

An Evaluation of the Influence of Information Sources on Adoption of Agroforestry Practices in Kajiado Central Sub-County, Kenya

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Abstract Access to information on agroforestry is a key transformer to agricultural productivity. This study was undertaken to find out Information Communication and Technologies (ICTs) sources and factors influencing access and use of these information sources by smallholder agroforestry farmers in Kajiado Central, sub-County in Kenya. A survey of 67 respondents was analyzed using Chi-square at 0.05 levels of significance to determine relationship between socio-economic characteristics of households and access to agroforestry information sources. The results showed 53.7 % of the farming households used face to face communication namely; neighbours and friends, extension agents and group meeting, while 34.1 % actively used ICTs information sources namely; radio, television, telephone and internet; and 28.8 % used demonstrations and publicity events to disseminate (one way) or share (receive and send feedback) information on agroforestry practices. Land size, secured land tenure, education level, monthly income and distance to the shopping centre were socio-economic factors found statistically significantly difference ($p < 0.05$) and positively influencing farmers' access to sources of agroforestry information. The study recommends policy makers, planners and implementers to empower farming households through capacity building, incorporating ICT devices, supporting farmers to farmers meetings to promote agroforestry practices in Kenya.

Keywords Agroforestry, Information Sources, Socio-economic Factors

1. Introduction

Globally, farmers constantly seek agricultural information to increase production and overcome challenges of reducing land productivity potential. In Kenya, research institutions, universities, agricultural based firms and financial

institutions are core agricultural information sources available to farmers through various other information platforms that integrate ICT devices [1]. These institutions are essential knowledge base as they hold diverse agroforestry information and research findings as well as relevant skills developed to improve agricultural and industrial practices.

In the past three decades or so, agroforestry practices [2], was promoted through pilot projects targeting communities in Kajiado sub-County, Kenya to embrace sustainable land use systems [3]. On farm tree planting in form of woodlots, silvi-pasture and apiculture with trees, wind breaks, boundary planting, fodder banks, and fruit orchards are some of the agroforestry farming systems adopted in the area of this study. These practices, plotted by either the government ministries or private sector are either modification of an existing practice more novel to farmers. The aim is to conserve the drylands through increased vegetation cover, provision of fodder [4] and wood fuel, soil protection, food security as well as lessen negative effects of climate change [5, 6].

Adoption of agroforestry practices in the recent years made tremendous strides though many of the success stories appear to be confined to small areas. This infers that in terms of its wider application there exist challenges which are not well documented. "Reference [7] proposes that adoption of agroforestry practices like any other innovation is a process influenced by a number of both physical and social factors".

This study identified influencing factors that include; gender of farmers, land size, level of education, farmers' experience, farmers' association, contact with research and extension, land tenure, agro-ecological zone, distance to nearest center, and farmer's income.

Agroforestry practices and knowledge are transmitted via traditional means; personal communication, impersonal documents e.g. mails and memos; extension agencies, face-to-face meetings, publicity events and demonstrations farms. According to reference [8], the 21st Century saw

emergency of modern communication pathways that range from simple to more rich and modern tools which use ICTs. Overall, these ICTs such as computers, GPS systems, mobile technologies, satellite radios, and TVs, World wide web in the agroforestry value chain to mention but a few, have expanded networking and transmission of complex electronic data, and bulky agricultural information to wide and diverse audiences [9], increasingly putting a premium on intellect and knowledge as the dominant factors of production. This is a major change that is reshaping the farming household's economy.

“Reference [10] argues that ICTs are relatively complex unless farmers using are educated to utilize these tools for acquiring information efficiently and cost-effectively”. Similarly, in a people-centered participation approach of communication, identification of networks of information flow provides deeper insight into the pattern of information exchange in the farming community [11].

Adoption of agroforestry practices in Kenya is disadvantaged by adverse policies, legal constraints and lack of coordination between the governmental sectors to which it contributes; namely, agriculture, forestry, rural development, environment and trade. Aspiration of agriculture policies in Kenya since independence has generally has been to attain self-sufficient in basic food production for domestic consumption and export, generate farming incomes, expand strategies and levels of profitable and efficient food production. Buttoud [12] observe that agroforestry has not been addressed sufficiently in policy formulation, and nor has it been integrated into land-use planning or rural development programmes. Thus, the potential of agroforestry to enrich farming communities and national economies has not been fully exploited.

