/09

Sign: ----------

Date: ----------

Recommendation

This work has been submitted with our approval as the candidate's supervisors.

1. Dr. Isaiah Tabu, PhD (Department of Crops Horticulture and Soils, Egerton University)

Sign: ----------

Date: ----------

2. Dr. Erick Cheruiyot**,** PhD (Department of Crops Horticulture and Soils, Egerton University)

Sign: ----------

Date: ----------

COPYRIGHT

DEDICATION

To the loving memory of my late father, Mr. Peter Maritim Koskei, who passed away as I was writing this thesis.

ACKNOWLEDGEMENTS

My heartfelt gratitudes go to my supervisors, Dr Isaiah Tabu and Dr. Erick Cheruiyot for their sterling guidance and friendly support during the writing of this thesis. Their encouragement and thoughtful comments made this work a success. I also acknowledge the staff of the Department of Crops, Horticulture and Soil Sciences (CHS) and Crop Management Research Training (CMRT) for their wonderful academic support during my study.

Special thanks go to members and farmers of Kapset and Litein Tea Factories for their willingness and co-operation during data collection. I am grateful to my friends notably Oduori, Lang'at and Millicent for assisting in many ways throughout my study.

Last but not least, I extend appreciation to the Bwerere family members, relatives and colleagues for their encouragement and moral support. Most notably, I owe the greatest debt to my mother for her strong emotional and constant encouragement and, for her long patience that helped me remain focused throughout the study period.

Above all, I give glory to the Almighty God for giving me strength and endurance throughout the study period.

ABSTRACT

Tea sub-sector is Kenya's second largest foreign exchange earner after horticulture. The small holder farmers own about 80% of the land under tea but produce about 60% of made tea. These farmers realize lower yield per unit area as compared to their large scale counterparts which own about 20% of land under tea and contribute about 40% of made tea. Tea Research Foundation of Kenya in conjunction with the Ministry of Agriculture have developed several technologies aimed at improving yield and quality of tea. The technologies include high yielding clones, selective application of herbicides, insect, pest and weed control, fertilizer recommendation rates and harvesting practices. Small holder farmers however continue to realize low declining crop yields inspite of the technologies. Access to information is a potential avenue for increasing yield, but little work has been done to quantify the sources of information and how they affect yield. A study was carried out to determine access and use of information by small holder tea farmer in Bureti District, Kenya. A combination of purposive, multistage and proportionate random sampling was used to get 170 respondents for the interview. Data collected was analyzed using Statistical Package for Social Sciences (SPSS) version 15 and Heckman Selection Model. Results showed that a majority (79%) of small holder tea farmers get information from extension agents, while 12% and 9% get fellow farmers and the radio respectively Off-farm income, education level, household size, marital status and time spent to tea buying center significantly influenced access to information by small holder tea farmers. Farmers who had access to information realized a significantly higher mean tea yield (623 kg per hectare per month) compared to the non-participants who realized a mean of 414 kg. The study emphasized the need for appropriate information to reach small holder tea farmers so as to facilitate increased yield.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

ADF	African Development Fund
AKIS	Agricultural Knowledge and Information System
ASDS	Agricultural Sector Development Strategy
CBS	Central Bureau of Statistics
CIS	Commonwealth of Independent States
CPDA	Christian Partners Development Agency
EATTA	East African Tea Traders Association
EPZA	Export Processing Zones Authority
ERS	Economic Recovery Strategy
GDP	Gross Domestic Product
GoK	Government of Kenya
ICT	Information Communication Technology
KETEPA	Kenya Tea Packers limited
KG	Kilogram
KHRC	Kenya Human Rights Commission
KTDA	Kenya Tea Development Agency
LH_1	Lower Highland Zone I
MDGS	Millennium Development Goals
NTZDC	Nyayo Tea Zones Development Corporation
SRA	Strategy for Revitalization of Agriculture
TBK	Tea Board of Kenya
TRFK	Tea Research Foundation of Kenya
TRIEA	Tea Research Institute of East Africa
UM_1	Upper Midland Zone I
FFS	Farmer Field School
T&V	Training and Visit
ICT	Information Communication Technologies
IFPRI	International Food Policy Research Institute
SPSS	Statistical Package for the Social Sciences

CHAPTER ONE

INTRODUCTION

1.1 Background Information

The Agricultural sector is one of the main drivers of the economic growth in Kenya. The sector accounts directly for about 26% of the Gross Domestic Product (GDP) and indirectly to about 27% of GDP through linkages with manufacturing, distribution and service related sectors (TRFK, 2011). Agricultural products account for about 65% of the country's exports, with tea accounting for about 26% of the total export earnings. Agriculture contributes significantly to the attainment of Millennium Development Goals (MDGS) number one which aim at halving the people suffering from extreme poverty and hunger by 2015. In addition, it contributes significantly towards the economic pillar of the Kenya's Vision 2030 whose goal is achieving an average growth rate of 10% per year over the next 5 years (World Bank, 2008). Since only about 20% of the country is classified as medium to high potential agricultural land (CBS, 2007), intensification through introduction and use of improved agricultural technologies is necessary.

The tea sub-sector is Kenya's second largest foreign exchange earner after horticulture. Since its introduction in 1903, the country has increased the production from about 18,000 tons to a total of about 377,000 million tons in the year 2011 (TBK, 2012). The increase was mainly through expansion of the area under the crop (Rono and Wachira, 2005). Currently, Kenya contributes about 10% of the total world produce making it the third world tea producer after China and India (TRFK, 2011). In Kenya, the tea industry is divided into large scale estates and small holder sub-sectors (CPDA, 2008). The former is under control of big multinational companies and account for about 40% of total made tea (TRFK, 2011). The later with average holdings ranging from less than one hectare to 20 hectares, are managed by the Kenya Tea Development Authority (KTDA) through the individual tea processing factories (Mwaura and Muku, 2007). The small holder farmers own about 80% of the land under tea and produce over 60% of made tea in the country (Kinyili, 2003).

The KTDA renders managerial, production, transportation and marketing services to small scale sub-sector (CPDA, 2008). In order to smoothly function, operations are organized under different factories which involve green leaf transportation, input supply, processing and marketing of processed tea (EPZA, 2005). The KTDA manages about 422,000 growers, 53 factories, and markets the produce. Management involves supervising and advising farmers on the best husbandry practices through its extension staff, provision of inputs, collection and transportation of harvested tea to the factories, processing and marketing of the final product (CPDA, 2008). In an effort to improve efficiency, the Kenya government in 1999 liberalized the smallholder tea sub-sector by restructuring KTDA and the ownership of tea factories (Sudath, 2008). The government thus withdrew from controlling services such as extension, processing and marketing to allow the private sector to take over the restructured KTDA as a private entity (Nyangito, 2001). It was expected that the interventions would result in lower marketing margin, higher producer prices and increased productivity (Winter-Nelson and Temu, 2002).

The tea produced by the small scale farmers has four market outlets namely; Mombasa tea auction that absorbs 75% of the product, the Kenya Tea Packers limited (KETEPA) that takes 7% of the tea, direct sales to both overseas and local market that takes 15% and factory door sales that takes 3% of total produced tea. Currently, there is an emerging parallel system where farmers sell green tea leaf directly to private factories or to middlemen for immediate payments without any contractual arrangements (Kinyili, 2003).

In an attempt to maximize yield, Tea Research Foundation of Kenya (TRFK) conduct research on production based technologies (TRFK, 2011). Consequently, TRFK has developed production technologies which include high yielding clones, selective application of herbicides, fertilizer recommendations and harvesting practices. Production related information is commonly disseminated by TRFK through various publications, agricultural shows and open days (Anon, 2002). Kenya Tea Development Agency factory extension staffs also disseminate the information during their normal day to day operations. The improved technologies have increased tea yields in Kenya from an average of 1,500 kg to 2,600 kg of made tea per hectare per year on the large estates, and from an average of 600 kg to 2000 kg of made tea per hectare per year under the smallholder production system. Fertilizer application accounts for about 50% of the increases in yields (TRFK, 2011).

Transfer of improved technologies to farmers is the major challenge for both researchers and technology transfer agencies. Despite the development of appropriate production technologies, small holder tea farmers experience sub-optimal and declining crop yield (Owuor *et al.*, 2001) as compared to the large estates (TRFK, 2011). Large-scale tea growers have largely benefited from the use of the tea production technologies (Othieno, 1994). In 2010 the yield from smallholder producers stood at 2000 kg of made tea per hectare while that of large estate was 2600 kg. The difference between the two sub-sectors is mainly attributed to the adoption of improved technologies, including improved tea clones (TRFK, 2011). Owuor *et al.* (2008) noted that the low declining crop yield among small holder tea farmers is probably because the improved production technology and innovations are not reaching the farmers or that they are not being adopted. This is linked to limited access of information related to such innovations. There is therefore a major challenge to increase adoption of improved technologies so as to close the gap between research and actual farm yields.

Limited user awareness, adaptation and adoption of improved technology is generally known to affect crop yield. Kinyili (2003) noted that access to information is a potential avenue for improving yield among the small holder tea farmers. The farmer's access to information helps them to know about improved technologies and enhance the adoption of new innovations (Daberkow and McBride, 2003). Sudath (2008) noted that agricultural innovation diffusion is largely affected by information available on the innovation. Utilization of relevant, accurate and up-to-date information would therefore ensure increased productivity (Banmeke and Ajayi, 2008).

1.2 Statement of the Problem

Tea is one of the most important cash crops in Kenya. Currently, Kenya contributes to about 10% of the global tea exports. The crop is usually grown in Lower Highland Zone I (LH_1) and Upper Midland Zone I (UM_1), where the agro-ecological conditions are ideal. Appropriate technologies aimed at improving the yield and quality of processed tea have been developed by TRFK.. The yields realized by small holder tea farmers are however not consistent with the technologies. For example small holder farmers realize about 2000 kg made tea per hectare yet

clones that yield up to 4000 kg have been developed. Small scale farmers in Bureti District, one of the areas with ideal conditions, realise only about 1.2 kg per bush per year compared to a potential yield of 3 kg. In addition to the sub-optimal production, yields have also been declining. Many studies addressing the low and declining crop yield have mainly been directed towards production based innovations and little about information and communication. Access to information is one of the important prerequisites of the adoption process. It is generally known that limited use of information on technologies is among the factors that contribute to low production. Little has however been done to quantify and document how access and use of information contributes to the increased yields among small holder tea farmers.

1.3 Objectives

1.3.1 Broad Objective

To contribute to increased tea production through efficient and effective access and use of information by small holder tea farmers in Bureti District.

1.3.2 Specific Objectives

1. To identify and characterize the sources of information used by small holder tea farmers.
2. To determine the factors that affect small holder tea farmers in accessing and using information on tea production.
3. To determine the effect of access of information on tea yield among small holder tea farmers in Bureti district.

1.4 Research Questions

1. What sources do farmers use to access information on tea production?
2. What factors affect small holder tea farmers in accessing information on tea production?
3. How does access to information affect yield of tea among small holder tea farmers in Bureti district?

1.5 Justification

Kenya is one of the most important producers of high quality black tea in the world. As one of the leading cash crops in Kenya, tea makes a significant contribution to Kenya's economy. The

tea earnings accounts for 4% of the country's gross domestic product (GDP). About four million people, one tenth of the country's population rely on tea for employment (TRFK, 2005; Mwaura and Muku, 2007). Tea is a rural based enterprise, and contributes directly to the attainment of the Agricultural Sector Development Strategy (ASDS) and Kenya's Vision 2030 (TRFK, 2011).

Most of Kenyan tea is grown in the highlands West and East of the Rift Valley, at high altitudes between 1500 to 2700 meters above sea level. Bureti District is a high potential area and is one of the tea growing zones. The temperatures in the District range from about 18^0C to 20^0C and rainfall between 1,700 mm and 2,020 mm per annum (Bureti Development Plan, 2008). Although the District is a high potential area, it still realizes sub-optimal declining tea yields. Information is one of the critical inputs into sustainable agricultural production. According to Mahaliyanaarachchi (1995), low adoption of improved technologies by small holdings is responsible for the sub-optimal production levels. Access to information is thus a potential avenue for improving tea yield among small holder farmers (Owuor *et al.*, 2001). Putting effective information on tea production in place could play a significant role in increasing tea production.