1.1. Problem Statements

Kenya's economy is heavily dependent on agriculture which on the other hand is the leading driver of deforestation [12]. Agricultural research institutions, universities and colleges, public and private agricultural based firms as well as financial institutions are the basis of policies that informs and guide farming decisions so as to impact positively on the desired farming goals.

Vision 2030 blue-print [13], a Government of Kenya's Policy document, prods a growing concern among farmers engaged in the tree growing and tree/crop inter-growing on-farm. This type of agroforestry system [14] shows many challenges that include limited access to information source and inadequate knowledge on tree/crop growing on-farms precisely in Arid and Semi-Arid Area (ASALs).

Few studies have been undertaken to investigate how

information sources publicize information for adoption of agroforestry practices within farming communities. Most of this information is derived mostly from biophysics such as soil erosion control. Consequently, many farmers are poorly informed as they do not understand extension factors that lead to agroforestry practices. It is therefore of great concern that information, through ICT, on factors influencing adoption of agroforestry practices is insufficient and should be studied.

1.2. Objective of the Study

The broad aim of the study was to identify the ICT information sources used in the adoption of agroforestry practices and what factors influence the use of these information sources by smallholder agroforestry farmers in Kajiado Central, sub-County.

1.3. Research Questions

This study sought to answer the following questions:

- 1.3.1. Is there positive correlation relationship between the available ICT information sources and agroforestry practices among small-scale farmers?
- 1.3.2. Do socio-economic factors affect the farmers' access to sources of ICT information?

2. Methodology

2.1. Study Area

The study was carried out in Kajiado Central sub-County in the southern part of the Great Rift Valley. The sub-County covers about 21,105 Km². It is divided into five administrative divisions namely: Central, Bissil, Namanga, Elangata wuas and Ildamat [15]. The sub-County neighbours Mashuru to the East, Republic of Tanzania to the South West, Loitoktok sub-County to the South East, Makueni sub-County to the North East, Isinya sub-County to the North and Kajiado North sub-County to the North West.

About 50 per cent of the sub-County lies in semi-arid zones (zones AEZ-V, 37 per cent under AEZ-IV and 80 per cent under AEZ II-IV [16]. The rainfall pattern is bi-modal with long rains falling in between March and May and the short rains falls between October and December. The sub-County receives between 500 to 800 mm average annual rainfalls while maximum rainfall is estimated at 1,250mm per annum.

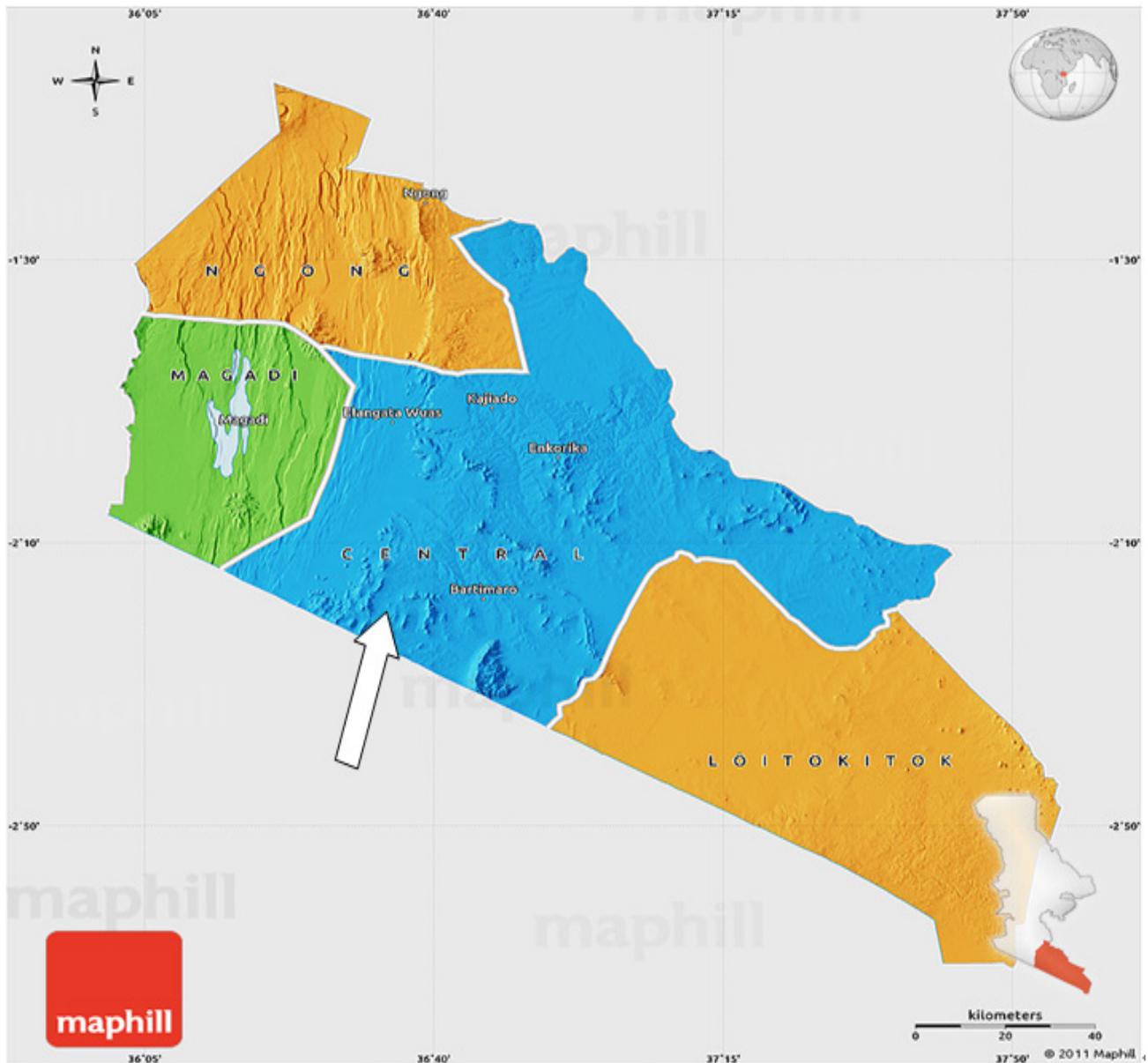


Figure 1. Map of Kajiado County with arrow showing the Central sub-County [17]

This sub-County was purposely selected for this study because it is one of the ASALs areas in Kenya where tree growing technologies were predicted to cascade during the implementation of Social Forestry Training Project (SFTP), a joint project formulated in 1987 between Kenya and Japan Governments [18]. Kitui and Makueni sub-Counties were the focal points where the project developed tree planting technologies to improve provision of forest products and the livelihoods of the inhabitants [19,20]. These sub-Counties experience erratic change in land use, dynamic agricultural and livestock productivity, low incomes and poverty [21]. Initially, majority of the land in Kajiado Central sub-County was communally owned by Maasai pastoralist who engaged largely in livestock production but lately the land is being subdivided into individual small farm holdings. The new land use arrangements coupled with social and economic changes has placed the community in a transition lifestyle

[22]. This new land system, aggravated by recurrent drought and other climatic changes presents distinctive problems to the farming community and the existing natural resources.

For instance, indigenous tree species that dominated the area, some conserved into fodder banks for use during dry spell are threatened by land degradation and human activities such as charcoal production, clearance for structures or conversion to agricultural uses. This diverse shift of farming system provided a good entry into the study.

2.2. Research Design

This study used a non-experimental research design where a survey [23] was conducted to measure responses from small-scale farming households practicing agroforestry within Kajiado Central sub-County. Munyua [24] defines small-scale farmers as growers that derive their livelihood

from holdings of less than 2–5 acres (usually less than 2 hectares). Therefore most of the study respondents were smallholder farmers (98.2%) having a farmland ranging between less than 1 and 3.5 hectares.