1.6 Scope and Limitations

The study was confined to Bureti District as one of the high potential tea growing zones in Kenya. The parameters of interest were household socio-economic and institutional variables as they influence and determine the access and use of information by small holder tea farmer. The study further considered socio-economic and institutional variables that affect tea yield other than information.

The limitations of the study were limited resources being finances, and accessibility of the respondents given their locations and road infrastructure status in the rural areas of Bureti District.

1.7 Definition of Terms

Small scale farmer: It is used herein to refer to a crop producer with less than 20 hectares of land.

Household: A group of people bound together by ties, kinship, or joint financial decision; who live together under single roof or compound, answerable to one person as the head and share the same eating arrangement.

Information: It is data that has been processed to a productive resource, potentially influencing the efficiency of production.

Technology: It refers to a new, scientifically derived, often complex input supplied to farmers by organizations with deep technical expertise.

Access: It is defined as the availability or potential for use at the individual, household, or community level. Access implies the right or ability to use a resource or input but is not an actual use measurement.

Adoption: It is the initial use of an input or method by an individual, household, or community that often, but not always, occurs in the context of an established program or scheme.

CHAPTER TWO

LITERATURE REVIEW

2.1 Agricultural Production in Kenya

Kenya covers approximately 582,646 km^2 comprising 97.8% land and 2.2% water surface. Of this land, only about 20% is classified as medium to high potential agricultural land and the remaining 80% is mainly arid or semi-arid (Jaetzold *et al.,* 2006). Small-scale farmers, mainly in the high potential areas, dominate Kenya's agriculture. The sub-sector accounts for about 75% of total agricultural output and 70% of marketed agricultural production (GoK, 2006). Kenya's principal cash crops include tea, coffee and pyrethrum, which are grown in agro-ecological zones of high to medium agricultural potential (CPDA, 2008).

The agricultural sector is the main source of national income, employment and contributes to poverty reduction and food security. It accounts for about 60% of total national employment. Agriculture directly contributes to about 26% of the GDP and 60% of the export earnings mainly from tea, coffee and horticulture. It further indirectly contributes about 27% to the GDP through linkages with manufacturing, distribution and service related sectors (KHRC, 2008). Agriculture is a vital tool for achieving the MDGs, number one that include halving the proportion of people suffering from extreme poverty and hunger by 2015. In order to achieve this target, agricultural sector is expected to grow by approximately 5.0% (World Bank, 2008). According to the Kenya Vision 2030's, Agricultural Sector Development Strategy (ASDS), for the period 2009 to 2020, the agricultural sector is a key economic driver for delivering the 10% annual economic growth rate envisaged under the economic pillar of the Vision 2030 (TRFK, 2011).

2.2 Tea Production in Kenya

2.2.1 Importance of Tea to Kenya's Economy

Tea *Camellia sinensis* is a rural based enterprise which makes significant contribution to objectives of the Economic Recovery Strategy (ERS), the Strategy for Revitalization of

Agriculture (SRA), Government's Agricultural Sector Development Strategy (ASDS) as well as the economic pillar of the Kenya's Vision 2030 by contributing to the overall growth of agriculture (TRFK, 2011). It is one of the country's leading export crops (Gesimba *et al.*, 2005), which has been competing favourably with horticulture and tourism. The earnings accruing from tea export in Kenya generally increased from Ksh 47.2 billion in 2006 to 97 billion in 2010 (TBK, 2012). The tea industry is a major source of employment in the country, accounts for about 4% of the country's GDP and about four million people derive their livelihoods from it (Mwaura and Muku, 2007). The crop also contributes significantly to the development of rural infrastructure hence stemming out rural-urban migration and environmental conservation through enhanced water infiltration, reduced surface erosion, and mitigation of global warming through carbon sequestration (TRFK, 2011).

2.2.2 Status of Tea Production

Tea was first introduced in Kenya around 1903, but until 1963 growing of the crop was restricted to large-scale farmers and multinationals (EPZA, 2005). The crop has since opened to small scale farmers and spread across the country making it an important economic mainstay for many small holder farmers. The cultivation of the crop has expanded rapidly in terms of volumes produced and area planted. The volume of tea produced has since risen rapidly from 18,000 tons in 1963 to a total of about 377,000 million tons in the year 2011 (TBK, 2012). The increase has been attributed mainly to the expansion of area under the crop (Rono and Wachira, 2005).

Kenya is ranked third after China and India in terms of annual tea production and accounts for about 10% of the world production and 22% of the export share (TRFK, 2011). The main buyers of Kenyan tea include Pakistan which imports about 23% of the total exports followed by the United Kingdom, Egypt and Yemen. The country is also exploring new markets that include West Africa, North Africa (apart from Egypt), Middle East, the Eastern Europe and especially the Commonwealth of Independent States (CIS) including Russia, Hungary, Czech Republic and Bulgaria (EPZA, 2005). Kenya prides itself as the producer of the best quality black tea in the world because of the efficient harvesting and processing practices (TRFK, 2011).

In addition to quality, Kenya has the highest productivity (yield per unit hectare) compared to other major tea growing regions worldwide (CPDA, 2008). The large scale estates realize higher crop yields than the smallholder tea growers (Owuor *et al.,* 2001). For example in 2010, the yield on smallholder farms stood at about 2000 kg made tea per hectare compared to large estates at 2600 kg made tea per hectare. The TRFK has however developed improved clones that are capable of producing between 5,000 kg and 8,000 kg of made tea per hectare per year (TRFK, 2011). The large differences between research yields and the average farm yield are due to limited adoption of improved technologies.

The tea growing areas mainly lie West and East of the Great Rift Valley in Kenya. Generally, tea is usually in Lower Highland Zone I (LH_1) and Upper Midland Zone I (UM_1), where annual rainfall is high and well-distributed ranging from 1200 mm to 2500 mm annually with mild temperatures of between 12^0C to a maximum of 28^0C. The ideal soils should be deep, well drained with a pH range of between 4.5 and 6.5 (Kinyili, 2003).

Currently, about 60% of the crop in the country is produced by the small holder farmers who process and market their crop through KTDA as the management agency (CPDA, 2008). The remaining 40% is produced by the large scale estates, that are managed by major multinational firms associated with tea in the world (Gesimba *et al.*, 2005). Kenya Tea Development Authority manages about 422,000 growers, 53 factories, and markets the produce. Management involves supervising and advising farmers on good husbandry practices; provision of inputs, collection and transportation of harvested tea to the factories, processing and marketing of the final product (CPDA, 2008). In an effort to improve efficiency, the Kenya government in 1999 liberalized the smallholder tea sub-sector by restructuring KTDA and the ownership of tea factories (Sudath, 2008). Consequently, the government withdrew from controlling services such as extension, processing and marketing to allow the private sector to take over the restructured KTDA (Nyangito, 2001). It was expected that the interventions would result in lower marketing margin, higher producer prices and increased productivity (Winter-Nelson and Temu, 2002).

2.2.3 Organization of the Kenyan Tea Industry

The tea sector has been organized into regulatory and policy making, research, production and marketing operations. The control, management and organization of the tea industry in Kenya are structured as shown in Figure 2.2 below.

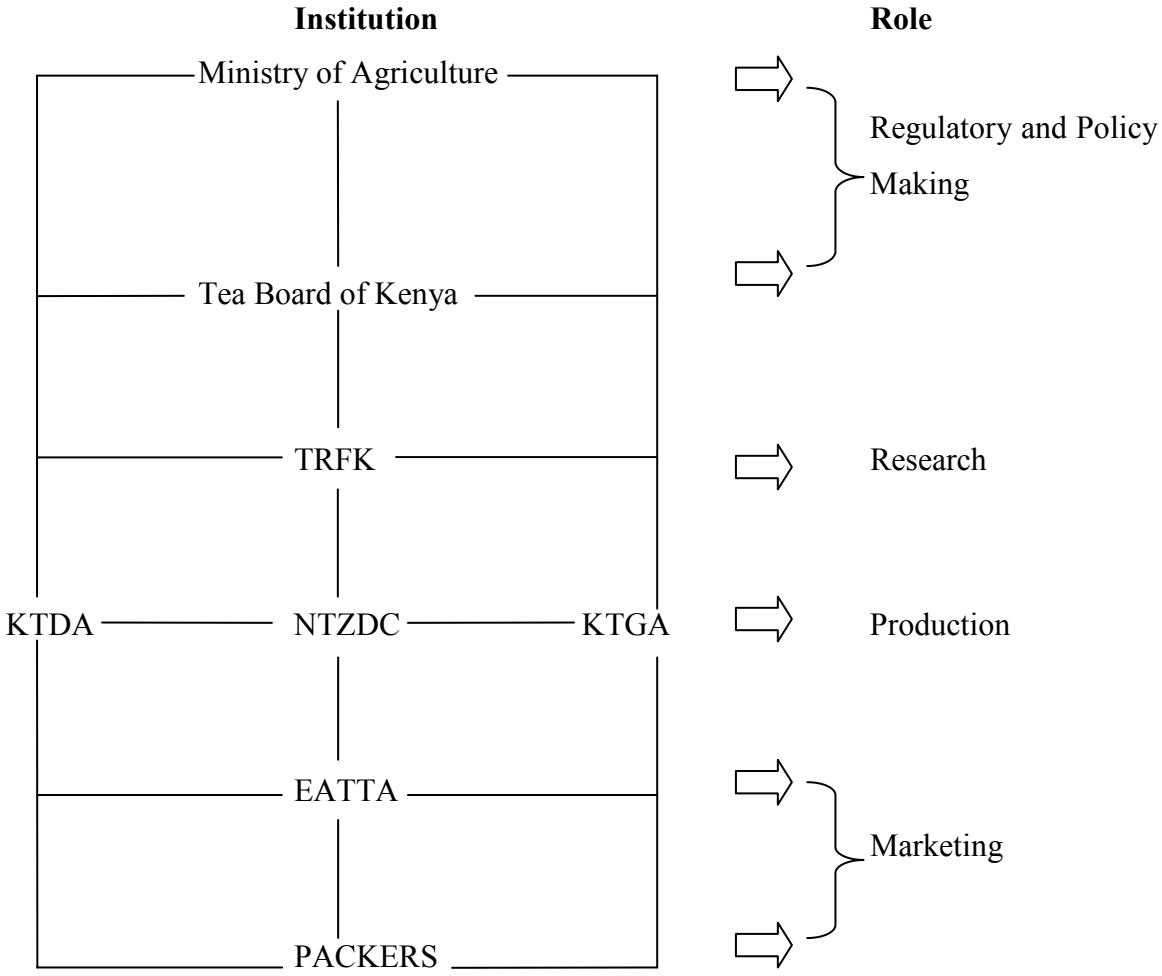


Figure 2.1: Organization of the Kenyan tea industry

Source: TRFK 2011.

Tea producers are categorized into small scale farmers under KTDA and large estates which are under the umbrella of Kenya tea growers association (KTGA). The KTGA is an association of mainly the large estate or plantation tea producers (CPDA, 2008). Nyayo Tea Zones Development Corporation (NTZDC) is a government corporation which was established to

manage the tea belts around forests to create buffer zones meant to protect the forests from human settlement or encroachment. Marketing in the industry is carried out hand in hand by East African Tea Traders Association (EATTA) and tea packers. The EATTA, which is an export auction system, is operationally known as The Mombasa Tea Auction. It is a voluntary organization which brings together tea producers, buyers (exporters), brokers, packers and warehouse operators. Tea packers pack tea in household brands as well for corporate consumer chains. Some of the leading packers include Kenya Tea Packers (KETEPA), Unilever Tea and Kikuyu Highlands Tea Company (EPZA, 2005).