2.3. Sampling and Sample Size

Population for this study was 201 small-scale farming households registered by Kenya Forestry Service (KFS) in the sub-County. A sample size of 67 heads of households which was about 30% of smallholder farmers were selected using a simple random sampling method [25].

Snowball sampling method was used to select respondents who gave multiple referrals of whom only one subject was interviewed amongst them. These households are sparsely distributed within the sub-County whose population density is 22 per Km². Thus, the choice of the new respondent was guided by factors such as social networks, accessibility and the level of farmer's willingness to respond.

2.4. Data Collection and Analysis

Primary data comprising respondents demographic attributes; age, gender, level of education, monthly income, and land size; socio-economic factors; and information sources sought by farmers was collected using semi and close-ended structured questionnaire. The questionnaire was pre-tested before administration between April and June 2014. Similarly, secondary data consisting of information from literature, and reports with relevant information was referred to.

Descriptive statistical analysis including frequency distribution, percentage, cross tabulation, mean and standard deviation (SD) were used for data analysis using Statistical Program for Social Scientists (SPSS) version.

Data was analyzed using descriptive statistics that

involved the use of frequency distributions. Pearson Chi-square test (χ^2) and regression analysis was used to test statistical significance (differences) between the farmers' socio-economic and specific characteristics variables and results presentation in tables, graphs and charts.

3. Results and Discussions

Results from this study show that the small scale farming households in the sub-County access agroforestry knowledge and practices from sources both ICTs communication channels [26]; such as mass media, with minimal use of social media and primary sources; research institutions, universities; Agricultural based firms and financial institutions as well as other secondary sources; farmers to farmers meeting, neighbours and extension agents, that are the most frequent used information sharing platforms.

3.1. Information Sources

The outcome of the respondents query on information sources and the reasons for interaction shows ICTs enabled knowledge exchange amongst the farming households thus increased farmers' awareness of information on agroforestry practices (Table 1). Of the respondents, 81.8% accesses mass media which include radio and television and 6.8 % regard it credible. Extension agents, individual farmers are highly accessible with 87.8% and 81.8% respectively. Both research institutions and Universities are the least accessible but they offer credible and appropriate information. Test statistic show p-value is $< \alpha=0.005$ indicating an interaction between farming households and the listed information sources.

Table 1. Information sources and reasons for interaction

Source of the information	Reasons for interacting					
	Credibility (%)	Appropriateness (%)	Accessibility (%)	Ease to use (%)	Not sure (%)	Total (n)
Universities	57.1	28.6	2.0	0.0	12.2	49
Research institution	30.6	57.1	0.0	0.0	12.2	49
Financial institutions	20.0	2.2	20.0	4.4	53.3	45
Mass media	6.8	0.0	81.8	6.8	4.5	44
Agricultural based firms	6.1	30.6	57.1	0.0	6.1	49
Individual farmers	4.1	6.1	87.8	2.0	0.0	49
Internet	2.0	2.0	20.0	70.0	6.0	50
Extension agents	0.0	2.1	93.6	2.1	2.1	47
Test Statistics; $\chi^2= 549.346$; d.f = 28; p = 0.00						

3.2. Communication Channels

Table 2 shows the frequency and %age of secondary information sources that incorporate ICTs used to access information on agroforestry practices. Neighbours, friends and extension agents with average 53.7 % respondents used face to face communication channels. On average 34.1% used ICTs namely radio, television, telephone and internet, and 28.8 % on average relied on demonstration and publicity events.

Table 2. Frequency of Communication channels used in sharing agroforestry information

Channel	Frequency	%	Total
Neighbour and friends	45	67.1	100
Group meetings	40	59.7	100
Radio programmes	39	58.2	100
Agricultural publicity events	38	56.7	100
Agricultural publications/reports	31	46.3	100
Extension agents	23	34.3	100
Internet and blogs site	20	29.8	100
TV news and related programs	19	28.4	100
Research centers demos	19	28.4	100
Telephone	14	20.9	100
Church	1	1.5	100

3.3. Communication Pathways Levels of Influence

This study found ICTs, neighboring farmers, extension agent and group meetings were highly influential communication channels used by the households (Table 3). Since the p-value is less than $\alpha=0.05$ we conclude that there is statistical significance and the level of influence by the communication pathways is significant.