2.2.4 Information Generation on Tea

Research on tea was first initiated in 1949 by Brooke Bond limited which later became the Tea Research Institute of East Africa (TRIEA) and then the TRFK in 1980 (KHRC, 2008). The TRFK in conjunction with Ministry of Agriculture are very instrumental in generating technologies for the tea industry. The TRFK's mandate is to promote research and investigate problems and systems of husbandry associated with tea productivity, quality and land suitability. Research is currently conducted in the areas of Crop Improvement and Management, Sustainable Ecosystem Management and Conservation, Tea Processing and Value Addition, Economics, Field Advisory and Corporate Communication (TRFK, 2011).

Technological recommendations for these themes are disseminated through various publications such as annual bulletins, field days and open days (Anon, 2002). There are also other attempts by technology transfer agencies to ensure that they reach individual farmers. For example, in 2006 the Lipton and KTDA started the pilot Farmer Field Schools (FFS) in Kericho district in a bit to increase and sustain crop yield (Hiller *et al.,* 2009). The technologies included disseminated high yielding clones, selective application of herbicides, pest and disease control, fertilizer recommendation rates and harvesting practices.

2.3 Agricultural Information

Information is one of the important resources required for the improvement of agricultural production. Samuel (2001) identifies agricultural information as the data for decision-making and a resource that has to be acquired and used in order to make informed decisions. Agricultural

information consists of published or unpublished knowledge that may broadly be categorized as technical/scientific, commercial, social and cultural and legal information (Aina *et al*., 1995).

Information is a productive resource that can affect the efficiency of production (Blackie and Dent, 1979). The decision making process by the farmer depends on the information that is available. Information facilitates the farmer to be more rational and hence increase the decision making abilities (Asres, 2005). According to Balit (1998) the least expensive input for rural development is adequate access to knowledge and information. Muvezwa (2006) infact suggested that information is now a fifth factor of production in addition to land, capital, labor, and technology. As population grows and the capacity of the land diminishes it is necessary to apply new methods of farming and technologies that are more effective and diversified sources of information (Gundu 2006). Lack of information and technical knowledge is among the factors responsible for low crop yield (Abbas *et al.,* 2008). Utilization of relevant, accurate and up-to-date information in the agricultural sector would ensure increased productivity (Banmeke and Ajayi, 2008). The farmers require a wide range of information that is related to production, policy and economic for sustainable production.

2.3.1 Factors Affecting Farmer's Access and Use of Agricultural Information

Socio-economic characteristics of a farmer such as farm size, farming experience and education influence the adoption of technologies (Hudson and Hite, 2003). Farmers' decision to adopt a new agricultural technology in preference to old technologies depends on factors such as access to institutional services and in-put supply markets (Khan *et al*., 2008).

According to Schnitkey *et al*. (1992), age is related to farming experience and affects information access.In general, older farmers are less willing to try out new innovations or take risks compared to younger farmers (D'Souza *et al.,* 1995). Older farmers are less likely to engage in simultaneous receiving and providing of information, perhaps due to their low ability to communicate (Katungi, 2006).

Sourcing of agricultural information and use is along gender lines. Women are more risk averse (Croson and Gneezy, 2008) and perceptions that women are not "real" farmers also limit their

access to information sources (Doss, 2001). Male farmers are engaged in more geographically dispersed social networks, thus giving them a greater chance to access information (Haddad and Maluccio, 2003).

Marital status of a farmer influence access to information. Opara (2008) noted that married farmers sought information more due to desire to produce more for family consumption and also for sale. The desire to produce more could lead to agricultural information seeking and use. The size of a household is also a factor that affects agricultural information access and use. Kacharo (2007) asserts that higher number of family members leads to higher exposure to get information.

Agricultural information can only be properly exploited by farmers who have certain levels of formal literacy. Farmers with basic education are more likely to adopt new technology, and become more productive. Education enhances the ability to derive, decode and evaluate useful information for agricultural production (Ani, 1998). According to Gundu (2006), the adaptation and use of new innovation assumes a higher level of literacy. Most farmers in the developing world are however rural based and are less literate. For instance, in 2008, the adult literacy level in Kenya was 74% (Tilvawala and Myers, 2009). Arokoyo (2005) identified high level of illiteracy as a major constraint to Information and Communication Technology (ICT) utilization by farmers.

Land is one of the most important resources in Kenya as it is the base upon which agriculture activities are carried out (GoK, 2006). Resource endowment is one of the factors affecting farmers' decision to adopt a new agricultural technology (Khan *et al*., 2008). Land size is often used as an indicator of wealth and proxy for social status and influence. Farmers with large farms are likely to be better informed (Nkonya *et al.,* 1997), richer and more keen in searching for information on improved technologies (Okwu and Iorkaa 2011).

Agricultural production coupled with security of tenure is more reliable and allows for a wider and more diversified cropping patterns as well as production of high value crops. Secure land

tenure provides an incentive and authority for farmers to adopt technologies. Lack of secure property rights affects the household investment (Samuel, 2001).

The ability of farmers to adapt technologies requires financing so as to improve production. Earnings from off- farm activities provide ready cash for input purchases as well as other household needs. Lack of access to credit and savings services for farmers in many rural areas, limit their ability to purchase needed technological inputs (Anderson, 1984). Gundu (2006) found that the small holder farmers lack economic capability to access and use relevant information. Off-farm income may be used to compensate for missing and imperfect credit markets (Lamb, 2003). Greater off-farm income means more cash available to the household to invest on-farm (Clay *et al*., 1998).

Social networks play an important role in information transfer. Farmers observe and learn from others in their network about the suitability and profitability of new agricultural production methods. The networks are particularly important for women, who often have less access to formal dissemination channels (Gundu, 2006). In contrast, men may be engaged in more geographically dispersed social networks, such as community projects, and may participate more in civic engagement (Haddad and Maluccio, 2003). Such participation provides them with greater access to information about agricultural innovations and stimulates information exchange with others (Granovetter, 1973). Rogers (1995) indicated that the core of technology diffusion consists of interpersonal network of information exchange between those individuals who have already adopted innovation and those who are then influenced to adopt. Together, they assess the worthiness of technologies and suitability to their farming conditions (Minja *et al*., 2004). Katungi (2006) indicated that social capital is measured by five indicators, each capturing a different aspect of social interaction: the size of the social network, the frequency of interaction in social institutions and civic engagement.

Neelemaghan (1981) pointed out that one of the prerequisites for information use is its accessibility, because farmer's mobility may be limited even basic access to public markets may be limited which constitutes an important place where agricultural information is exchanged (Katungi, 2006).

2.3.2 Agricultural Information Access and Technology Adoption

Technology is a new, scientifically derived, often complex input supplied to farmers by organizations with technical expertise. It is a process designed to achieve a given action while reducing the uncertainty in the cause-effect relationship (Simpson and Owens, 2002). The awareness and use of appropriate technologies largely affect production and productivity of any farm produce. The major challenge however is getting people to use technology. Information dissemination, the process through which information about a new technology reaches the intended users (Parr *et al*., 1990), is thus important.

Access is the availability or potential for use of information at the individual, household, or community level. Knox and Meinzen-Dick (1999) identified access to information as a critical dimension for technology choice. The decision to adopt innovations depends largely on access to information available (Daberkow and McBride, 2003). Improved information and knowledge flow to, from and within the agricultural sector are a key component in improving small-scale agricultural production. The biggest challenge is not just information but the amount and quality of information available. The small-scale farmers who account for the bulk of agricultural production have lagged behind in adoption of improved practices because of limited access to information (Rutto, 1996). Adoption is the initial use of an input or method by an individual, household, or community. A new technology is useful only if farmers adopt it. Information on innovation transfer involves creation, organization, dissemination, diffusion and use (Achleitner, 1995). Rogers (1995) defined diffusion as a process of communication by which an innovation is spread via certain communication channels to members of a specific community over time. Sudath (2008) noted that agricultural innovation diffusion is largely affected by information available on the innovation.

2.3.3 Agricultural Knowledge Information Systems (AKIS)

Generally, there are different generators and users of agricultural information. Aina *et al.* (1995), identified generators and users as policy makers and planners, researchers, extension staff, educators and students, agro-base industries and services staff, and farmers. The Agricultural Knowledge and Information Systems (AKIS) aims to integrate generators and users to harness knowledge and information from various sources for better farming and improved livelihoods

(Figure 2.3). FAO (2001) identified AKIS as a system of people and institutions that generates, transfers, and utilizes agricultural knowledge and information. The basic assumption of this system is that information relevant for decision-making is generated by different actors and reaches farmers in many different ways. This helps to create synergy between indigenous technical knowledge and research (Ahmed, 2007).

The AKIS links rural people and institutions to promote mutual learning and generate, share, and utilize agriculture related technologies, knowledge and information (Roling and Engel, 1991). The system responds to information needs of farmers helping them in decision making and management of their farms. The relevance of AKIS is the manner in which a new technological idea, or technique, moves from the level of creation to level of use. This promotes mutual learning and generates, shares, and utilizes agriculture related technologies, knowledge and information with the purpose of working synergically to support decision-making, problem solving and innovation in a given country's agriculture (Rolling and Engel 1991). Röling (2007) likened AKIS to a network of actors in a theatre of innovation. These actors potentially make complementary contributions towards innovation. The network is based on shared perceptions with respect to issues at stake. It has a strong focus on how information and ideas are communicated between the various actors in rural areas and how this knowledge can be harnessed for rural livelihoods; recognizes learning and innovation in an interactive process (Assefa *et al.,* 2006).

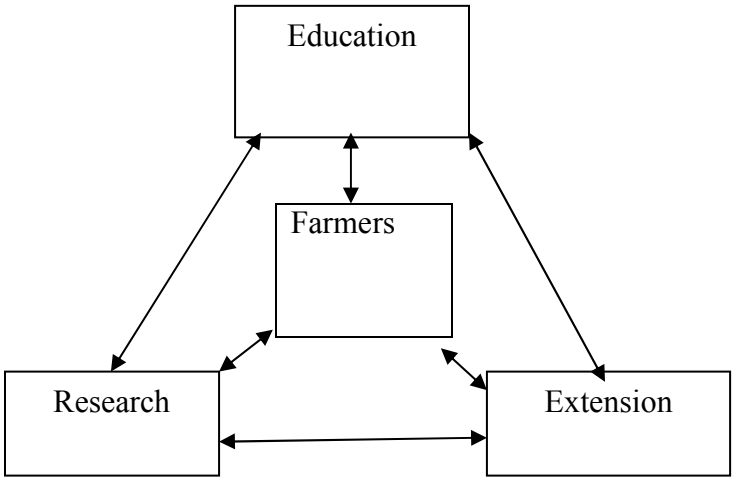
<table>
<tr><td></td><td>Policy environment
-Laws
-Incentives</td><td></td></tr>
<tr><td>Governance structure</td><td> 
</td><td>-External sector
-International agricultural research centers
-Commercial firms
-Donor agencies</td></tr>
<tr><td></td><td>Structural conditions
-Markets
-Inputs/outputs
-Resource base
-Infrastructure</td><td></td></tr>
</table>

Figure 2.2: Structure of the AKIS framework

Source: Elliott 1987.

2.3.4 Dissemination Channels of Agricultural Information

Information generated has to be transferred from the source to the end users in a systematic way. An improved information and knowledge flow to, from and within the agricultural sector are a key component in improving small-scale agricultural production (Asaba *et al*., 2006). A major task in agricultural development is the transfer of improved technologies to farmers (Pipy, 2006). For information access to be effective, dissemination channels need to be oriented towards the

user's needs, as well as the types and levels of information and in forms and language preferred by the user (Barbara and White, 2001). Information dissemination channels may be broadly grouped into personal, electronic and print.

The agricultural extension system being one of the personal channels has been considered as a primary vehicle for diffusing technologies (Kidd *et al.*, 2000). Agricultural extension has a strong reliance to transfer agricultural knowledge (Hedjazi *et al.*, 2006) generated through research with the aim of acquiring useful information and changing attitudes and practices by farmers. It is considered as a process of bringing desirable change in the behaviour of the farmers to adopt innovations relating to agriculture in such a way that they are clear and convinced of their utility (Khan, 2005). Kenya Tea Development Agency factory extension staffs are a major dissemination channel of information among the small holder tea farmers. In a bit to increase the yield, KTDA extension staff formerly under the Ministry of Agriculture were redeployed to be under specific factories to make them more effective (Owuor *et al.*, 2001). However, CPDA (2008) pointed out that there is very little support and limited extension services particularly from KTDA. Since 1974/75 the number of extension staff has been declining while the number of farmers is continually increasing (Owuor *et al*., 2008). Owuor (2005) similarly noted that an increase in extension activities was necessary for enhanced yields. Access to extension services is a key determinant in the adoption and use of improved technologies and farming practices (Ebrahim, 2006). Therefore, the frequency of extension contact has an important role in the access to and utilization of agricultural information.

Agricultural extension has evolved through improvements, development and adoption of more participatory systems. One of the models for technology transfer is Training and Visit (T&V) extension system which was promoted by the World Bank. The system was developed to put the farmer, the resource constraints, abilities and needs at the center of the whole extension effort (Semana, 2002). The high costs of operating the elaborate structures, combined with the lack of new technologies, however led to the abandonment of the model. Few of the classic T&V programs still operate today (Semana, 2002). The Farmer Field School (FFS) is another approach which was initially developed in Asia in the early 1990s to address a major threat to food security resulting from dramatic yield losses caused by the brown plant hopper. It is an

innovative, participatory and interactive learning approach. Farmer Field School is a learner centred approach, whereby farmers through observation, experimentation and evaluation, leading to understanding, are equipped to address challenges and introduce appropriate changes in their farm management practices (Hiller *et al.,* 2009). The field is the primary learning material, and extension workers are facilitators not teachers. Farmers are the main actors in this process and outsiders (extension agents, researchers, Non-Governmental Organizations) take a role as facilitators or resource centres.

Fellow farmers are other personal dissemination channels of agricultural information. More experienced farmers become the best discussion partners for other farmers (Place *et al*., 2005). Together, they assess the worthiness of technologies and suitability to their farming conditions (Minja *et al.,* 2004). Fellow farmers may used to complement the extension agents due to their easy reach. The efficiency of its utilization may however be limited by lack of trust amongst farmers.

Mass media includes electronic such as radio, television and internet and print like newspapers, magazines, posters and extension brochures (Abubakar, 2007). Mass media plays a great role in provision of agricultural information in shortest possible time over a large area (Tadesse, 2008). Djojomartono and Pertini (1998) noted that radio and television are more appropriate for one-way communication, reaching a lot of people quickly with fairly simple ideas. Radio has been acknowledged as the most important medium for communicating with the rural populations of Sub-Saharan African countries (FAO, 2001). Lwoga (2010) noted the advancements in the ICTs as an opportunity for developing countries to harness and utilize information and knowledge so as to improve productivity in agriculture. Technological constraints however, such as unstable supply of electricity and the lack of adequate technical support may limit the use of electronics (Melkote and Steeves, 2001).

Mohammed and Wanaso (1993) pointed out that the choice of communication channels is to a large extent a factor of farmer's circumstances. Different dissemination channels influence adoption at the different stages of the individual decision making process (Rogers, 1995). For instance, Mass media is particularly effective in making farmers aware of new technologies

(Venkatesan, 1995). Therefore, multiple dissemination channels of information need to be used to deliver relevant information to farmers. Farmer's access to different information channels at various stages helps them to get information about improved technologies and enhance the adoption of new innovations.

2.4 Conceptual Framework

To enhance increased yield of small holder tea farmer, effective access to and utilization of agricultural information by farmers play crucial roles. Access to information influences the adoption of technologies (Daberkow and McBride, 2003). The benefits of adopting new and/or innovative technologies and farming practices of tea are clear from the cost/return relationships. Large-scale tea growers have largely benefited from the use of the tea production technologies (Othieno, 1994). The small-scale farmers have generally lagged behind in adoption of improved practices, thus leading to low declining yields. As a result of different external and internal factors, small holder tea farmers continue to realize low crop yield. To enhance the production, one of the options would be to increase farmers' access to and use of tea production information. Identifying and working on the problem that limits the extent of access and use is a priority for enhanced crop yield. This can be done through analyzing the socio-economic and institutional factors that might significantly influence information access and utilization.

The conceptual framework of the study is based on the assumption that access and use of information are influenced by different technological factors, socio-economical and institutional variables.

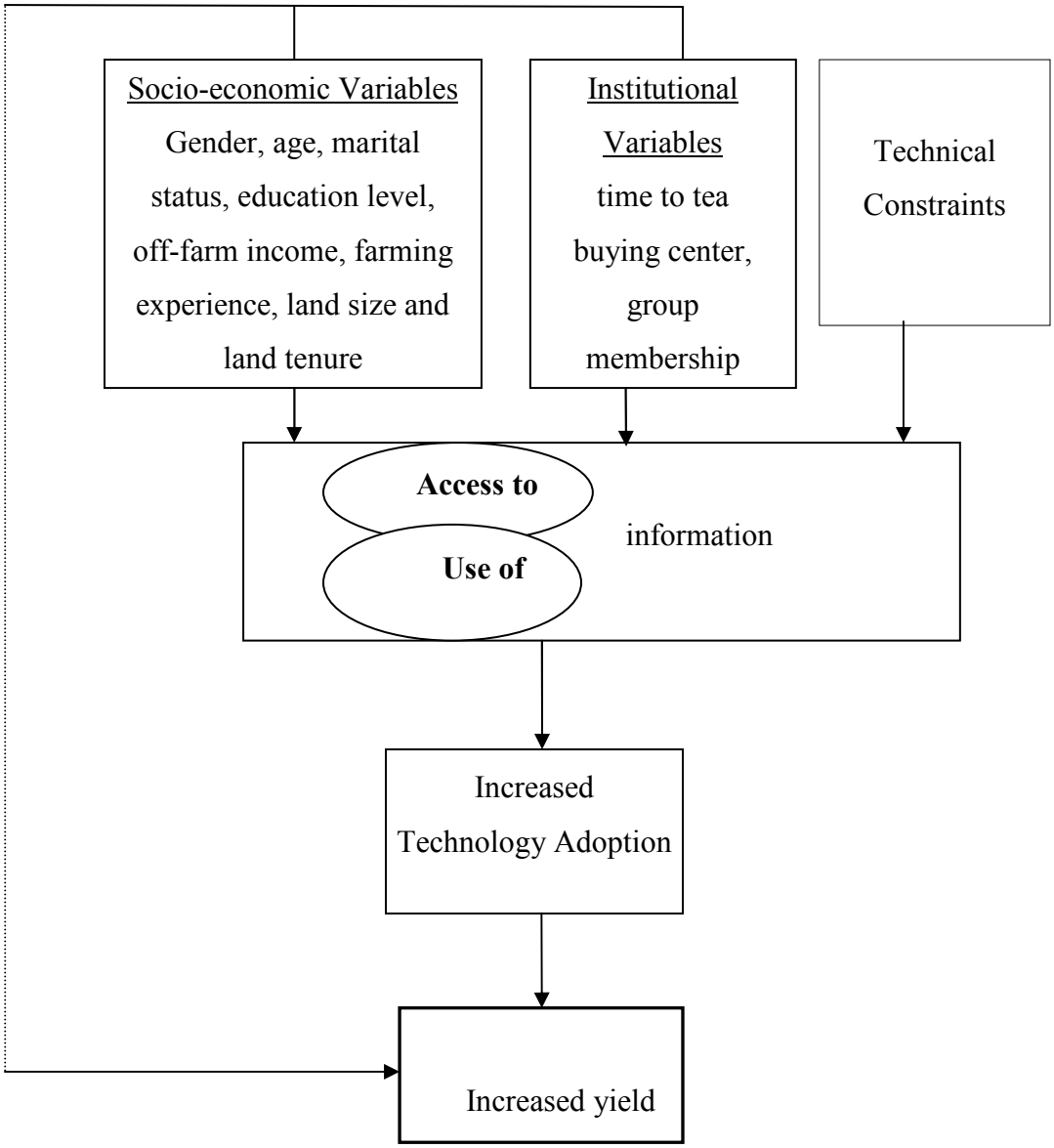


Figure 2.3: Conceptual framework

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Location

The study was carried out in Bureti District, Rift Valley Province of Kenya. The District is bordered by Kericho District to the North, Nakuru District to the North East, Sotik to the East, Nyamira District to the South West and Borabu District to the West. It lies between latitudes, $0^0$25' and $0^0$43' South of the Equator, and between longitude 35^0 05' and 35^0 35' East. The District covers a total area of 1,100 km^2. The climate of the District is described as highland sub-tropical climate with rainfall of between 1,700 mm and 2,020 mm and temperatures between 16^0C to 20^0C, that is ideal for tea production. The tea clones grown in the area include TRFK 303/577, TRFK 11/4 and TRFK 31/8 among others (GoK, 2008).

3.2 Research Design and Sampling

A combination of purposive, multi-stage and proportionate random sampling techniques was used. Two out of four KTDA managed factories (Kapset and Litein) were purposively selected based on the tea yield per hectare. They both had a total of 28,774 tea growers which was used to obtain a sample of 170 using Yamane (1973) formula. If 50% figure is considered to give the highest sample acceptable value and assuming 50% of the growers were not accessing and using technological information for high tea production, the desired sample size sample size of 170 was arrived at according to Yamane (1973) formula as;

$n = z^2pqN/ (z^2pq + Ne^2)$

where

z = the standard deviate,

p = the proportion of the population with the desired characteristic,

q = 1 – p,

N = Number of tea growers in the factories of study,

e = acceptable margin of error.

A proportionate random sampling technique, based on the individual factory population was applied (42:58) to obtain each factory sub-sample for each factory. A Proportionate distribution among the tea buying centers from the individual factories was applied and selection of individual households within the tea buying centres random was applied to obtain

3.3 Reliability of the Instrument

To ensure consistency of the instrument obtained from the test, it was pretested using a random sample of 10 farmers in Kericho district. This location was chosen because it has similar characteristics as those found in the study areas. The number 10 was chosen for the pretest based on Kathuri and Pals (1993) suggestion that it is the smallest number that yields meaningful results in data analysis in a survey research. The pretest was subjected to the spilt-half analysis technique according to Cronbach's formula;

$$\alpha = (N*r/1+(N-1)*r)$$

Where N = number of items and r is the average inter-item correlation among the items.

The study used Cronbach alpha as the reliability coefficient of at least 0.7 which is accepted (Santos and Reynaldo, 1999). Since a reliability coefficient of 0.7 was obtained from the pre test, the instrument was therefore used for survey.

3.4 Instrumentation

The questionnaires were administered to tea growing households which provided their institutional and socio-economic information and also the status of access and use of tea production information. The questionnaire interview was conducted by the researcher and enumerators trained for the purpose. Pre-testing of the survey instrument was done in Kericho, a different tea growing area.

3.5 Validity of the Instrument

Validity is the extent to which you can draw accurate and meaningful inferences based on the results obtained from an instrument (Mugenda and Mugenda, 1999). Content and construct validity were used to evaluate the inferences based on the results from the instruments. Content validity is the degree to which an instrument actually measures the variable it claims to measure (Kathuri and Pals, 1993). That is to ensure the items in the questionnaires represent the content

area. Construct validity is a measure of the degree to which data obtained from an instrument meaningfully and accurately reflects a theoretical concept (Mugenda and Mugenda, 1999). To establish content and construct validity the researcher sought expert opinion concerning the research instruments from the supervisors and five other professionals in the field from the Faculty of Agriculture at Egerton University. A pilot study for a sample of 10 farmers was carried out from the neighbouring Kericho district to ascertain their validity and reliability. This helped the researcher to establish the accuracy of the instruments to be used.

3.6 Data Analysis

Objective 1: To identify and characterize the sources of information used by small holder tea farmers. This objective was analysed using Statistical Package for the Social Sciences (SPSS) version 15. Descriptive statistics such as frequencies, measures of central tendency and dispersion were used.

Objective 2: To determine the factors that affect small holder tea farmers in accessing information on tea production. This was analyzed using Heckman's selection model. The Heckman's two-step selection model was chosen to correct for selectivity bias in the sample (Heckman, 1979). The Heckman model consists of two equations: a selection equation or probit model and ordinary least squares equation.