Table 3. Use of ICTs on adoption of Agroforestry practices from institutions

Source of Agro-forestry information	Do you use ICTs devices while seeking agroforestry information			Total (%)
	Yes (%)	No (%)	Total (n)	
Research Institutions	81	19	26	100
Universities	88	12	17	100
Agricultural business firms	77	23	13	100
Financial Institutions	100	0	1	100
Test statistics: $\chi^2=0.932$; d.f. =3; p=0.818				

The result Chi-square value $\chi^2=0.932$, probability p = .818 ($\alpha=0.05$) show relationship between the information sources and adoption of agroforestry practices within smallholder agroforestry households. This verifies tree planting on farm has impacted on the quality of life, since 84.2 % of the

respondents indicated they benefited with tree products e.g. fuelwood, herbal medicine, fruits, soil control, protection (fencing and shade), and aesthetic.

Regression analysis also show statistical significance between use of ICTs as sources of information and adoption of agro-forestry practices; that is, the adoption of agro-forestry practices is dependent on farmers' interaction with institutions.

This study established that farming households' socio-economic factors such as level of education, tenure of land, land size, net monthly income, and distance to the shopping centre affect farmers' access to information sources. A cross tabulation using Chi-square significant ($\alpha=0.05$) shows a significant relationship between sources of agro forestry information and these socio-economic factors.

Contrary, there is no significant relationship between the type of house and period of settlement and access to information sources (Table 4). The Chi square formula used is as follows:

$$\frac{(Observed - Expected)^2}{Expected}$$

Table 4. Relationship between socio-economic factors and access to information sources

Socio economic factors	Chi-Square	df	Asymp. Sig. (a=0.05)
Level of education	10.429 ^a	3	.015
Type of house	5.778 ^a	4	.216
Tenure of land	11.097 ^a	2	.004
Period of settlement	6.786 ^a	3	.079
Land size (acreage)	47.019 ^a	30	.025
Net monthly income	9.514 ^a	1	.002
Distance to the nearest shopping centre	10.827 ^a	4	.029
Other farming practices/animal husbandry	26.782 ^a	12	.008

4. Conclusions

This study has revealed that social interactions between neighbouring farmers, contacts with extension agents and use of ICTs are essential in adoption of agroforestry practices. Integrated agroforestry systems are increasing on farms in the form of boundary marking, home gardens, woodlots, pasturelands and alleys cropping [27]. Results shows that adoption of agroforestry practices can be strengthened by promoting regular farmers-to-farmers dialogue as observed by Frenzel and Kiptot[28,29] who noted that farmers are the prime agents of change in their respective communities.

The socio-economic variables studied indicate they affect the farmer's decision to adopt agroforestry. For instance, low formal education (21 %) and poverty is a hindrance to

adoption of agroforestry practices. Household heads above 49 years, who are mainly decision-makers, should be sensitized on the risks of deforestation, negative effects of climate change and the importance embracing farm forestry.

5. Recommendations

Reflecting on the findings of this study, agricultural institution should engage more in development of intervention as well as realistic strategies for disseminating and assessing technologies transfer. The change agents should improve their communication skills and avoid the use of excessive media or theoretical trainings which at times are ineffective to the intended audience.

The government working jointly with other development partners should; promote use of ICTs in agriculture and put in place pro-active policies to promote on-farm forestry; to mitigate the negative impacts of climate change; reduce the imbalance in the market of forest products such as timber, poles and posts and alleviate poverty [30]. Consequently, these policies should optimize awareness creation through multidisciplinary approaches that supports infrastructure and economic empowerment, and cascaded to the grass root level for ownership and implementation.

Finally, considering that data was captured from a sample of small farm holders and that some households declined to respond on matters of land and incomes, this made it impossible to draw a firm conclusion. Thus, further studies are recommended using a wider ecological unit of farming households and more so with household owning more acreage of land within the county to predict whether they follow the same pattern when adopting agroforestry practices.

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