The first step (probit model) of Heckman model captures the factors that affect small holder tea farmers in accessing tea production information. This procedure solves the sample selection problem. The probability of access to information is then determined by the significance of the *betas*. The left-hand side variable denotes probability of access to tea production information. The X_{1i} is a vector of factors that influence access to tea production information while ε is error term. The independent variables considered are; *age, gender, marital status, household size, level of education, land tenure, group membership, off-farm income and time to tea buying centre.*

For this study, the probit model was specified as follows;

$$Y^{*} = \beta_{1i}X_{1i} + \boldsymbol{\varepsilon} \begin{cases} Y^{*} = Y \text{ if } Z^{*} \geq 0 \\ Y^{*} \text{ access otherwise} \end{cases} \quad \text{.....Equation 1}$$

The second step of Heckman model is ordinary least squares which is used to assess other factors influencing yield besides information. The influence of these factors is determined by the significance of the *betas*. The ε is error term while X_{2i} is a vector of factors that influence yield. The following factors are considered; *age, gender, household size, education level, size of land, land tenure, off-farm income, group membership and farm experience.*

$$Z^{*} = \beta_{2i} X_{2i} + \varepsilon \quad \text{.....Equation 2}$$

Objective 3: To determine the effect of access of information on tea yield among small holder tea farmers in Bureti. It was analyzed using t-test where the sample was split into two sub-groups with one composed of the farmers that had access to information on tea production and the second was those who did not. The mean yields of each group were also determined and the difference was compared.

3.7 Variable Measurement

The variables of interest are described and measured as shown in Table 3.1 below.

Table 3.1 Variable measurement

Variable	Description	Measure
Age	Household head age	Years
Gender	Household head gender	1=male, 0=female
Marital status	Household head marital status	1=married,0=otherwise
Education level	Household head education	Years
Household size	Household size	Number
Size of land	Household owned land size	Hectares
Land tenure	Household head land ownership	1=yes, 0= no
Off-farm income	Household head access to off-farm income	1=yes, 0= no
Group membership	Household head membership	1=yes, 0= no
Farm experience	Household head tea farming experience	Years
Time to tea buying centre	Time spent to tea buying centre (one-way)	Minutes

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socio-Economic Characteristics of Small Holder Tea Farmers in Bureti District

A majority (85%) of households were male headed (Table, 4.1). This is consistent with findings by Peterman *et al.* (2011) that in Africa men dominate the production of cash crops while women are primarily responsible for the supply of food to the family. Most (82%) respondents were married, hence reasonable for large family sizes. The high numbers of dependants in most cases is translated into increased family pressure on the limited resources. On the other hand, large family size may provide for family labour required in agricultural production. Most (69%) farmers owned land with title deeds thus had security of tenure and could invest in farming activities. A majority (93%) of farmers spent up-to 12 years in school, suggesting that they were literate. Educated farmers are expected to understand agricultural instructions, manage and adopt technologies faster than the less educated counterparts (Edriss, 2003). Up to 93% of the households were members of group organizations. This was mainly as a result of the KTDA Credit and Savings Societies that have been established to handle financial matters of farmers. It has been established that group participation stimulates information exchange (Katungi, 2006). Income from non-farm activities has been found to increase the farmers' probability to invest on new technologies (Habtemariam, 2004). Most (55%) of the respondents however didn't have other sources of income apart from the farm.

Table 4.1: Socio-economic characteristics of farmers of small holder tea farmers in Bureti district

Characteristic	Frequency	Percent(n=170)
Gender		
Male	144	85
Female	26	15
Marital Status		
Married	140	82
Single	18	10
Widowed	12	8
Land tenure		
Those with title deed	117	69
Those without title deed	53	31
No. of years of schooling		
≤ 8 years	82	48
>8 & ≤12 years	76	45
>12 &≤16 years	12	7
Group Membership		
Those who are members of group organizations	158	93
Those who are not members of group organizations	12	7
Off-farm income		
Those with off-farm income	76	45
Those without off-farm income	94	55

The respondents had a mean age of 43 years with household size of 6 members (Table 4.2). The Kenya National Bureau of Statistics (2010) noted similar household sizes. This is expected to have a positive influence on family labor for tea production (CPDA, 2008), but also could have a negative effect of reducing resources available per capita. The mean land size per household was 4 hectaresof which about 50% is devoted to cultivation of tea. Nyangito (2001) also noted that

small holder tea farmers in Kenya hold and manage less than eight hectares of tea farms. Tea is thus the main source of livelihood in the area and provides work and income throughout the year, with relatively little investment and risk associated with crop. On the other hand, they also engage in other crops in order to avoid dependence on fluctuating income from tea (SOMO, 2008). Farmers had about 17 years farming experience in tea. Farming experience is an advantage for improving productivity, since it encourages rapid adoption of farm innovations (Obinne, 1991). Farmers spent approximately 10 minutes from their farms to the buying centres. Tea buying was central place where KTDA provided services to small holder tea farmers such as extension services, inspecting and collecting green leaf from respective buying centers (KHRC, 2008). This implies that most farmers were nearer the buying centres, hence likely that would receive information easily.

Table 4.2: Descriptive analysis of the socio-economic characteristics of small holder tea farmers I Bureti District

Characteristics	Unit of Measurement	Minimum	Maximum	Mean
Age	Years	21	74	43
Household Size	Number	1	23	6
Farming experience	Years	2	54	17
Size of land	Hectares	0.25	15	4
Land under Tea	Hectares	0.25	8	2
Time spent to tea buying center	Minutes	200	3	10

4.2 Sources of Information for Small Holder Tea Farmers in Bureti District

The study showed that majority (79%) of the farmers got information from extension agents. This was followed by fellow farmers at 12% and radio at 9% (Figure 4.1). The results are consistent with Banmeke and Ajayi (2008) who noted that the radio, extension agents and fellow farmers were established as some of the major sources of information for farmers.

Ozowa (1995), Opara (2008) and Odoemenem and Obinne (2010) similarly found that farmers ranked extension agents as a priority source of information. In addition, Mbigidde (2011) found that most of the farmers accessed agricultural information from tea factories, through KTDA extension staff. The popularity of the extension agent among the farmers is not surprising, given the strong KTDA extension agents in the field. Extension staff formerly under the ministry of Agriculture was earlier redeployed to be under specific factories to make them more effective and directly answerable to the farmers (Owuor *et al.*, 2001). Generally, researchers continue to develop the tea production technologies, which need to be passed to the farmers through an effective tea extension service (TRFK, 2011). Owuor (2005) pointed out that an increase in extension activities was necessary for enhanced yields. On the contrary, CPDA (2008) and Owuor *et al*. (2008) noted that there was limited KTDA extension services, especially as the number of farmers continue to increase.

Farmers ranked fellow farmers as the second most important source of information (Figure 4.1). This may be attributed to their easy access. The choice of communication channels is to a large extent a factor of farmer's circumstances (Mohammed and Wanaso, 1993). The results are consistent with Asiabaka and Owens (2002), Boz (2002) and Sivayoganathan (2008) finding that farmers rank fellow farmers and friends as an important source of information. Hiller *et al.* (2009) noted a very high level of dissemination of information on tea production from Farmer Field School (FFS) members to non-members in Kericho. Fellow farmers are important sources because of interpersonal communication that is more robust with built-in feedback mechanism (Opara 2008). Non-professional interpersonal sources of information such as other farmers have been found essential (Anyanwu *et al.,* 2002). This has to be considered as an important source since it enables farmers to learn from others based on their own on-farm experimentation (Salomon and Engel 1997).

Radio was ranked third as a source of information (Figure 4.1). Shepherd (2001) similarly noted radio as an appropriate communication channel available to a majority of rural farmers in Africa. Radio is appropriate in reaching many people quickly with fairly simple ideas (Venkatesan, 1995; Djojomartono and Pertini, 1998), especially with the advent of vernacular radio stations. Munyua (2000) noted that a radio is effective particularly in making farmers aware of new

technologies. It can be used by extension agents to deliver repackaged agricultural information from subject matter specialists to farmers.

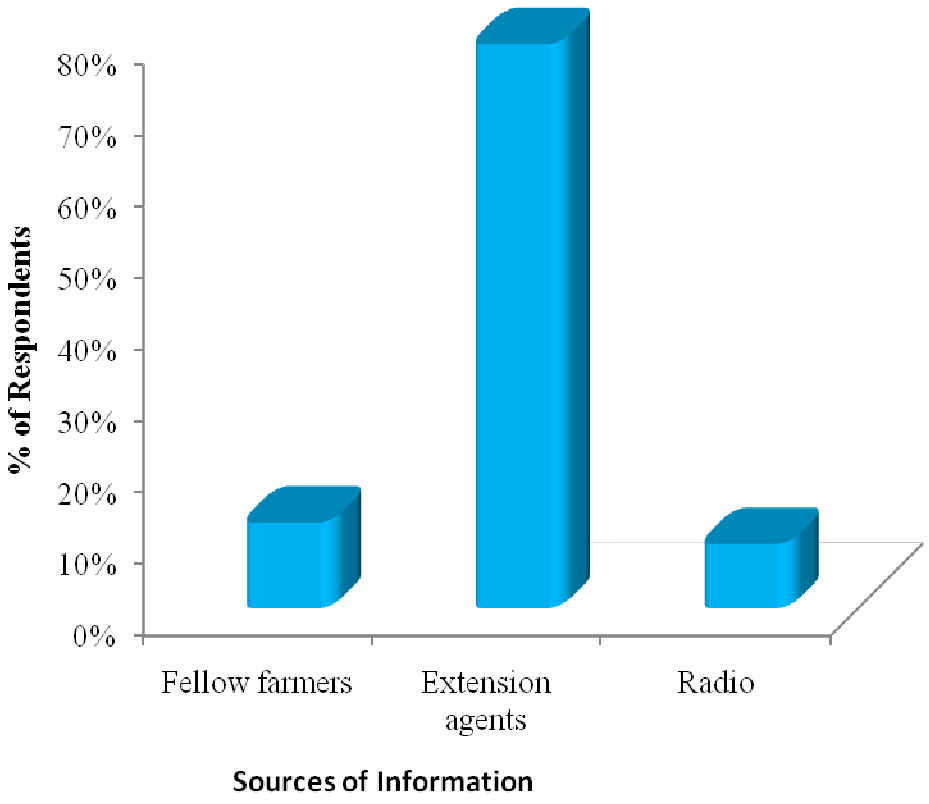


Figure 4.1: Sources of information for small holder tea farmers in Bureti district

4.3 Factors influencing Access and Use of Information on Tea Production by Small Holder Tea Farmers in Bureti District

The first step of Heckman model consists of a probit model that estimates the probability of small holder tea farmers to access information on tea production. The factors that were significant included off-farm income, education level, household size, marital status and time to tea buying center (Table, 4.3).

Access to off-farm income by the farmer increases the probability of access to information on tea production by about 48% (Table, 4.3). It implies that the higher the income earned the more the

farmers' financial capacity which increases the probability of investing in new agricultural technologies. The most important success factors for determining motivation to seek new technologies are those relating to human capital endowments and economic status such as income (Roche, 1998). Asfew *et al.* (1997) and Habtemariam (2004) noted that in addition to contributing to farm income, off-farm income and non-farm activities increased the probability of investing in new technologies. Lagat *et al.* (2003) noted that changes in income is needed to increase the probability of adoption.

The probability of access to information increases by 5% for each additional year of education of the farmer (Table, 4.3). It is generally known that farmers with basic education are more likely to adopt new technology. Ofuoku *et al.* (2008) noted that the increase in educational level increased with the farmers' willingness to use information on fish production. In addition, Mwabu *et al.* (2006) and Eze *et al.* (2006) noted that education level was among determinants in adoption of improved maize varieties and cassava production technologies by farmers. Education enhances the ability to derive, decode and evaluate useful information for agricultural production (Ani, 1998).

Marital status of the farmer negatively affects the probability of access to information (Table, 4.3). This suggests that un-married farmers access information more than married farmers. This could be attributed to the fact that un-married farmers participate more in social activities due to limited responsibilities, while married farmers choose to stay at home to attend to family matters and help in domestic tasks. In contrast, Opara (2010) noted that marital status was positively associated with agricultural information access and use.

An increase by a member of household increased the probability of access to information by 10% (Table, 4.3). As a household size increases, the demand for food and other needs increases and hence pressure to produce more for family consumption which could lead to agricultural information seeking and use. Tawari (2006) also noted a higher adoption of technologies among fishers having the larger household sizes. A high number of household members lead to increased exposure to information (Kacharo, 2007).

Geographical distance to the market is commonly used as a measure of spatial diffusion of physical technologies such as seed. The approximate time to tea buying centre had negative significance on access to information implying that a reduction in one minute increases the probability of access to information by 3% (Table, 4.3). Kenya Tea Development Authority provides services such as extension services, inspecting and collecting green leaf from respective buying centers to small holder tea farmers (KHRC, 2008). Thus farmers who can easily get to tea buying centers are able to interact with fellow farmers, factory leaf collection staff and extension. Fertilizer adoption and intensity of use is generally adversely affected by distance to fertilizer market (Karanja *et al.,* 1998). In addition, Katungi (2006) found that market serves as a forum for the exchange of goods, and constitute an important place where agricultural information is exchanged. Moreover, farmers located near to a market will have a chance to get information from other farmers and input suppliers. The closer the farmers are to the market, the more likely that they would receive information (Roy *et al.*, 1999; Negash, 2007).

Table 4.3: The Probit Model on socio-economic factors affecting access to information by small holder tea farmers

Independent variable	**Coefficient**	**Std. Err.**	**P>|z|**
Off-farm income	0.475	0.205	0.020***
Gender	0.211	0.229	0.357
Age (years)	-0.011	0.009	0.196
Educ. Level (years)	0.049	-0.027	0.067**
Household size	0.101	0.035	0.004***
Group membership	0.186	0.429	0.665
Land tenure	-0.000	0.000	0.212
Marital status	-0.085	0.006	0.000***
Time to tea buying center (minutes)	-0.003	0.000	0.000***
/athrho	18.661	771.360	0.981
/lnsigma	6.148	0.066	0.000
Rho	1	3.43e-13	
Sigma	467.5631	30.77753	531.9501
Lambda	467.5631	30.77753	527.8859

Number of observations = 170	chi2(1) = 115.22
Censored observations = 34	Wald chi2 (34) = 125.69
Uncensored observations =136	Prob> chi2 = 0.0000
LR test of indep. eqns. (rho = 0):	

*sig at 10%, ** sig. at 5%, *** sig at 1%.

4.4 Other Factors Influencing Tea Yields Besides Information

The second step of Heckman model (ordinary least squares) sought to assess factors, other than information that influence change in yield. The factors that were found significant included off-farm income, household size, group membership, farm experience and size of land (Table, 4.4).

Off-farm income showed a positive influence on yield which suggests that farmers with other sources of income besides farming had higher incomes that enabled them to build assets and invest in farming (Table, 4.4). Clay *et al*. (1998) noted that greater off-farm income means more

cash available to the household to invest on the farm, as farmers are increasingly finding it difficult to use major inputs such as fertilizers due to increasing costs (TRFK, 2011).

The household size had a positive influence on yield (Table, 4.4). A large household size is expected to have a positive influence on the supply of family labour. Large households are also likely to be under pressure to produce more because of family consumption (Opara, 2010). CPDA (2008) found that most of the small holder tea farmers use family labour. The availability of family labour has been observed to encourage a farmer to cultivate more crops (Opara, 2010).

Farmers who were members of groups had higher yields as compared to their non-participants (Table, 4.4). It is argued that group participation positively influences the adoption of innovations. Group membership provides a social forum where farmers share experience and exchange information in innovation in the farming community (Mama, 2010). Learning through social networks (Jackson and Watts, 2002) is an important determinant of technology adoption.

Farming experience on tea had a negative influence on yield (Table, 4.4). Schnitkey *et al*. (1992) and Gebremedhin *et al.* (2009) argue that farming experience is an indicator of age. This implies that the older the farmer the lower the yield which may be attributed to reduction of physical energy to undertake tea production activities. Similarly, Odoemenem and Obinne (2010) noted that age was negatively correlated with cash income. Dimara and Skuras (1998) pointed out that as farmers grow older they become less energetic. In the process of growing old, an individual undergo social, psychological and physical changes which may result in the decline in physical energy (Fabyan, 1999).

The positive relationship between size of landholding and yield means that when respondents' size of land holding increases, the yield also increases (Table, 4.4). Similarly, Mpawenimana (2005) noted that land acreage had a positive relationship with banana output. It has been established that farm size exerts a positive influence on the adoption of improved technologies which may in turn increase production (Yenealem, 2006; Kacharo, 2007). Farmers with large farms are likely to be better informed and are able to take risk associated to experiment with new practices (Nkonya *et al*., 1997).

Table 4.4: The Ordinary Least Squares on socio-economic factors affecting yields due to access to information

Independent Variable	Coefficient	Std. Err.	P>|z|
Off-farm income	232.725	95.200	0.015**
Gender	121.955	106.960	0.254
Age (years)	-6.125	4.070	0.132
Educ. Level (years)	-20.095	12.368	0.104
Household size	42.080	16.406	0.010**
Group membership	522.633	199.712	0.009***
Farm experience (years)	-1.528	0.048	0.000***
Size of land (hectares)	6.142	0.068	0.000 ***
/athrho	18.661	771.360	0.981
/lnsigma	6.148	0.066	0.000
rho	1	3.43e-13	
sigma	467.5631	30.77753	531.9501
lambda	467.5631	30.77753	527.8859

Number of observations = 170	chi2 (1) = 115.22
Censored observations = 36	Wald chi2 (34) = 125.69
Uncensored observations =134	Prob > chi2 = 0.0000
LR test of indep. eqns. (rho = 0):	

*significant at 10%, ** significant at 5%, *** significant at 1%.

4.5 Relationship between Access to Information and Yield

Farmers who had access to information had significantly higher mean tea yields, that is, 623 kg per hectare per month compared to non-participants with mean of 414. This infers that access to information contributes to the increase in yields.

Kinyili (2003) and Owuor *et al.* (2001) noted that access to information is a potential avenue for improving yield among the small holder tea farmers. Information is a powerful tool in addressing the quality and quantity of agriculture (Lesaoana-Tshabalala, 2001). It is a resource that must be acquired and used for the improvement of agricultural production (Samuel, 2001), without good quality agricultural information, bad decisions are made (Ducombe and Heeks, 2001).

Production and productivity of any farm produce is largely dependent on the awareness and the use of appropriate technologies (TRFK, 2011). Banmeke and Ajayi (2008) noted that utilization of relevant, accurate and up-to-date information ensures increased productivity. Preve (1999) noted that an adequate information supply was required for a successful agricultural business. The findings emphasize that relevant and timely information has to be organised according to language and format understood by farmers.

Table 4.5: t-test for equality of means

Farmers	**Number**	**Mean yield/month(/kg/ha)**	**t-test**
With access to tea production information	134	623	0.004
With no access to tea production information	36	414	

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

On the basis of this study the following conclusions were made:-

1. A majority (79%) of small holder tea farmers source information from the KTDA extension agents. This was followed by fellow farmers at 12% and radio at 9%.
2. There was a positive relationship between small holder tea farmers' access and use of information and (a) off-farm income, (b) education level, (c) household size and (d) time spent to tea buying center, while (e) marital status and had a negative influence.
3. Information access by small holder tea farmers contributed to increased yield. Farmers who had access to information had significantly higher mean tea yields of 623 kg per hectare per month as compared to non-participants with mean of 414 kg. Having access to agricultural information is an essential ingredient that leads to better production.

5.2 Recommendations

Based on the findings of the study, the following recommendations were made:

1. Small holder tea farmers are more likely to be motivated in seeking information on technologies from agricultural experts such as extension agents.Since there is shortage of KTDA extension staff, farmer-to-farmer extension should be enhanced.
2. Factors that had a positive significance influence on access and use of information by small holder tea farmers need to be increased. Such factors include off-farm income, education level, household size and time spent to tea buying center, They are generally important for passing on agriculture information in the small holder tea farming.
3. Farmers should be exposed to a wide variety of information sources to help them get information about improved technologies so as to enhance the adoption of new innovations. The TRFK, other research institutions and KTDA should work together to ensure information reaches the farmers. This would lead to increased yield.

4. There is need for further research to critically analyze other factors affecting the adoption of technologies among smallholder tea producers. This will provide further solutions to low technology adoption among smallholder tea farmers which has led to a wide gap between research and actual farm yields.

REFERENCES

Abbas, M., Lodhi, T.E. Bashir, A. and Mahmood, M. A. (2008). Dissemination of Wheat Maize Seed and Fertilizer in North Tanzania. *Indian Journal of Agricultural Economics* 48(1):1-12

Abubakar, S. Z. (2007). Approaches, Strategies and Challenges for Information Management and Usage in Fostering Sustainable Agricultural Growth and Rural Economic Development in Sub-Saharan Africa. Zaria, Nigeria. Retrieved on February 12, 2012 from: *http://ebookbrowse.com/codi-v-klis-information-management-usage-sustainable-development-abubakar-en-pdf.*

Achleitner, H. K. (1995). Information Transfer, Technology, and the New Information Professional. In The Impact of Emerging Technologies on Reference Service and Bibliographic Instruction (ed.). Greenwood Press, London.

Government of Kenya (GoK). (2006). National Report on Kenya Presented at the International Conference on Agrarian Reforms and Rural Development: New Challenges and Options for Revitalizing Rural Communities.

Government of Kenya (GoK). (2008). *Bureti District Development Plan. Kenya*.

African Development Fund (ADF). (2002). Agriculture and Rural Development Department, Nyayo Tea Zones Improvement and Forest Conservation-Operations North, East and South. Kenya.

Ahmed, A. (2007). Managing Knowledge in the 21st Century and the Roadmap to Sustainability. Greenleaf Publication: Sheffield, United Kingdom.

Aina, L.O., Kaniki, A.M. and Ojiambo, J.B. (1995). Agricultural Information in Africa. Third World Information Services Limited. Ibadan, Nigeria.

Ani, A.O. (1998). Assessment of Farmers' Extension Education Needs in Yobe State, Nigeria. *Nigerian Journal of Agricultural Education*, 1: 152–8.

Anon (2002). Tea Board of Kenya Projections. Kenya. Retrieved on January 11, 2012 from: *http://www.teaboard.or.ke/news/releases.html*

Anyanwu, A. C., Agwu, A. E. and Umeweni, C. A. (2002). Sources of agricultural information used by women farmers in Orumba Anambra State, Nigeria. *ASSET: An International Journal,* 2: 97-104.

Arokoyo, T. (2005). ICTs application in Agricultural Extension Service delivery. In: Adedoyin, F.S. (ed). Agricultural Extension in Nigeria. AESON, Ilorin. CTA (2003) ICTs – Transforming Agricultural Extension an e-discussion, 20th August – 29th September 2003.

Asaba, J.F., Musebe, R., Kimani, M., Day, R., Nkonu, M., Mukhebi, A., Wesonga, A., Mbula, R., Balaba, P. and Nakagwa, A. (2006). Bridging the Information and Knowledge Gap Between Urban and Rural Communities Through Rural Knowledge Centres: Case Studies from Kenya and Uganda, International Association of Agricultural Information Specialists (IAALD) *Quarterly Bulletin* 51(3/4).

Asfew, N., Gungal, K., Mwangi, W. and Seboka, B. (1997). Factors Affecting Adoption of Maize Production Technologies in Ethiopia. *Ethiopian Journal of Agricultural Economics*. 2: 52-69.

Asiabaka C.C. and Owens, M. (2002). Determinants of Adoptive Behaviors of Rural Farmers in Nigeria. Nigeria.

Asres, E. (2005). Access and Utilization of Development Communication by Rural Women in Dire Dawa Administrative Council, Eastern Ethiopia. Unpublished M.Sc. Thesis, Alemaya University. Ethiopia.

Balit, S. (1998). Listening to Farmers: Communication for Participation and Change in Latin America: In Training for Agriculture and Rural Development. FAO, Rome.

Banmeke, T. O. A. and Ajayi, M. T. (2008). Farmers' Perception of the Agricultural Information Resource Centre at Ago-Are, Oyo State, Nigeria. *International Journal of Agricultural Economics & Rural Development*: 1 (1).

Barbara G. and White, D. (2001). Developing an Effective Dissemination Plan. United States of America.

Boz, I. (2002). Does Early Adoption Influence Farmers' Use of The Extension Service? *Journal of International Agriculture and Extension Education* 9: 77-82.

Central Bureau of Statistics (CBS) (2007). Central Bureau of Statistics, Economic Survey. Ministry of Planning and National Development. Republic of Kenya.Nairobi.

Christian Partners Development Agency (CPDA). (2008). Report on Small-Scale Tea Sector in Kenya. Kenya.

Clay, D., Reardon, T. and Kangasniemi, J. (1998). Sustainable Intensification in the Highland Tropics: Rwandan Farmers' Investment in Land Conservation and Soil Fertility. *Economic Development and cultural change,* 46: 351-377.

Clayton. (1964). Agrarian Development in Peasant Economics. Pergaman Press, London.

Croson, R. and Gneezy, U. (2008). Gender Differences in Preferences. *Journal of Economic Literature* 47:1–27.

Daberkow, S. G. and McBride, W. D. (2003). Farm and Operator Characteristics Affecting the Awareness and Adoption of Precision Agriculture Technologies in the US. *Precision Agriculture* 4:163–177.

Dimara, E. and Skuras D. (1998). Adoption of New Tobacco Varieties in Greece: Impacts of Empirical Findings on Policy Design. *Agriculture Economics,* 19:297 – 307.

Djojomartono, M. and Pertini, S. (1998) Present Status of Information Technology Utilization in Indonesian Agriculture. Bogor: The Asian Federation for Information Technology in Agriculture. Indonesia.

Doss, C. R. (2001). Designing Agricultural Technology for African Women Farmers: Lessons from 25 Years of Experience. World Development. Mexico.

Duncombe, R., & Heeks, R. (2001). Enterprise across the digital divide: Information systems and rural micro-enterprise in Botswana. Journal of International Development, 14(1). 61-74.

Ebrahim, J. (2006). Adoption Dairy Innovations: Its Income and Gender Implications in Adami Tulu District. Unpublished M.Sc. Thesis Alemaya, University. Ethiopia

Edriss, A. K. (2003). The Dynamics of Groundnut Production, Efficiency, Profitability and Adoption of Technology in Sub-Saharan Africa. The case of Malawi. International Publishers and Press. Malawi.

Elliott, H. (1987). *Diagnosing constraints in agricultural technology management systems*. Paper presented at the international workshop on agricultural research management. The Hague, Netherlands.

Export Processing Zones Authority (EPZA). (2005). Tea and Coffee Industry in Kenya. Nairobi, Kenya. Retrieved on March 1, 2012 from: *http://www.epzakenya.com/UserFiles/File/Beverages.pdf*

Eze, C. C., Ibekwe, U. C. and Mwajiuba P.O. (2006). Detrminants of Adoption of Improved Production Technologies Among Farmer in Enugu State of Nigeria. *Global Approaches to Extension Practice*, 2:37-44.

Fabyans, M.O. (1999) Cereal crop management in the Tropics, Hinad: Japan. Bureau of Agricultural Policies, Australia

Food and Agriculture Organization (FAO) of the United Nations. (2001). Agricultural and Rural Extension Worldwide: Options for Institutional Reform in the Developing Countries. Rome, Italy.

Gebremedhin, B., Jaleta, M. and Hoekstra, D. (2009). Smallholders, institutional services, and commercial transformation in Ethiopia. *Agricultural Economics,* 40:773-787

Gesimba, R., Lagat, M., Liu, G. and Wolukau, J. (2005). The Tea Industry in Kenya: Challenges and Positive Development. *Journal of Applied Sciences,* 5: 334-336

Granovetter, M.S. 1973. The strength of weak ties. *The American Journal of Sociology,* 78:1360-1380.

Gundu, M. (2006). The Impact of the Level of Literacy on Access to Information by Urban Black Women at Kariba, Zimbabwe. Unpublished Honors Paper. Zimbabwe.

Habtemariam, K. (1996). Agricultural Education, Research and Extension in Ethiopia: Problems and Linkages. Addis Ababa, Ethiopia.

Habtemariam, K. (2004). Agricultural Extension with Particular Emphasis on Ethiopia. Addis Ababa, Ethiopia.

Haddad, L. and Maluccio, J. A. (2003). Trust, Membership in Groups and Household Welfare: Evidence from KwaZulu-Natal, South Africa. *Economic Development and Cultural Change*, 51:573-601.

Heckman, J. J. (1979). Sample Selection Bias as a Specification Error**.** *Econometrica* 47:153-161.

Hedjazi, Y., R. Rezaee and N. Zamani. 2006. Factors affecting the use of ICTs by Iranian Agriculture Extension Specialists. *Journal of Extension Systems*, 22: 1-15. Retrieved on January 11, 2012 from: *<http://www.jesonline.org/2006jun.htm#Hedjazi>*

Hiller, S., Onduru, D. D. and De Jager A. (2009). Sustainable Tea Production; An Assessment of Farmer Field Schools in Kenya. Kenya

Hudson, D. and Hite, D. (2003). Willingness to Pay for Water Quality Improvements: The Case of Precision Application Technology. *Journal of Agricultural Resource Economics,* 27: 433–449.

Jackson, M. and Watts, A. (2002). The Evolution of Social and Economic Networks. *Journal of Economic Theory,* 106: 265-295.

Jaetzold R. ,Schmidt H and Shisanya. (2006). Farm Management Handbook of Kenya: Natural Conditions and Farm Management Information V 11/B (Rift Valley and Central Province). Ministry of Agriculture, Nairoibi, Kenya.

Kacharo, D. K. (2007). Agricultural Information Networks of Farm Women and Role of Agricultural Extension: The Case of Dale Woreda, Southern Nations, Nationalities and Peoples' Region. Msc Thesis in Rural Development and agricultural Extension, Haramaya University Ethiopia.

Karanja, D.D., Thomas S., Jayne and Strasberg, P. (1998). Maize Productivity and Impact of Market Liberalization in Kenya. Tegemeo Working Paper: Tegemeo Institute, Egerton University. Nairobi, Kenya.

Kathuri, J. and Pals, D. (1993). Introduction to Educational Research. Egerton University Njoro, Kenya. Educational Media Centre. Kenya

Katungi, E. (2006). Gender, Social Capital and Information Exchange in Rural Uganda IFPRI and Melinda Smale, IFPRI (International Food Policy Research Institute) CAPRi Working Paper (59), University of Pretoria.Uganda. Retrieved on March 01, 2012 from: <*http://www.capri.cgiar.org/pdf/capriwp59.pdf*>

Kenya Human Rights Commission (KHRC). (2008). A Comparative Study of the Tea Sector in Kenya: A Case Study of Large Scale Tea Estates. Nairobi, Kenya.

Kenya National Bureau of Statistics (KNBS). (2010). Kenya Population and Housing Census Statistical Abstract. Ministry of Planning and National Development, Nairobi.

Khan, S.A. (2005). Introduction to Extension Education in Memon, R.A. and E. Bashir (eds.). Extension Methods (3rd ed.). National Book Found, Islamabad, Pakistan.

Khan, Z. R., Midega, C. A.O., Amudavi, D. M., Hassanali, A., and Pickett, J. A. (2008c). On-Farm Evaluation of the 'Push-Pull' Technology for the Control of Maize Stemborers and Striga Weed in Western Kenya. *Field Crops Research,* 106: 224–233.

Kidd, A.D., Lamers, J.P.A., Ficarelli, P.P. and Hoffmann, V. (2000). Privatizing Agricultural Extension: Caveat Emptor. *Journal of Rural Studies,* 16: 95-102.

Kinyili, J.M. (2003). Diagnostic Study of the Tea Industry in Kenya. Kenya

Knox, A. and Meinzen-Dick, R. (1999). Property Rights, Collective Action and Technologies for Natural Resource Management. CAPRi Policy Brief Number 1. Washington, D.C.: International Food Policy Research Institute. Retrieved on January 14, 2012 from: <*http://www.cgiar.org/capri/pdf/polbrief_01.pdf*>

Lagat, J. K., Ithinji, G. K. and Buigut, S. K. (2003). Determinants of the Adoption of Water Harvesting Technologies in the Marginal Areas of Nakuru District, Kenya: The Case of Trench and Water Pan Technologies. Kenya.

Lamb, R. (2003). Fertilizer Use, Risk, and Off-farm Labor Markets in the Semi-Arid Tropics of India. *American Journal of Agricultural Economics,* 85: 359-371.

Lesaoana-Tshabalala, B. (2001). Agricultural Information Needs and Resources Available to Agriculturists and Farmers in A developing Country with Special Reference to Lesotho. M.Sc. Dissertation, Rand Afrikaans University, Faculty of Art, Department of Information Studies. Botswana.

Lwoga, E.T., Stilwell, C. and Ngulube, P. (2010). Access and Use of agricultural Information and Knowledge in Tanzania. Tanzania.

Mahaliyanaarachchi, P. (1995). Information Sources of the Tea Small Holdings Sector in Sri Lanka. Sri Lanka.

Mama, J. K. (2010). Access and Utilization of Agricultural Knowledge, and Information by Women Dairy Farmers: The Case of Ada'a District, Oromia Regional State, Ethiopia Unpublished Thesis. Ethiopia.

Mbigidde, V. (2011). Effect of Information Pathways on Small Scale Tea Production in Western Kenya. Unpublished Thesis. Kenya

Melkote, S. and Steeves, H. L. (2001). Communication for Development in the Third world. Theory and Practice for Empowerment (2nd ed.). Thousand Oaks, CA: *Sage Publications*.

Minja E., Ulicky E., Mfoi M., Marawiti M., Mziray H., (2004). Farmer group activity reports for DFID crop protection programme (CPP). Bean IPM Promotion Project in Eastern and Southern Africa. Retrieved on January 24, 2012 from: *<http//:www.ciat.org/Africa/pdf/ffd_sanjajjuu_Tan_Uun04.pdf>*.

Mohammed and Wanaso. (1993). Analysis of sources of farm Information: A case study of Farmers in the Western zone of Plateau State Agricultural Development project. *The Nigerian Journal of Rural Extension and Developmen,t* 1:49 – 55.

Mpawenimana, J. (2005). Analysis of Socio-Economic Factors Affecting The Production of Bananas In Rwanda: A Case Study of Kanama District. Rwanda.

Mugenda, O. and Mugenda, A. (1999). Research Methods. Quantitative and Qualitative Approaches. African Centre for Technology St udies. Nairobi, Kenya.

Munyua, H. (2000). Information and Communication Technologies for Rural Development and Food Security: Lessons from Field Experiences in Developing Countries. Sustainable Development Department (SD), FAO of the United Nations. Retrieved on November 12, 2011 from <*www. fao.org/sd/cddirect/cdre0055b.htm*>

Muvezwa, J. (2006). The Fifth factor. Africa Capacity Building. Harare, Zimbabwe.

Mwabu, G., Mwangi, W. and Nyangito, H. (2006). Does Adoption of Improved Maize Varieties Reduce Poverty? Evidence from Kenya. International Association of Agricultural Economists Conference. Gold Coast, Australia.

Mwaura, F. and Muku, O. (2007). Tea Farming Enterprise Contribution to Small holders' Well Being in Kenya; Tea Research Foundation of Kenya. AAAE Conference Proceedings.

Neelameghan, A. (1981). Some issues in information transfer: A Third World perspective. *Journal of International Federation of Library Association and Institute,* 7: 8-18.

Negash, R. (2007). Determinants of Adoption of Improved Haricot Bean Production Package on Alaba Special Woreda, Southern, Ethiopia. Unpublished Thesis. Ethiopia. Retrieved on December 12, 2011 from: <*http://results.waterandfood.org/bitstream/handle/10568/682/Thesis_NegashDeterminants.pdf*>

Nkonya, E., Schroeder, T. and Norman, D. (1997). Factors Affecting Adoption of Improved Production Technologies and Interface of Out-Reach Efforts with Farmers. *Journal of Agricultural Resources,* 46(1).

Nyangito, H. O. (2001). Policy and Legal Framework for the Coffee Sub-Sector and the Impact of Liberalization in Kenya. KIPPRA Policy Paper No. 2. Nairobi, Kenya.

Obinne, C. (1991). Adoption of Improved Cassava Production Technologies by small Scale Farmers in Bendel State. *Journal of Agriculture, Science Technology,* 1:12-15.

Odoemenem, I.U. and Obinne, C.P.O. (2010). Assessing the Factors Influencing the Utilization of Improved Cereal Crop Production Technologies by Small Scale Farmers in Nigeria. *Indian Journal of Science and Technology* 3(1).

Ofuoku, A.N., Emah, G.N., & Itedjere, B.E. (2008). Information utilization among rural fish farmers in central agricultural zone of Delta State, Nigeria. *World Journal of Agricultural Science , 4:*558 – 564.

Okwu, O.J and Iorkaa, T.I. (2011). An Assessment of Farmers' Use of New Information and Communication Technologies as Sources of Agricultural Information In Ushongo Local Government Area, Benue State, Nigeria. *Journal of Sustainable Development in Africa,* 13(2).

Opara U. N. (2010). Personal and Socio-Economic Determinants of Agricultural Information Use by Farmers in the Agricultural Development Programme (ADP) Zones of Imo State, Nigeria, PhD Thesis. *Library Philosophy and Practice.*

Opara, U. N. (2008). Agricultural Information Sources Used by Farmers in Imo State, Nigeria Information Development. *SAGE Publications* 24(4).

Othieno, C.O. (1994). Agronomic Practices for Higher Tea Productivity in Kenya. Proceedings of the International Senimar on Integrated Management in Tea: Towards Higher Productivity. Colombo, Sri Lanka, April 26-27th, 1994 pp 79-85.

Owuor, P. O Kovoi, M.M. and Siele, D.K. (2001). Assessment of Technological and Policy Factors Impending Production of Green Leaf in Smallholder Tea Farms of the Kenya Tea Industry. An Assessment of Farmers Awareness and Adoption Levels of Technologies. Report Submitted to Africa Technology Policy Studies Network. Nairobi, Kenya.

Owuor, P. O. (2005). Tea in East Africa: In Global Advances in Tea Science. New Age International Limited, New Delhi, India, pp 171-188.

Owuor, P. O., Kavoi, M. M., Wachira, F. N., and Ogola, S. O., (2008). Sustainability of Smallholder Tea Growing in Kenya. Country Report. Kenya.

Ozowa, V.N. (1995). Information Needs of Small Scale Farmers in Africa: The Nigerian Example. Quarterly Bulletin of the International Association of Agricultural Information Specialists, IAALD/CABI 40 (1).

Parr, J. F., Papendick, R., Youngberg, I. G. and Meyer, R. E., (1990). Sustainable agriculture in the United States. In Sustainable agriculture systems (eds): C A Edwards, R Lal, R. Madden, R H and G Hose 50-67. Ankeny, IA: Soil and Water Conservation Society.

Peterman, A., Behrman, J. and Quisumbing, A. (2011). A Review of Empirical Evidence on Gender Differences in Non-Land Agricultural Inputs, Technology, and Services in Developing Countries. ESA Working Paper No. 11-11. Food and Agriculture Organization of the United Nations. Retrieved on February 25, 2012 at *<http://www.fao.org/docrep/013/am316e/am316e00.pdf>*

Pipy, F. O. (2006). Poultry Farmers' Utilization of Information in Lagelu Local Government Area, Oyo State of Nigeria. *International Journal of Poultry Science,* 5:499-501. Retrieved on December 20, 2011 from: *<http://www.pjbs.org/ijps/fin542.pdf>*.

Place, F., Adato, M., Hebinck, P., Omosa, M. (2005). The Impact of AgroForestry-Based Soil Fertility Replenishment Practices on the Poor in Western Kenya. IFPRI, Resaerch Report No. 142.

Preve, J. (1999). Algunos temas de pol´ıtica agr´ıcola para el futuro. Anuario 99. OPYPA, Ministerio de Ganader´ıa, Agricultura y Pesca, Montevideo, Entrelineas ltda.

Rogers, E.M., (1995). Diffusion of Innovations. Free Press, New York.

Roling N. and Engel, P. (1991). The Development of the Concept of Agriculture Knowledge and Information Systems. In Rivera W. Gustafson M (eds). Agriculture Extension: Worldwide Institution Evolution and Faces for Change. Elsevier, Amsterdam.

Rono, W. K and Wachira, F. N. (2005). Tea Research and Technology Development: Current Status, Future Strategies and Potential Institutional Collaboration in Kenya. P 8535- 850

International Symposium on Innovation in Tea Science and Sustainable Development in the Tea Industry. Conference Proceedings at Hangzou. China.

Roy, B.C., Bhogal, T.S. and Singn, L.R. (1999). Tenancy and Adoption of New Farm Technology: A Study in West Bengal, India. *Bangladesh Journal Economics*, xxii 1(1999): 39-49.

Rutto, J. K. (1996). Strategies for Financing Tea research in Kenya Forum on "Strengthening Partnership of Agricultural systems for Rapid growth in Kenya", Whitesands Hotel, Mombasa, Kenya.

Salomon, L. and Engel, (1997). Networking for Innovation: A Participatory Actor-Oriented Methodology. Royal Tropical Institute, KIT Press, Amsterdam, Netherlands.

Samuel, G. S. (2001). The Development of Integrated management Information Systems for Agricultural Extension Institutions of Developing Countries: The Case of Oromia Agricultural Development Bureau of Ethiopia. Aachen, Shaker, Ethiopia.

Santos, A and Reynolds, J. (1999). Cronbach's Alpha. A tool for assessing the reliability of scale online. Retrieved April 19, 2012, from http//: *www.joe.org/joe/1999*

Schnitkey, G., Batte, M., Jones, E. and Botomogno, J. (1992). Information preferences of Ohio commercial farmers: Implications for extension. *Amsterdam Journal of Agricultural Economic,s* 74: 486-497.

Semana A. R., Mangheni M. N. and Kibwika P. (2000). Approaches, Methods, Techniques and Required Resources for Effective Skills Development for the National Agricultural Advisory Services. Faculty of Agriculture, Makerere University, Kampala.

Shepherd A. W. (2001). Farm Radio as a Medium for Market Information Dissemination. First International Workshop on Farm Radio Broadcasting. FAO, Rome, Italy.

Simpson, B.M. and M. Owens. (2002). Farmer Field Schools and the Future of Agricultural Extension in Agrica. *Journal of International Agricultural and Extension Education,* 9:29-36.

SOMO. (2008). Sustainability Issues in the Tea Sector: A Comparative Analysis of Six Leading Producing Countries. Amsterdam, Netherlands.

Sudath, A. (2008). The Role of Information Technology in Disseminating Innovations in Agribusiness. A comparative Study of Australia and Sri Lanka.

Tadesse, D. (2008). Access And Utilization Of Agricultural Information By Resettler Farming Households: The Case Of Metema Woreda, North Gondar, Ethiopia.

Tawari, C.C. (2006). Effectiveness of Agricultural agencies in fisheries management and production in the Niger Delta. Doctor of Philosophy Unpublished Thesis. Rivers State University of Science and Technology, Port Harcourt, Nigeria.

Tea Board of Kenya (TBK). (2012). Ushering in 2012 with Optimism. Nairobi, Kenya. Retrieved on February 14, 2012 from: <*http://www.teaboard.or.ke/news/2012/21feb2012.html*>.

Tea Research Foundation of Kenya (TRFK). (2005). Tea Research Foundation of Kenya Annual Report for the year 2004. Kericho, Kenya.

Tea Research Foundation of Kenya (TRFK). (2011). Strategic Plan 2010-2015. Retrieved on February 14, 2012 from: <*http://www. www.tearesearch.or.ke* >

Tilvawala, K. and Myers, M. (2009). Information Literacy in Kenya. The University of Auckland Information Systems and Operations Management Owen G. Glenn Building Auckland, New Zealand. *Electronic Journal of Information Systems in Developing Countries,* 1: 1-11.

Venkatesan, V. (1995). The World Bank's experience with T & V in Africa: issues for the future agricultural extension in Africa. Proceedings of an International Workshop, Yaoundé, Cameroon. The Netherlands: Technical Centre for Agriculture and Rural Cooperation. Netherlands.

Winter-Nelson, A. and Temu, A. (2002) Institutional adjustment and transaction costs: product and inputs markets in Tanzanian Coffee System. *World Development,* 30: 561-574

World Bank (2008). Agriculture for Development; World Development Report 2008. Washington: World Bank.

Yamane, T. (1973). Statistics: An Introductory Analysis. Harper International, Tokyo.

Yenealem, K. (2006). Gender Disparities in Adoption of Improved Maize varieties between Male Headed and female Headed Households in Kuni woreda, Western Haragwe Zone, Ethiopia.

APPENDICES

APPENDIX A: A Questionnaire on Access and Use Information by Small Holder Tea Farmer in Bureti District, Kenya

Dear respondent,

I am Rosephy Cheptoo Koskei, a second year student at Egerton University undertaking a master's degree in Agricultural Information and Communication Management. The study is for academic purposes and the main objective is to increase tea production through efficient access and use of tea production information. The information you provide would be useful in understanding how to improve access and use of tea production so as to increase yields. The information you provide will then be treated with utmost confidentiality. Your assistance in answering the questions truthfully and accurately will be highly appreciated.

Questionnaire No. ……

Name of the factory: ……. …… …….

Name of the Tea Buying center: ……No……..

Name of respondent……

Date……

SECTION A: Background Information

1. Gender: 1=Male ☐ 2=Female ☐
2. Age: ……(years)
3. Education level: ……(years)
4. Marital status: 1=Single ☐ 2= Widowed ☐ 3=Divorced ☐ 4= Married ☐
5. Household Size: ……
6. Do you have other source of income apart from tea farming?

   1= Yes ☐ 2= No ☐
7. What is the approximate size of your land ……? (hectares)

8. Under what land ownership is your land? 1=Squatter ☐ 2=Hired ☐ 3=Borrowed ☐ 4=Communal ☐ 5=Own land without title deed ☐

   6=Own land with title deed ☐

9. For how long have you been practicing tea farming? ..... (years)

10. What is the production pattern of your farm?

    a. Crops. …….(hectares)

Crop Type	**Hectares**	**Yields**	**Units**
Tea			
Maize			
Beans			
Pineapple			
Others (specify)			

    b. Pasture ……. (hectares)

Livestock	**Breed**	**Number**
Cattle		
Sheep		
Others (specify)		

11. Are you a member of community associations or groups? 1=Yes ☐ 2=No ☐

SECTION B: Tea Specific Information

12. What is the approximate distance from your house to the tea buying center? ..... (Metres) ……. (Minutes spent in a one-way walk)

13. What has been your tea yield harvest in the last (kg/ha)?

    (1) One year……(year ended 2011)

    (2) Two years……(year ended 2010)

14. What has been the trend of tea yield in the last years?

    1=Decreasing ☐ 2=Increasing ☐ 3=Stagnated ☐

15. If decreasing, what are the reasons?

    1=Climatic factors ☐ 2=Biotic factors ☐

    3=Others (specify)…….

16. Do you have knowledge on the existence of tea production information?

    1=Yes ☐ 2=No ☐

17. What is your priority source of information on tea and agriculture related activities which you get?

    1= Extension agents ☐ 2= Radio ☐ 3= Television ☐ 4=Internet ☐
    5= Fellow farmers ☐ 6= Others (specify)……..

Thank you for providing this information

******END******