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RELATIONSHIP BETWEEN ADVISORY SERVICES AND ADOPTION OF AGRICULTURAL INDIGENOUS PRACTICES IN CHUKA SUB-COUNTY, KENYA

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ABSTRACT
Adoption of agricultural indigenous practices (AIPs) holds the promise for agricultural and environmental sustainability. However, the adoption rate has been low among smallholder farmers for decades. Level of advisory services (ASs) accessibility has been documented as one of the key drivers of adoption. However, little information exists to show the relationship between access to ASs and adoption of AIPs in Chuka sub-County. Therefore, the objective of the studyintended to generate factual information regarding the relationship between access to ASs and AIPs adoption among smallholder farmers in the said sub-County. Data was collected from 100 farmers through stratified sampling. Percentages, mean, frequencies, standard deviation, and simple Pearsoncorrelationwere used to analyze data at $p<0.05$. Results of Pearson correlation indicated a significant positive relationship between access to ASs and adoption of AIPs ($r = 0.51$, $p = 0.01$). Conversely, ASs were rated as inaccessible. Further, the study revealed that radio was the most widely used source of information. It was concluded that access to ASs influenced adoption of AIPs among farmers since the relationship was significant. It was therefore, recommended that County government should formulate policies and incentives to enhance access to agricultural ASs towards the adoption of AIPsforagriculturalandenvironmentalsustainability.Countygovernmentshouldalsostepupsupportforextension education and trainings for effective adoption of AIPs among farmers.
Keywords: Adoption, agricultural indigenous practices, radio, accessibility, advisory services, smallholder farmers

INTRODUCTION

Growing human population has led to significant changes in global food production systems characterized by unsustainable conventional farming practices (Tyagi *et al.,* 2014). In order to meet this burgeoning pressure on the planet earth, farmers ought to focus more on practices that mayenhance the processes of sustainability (Abdullah & Hassan, 2015). Therefore, much effort is being made into using indigenous knowledge-based practices as a coping strategy, to monitor, mitigate and adapt to climate related problems. Application of practices that enhance a balance between nutrient inputs and outputs has gained prominence among farmers (Patil *et al.*, 2014). Agricultural indigenous practices (AIPs) boost soil nutrients and soil structure. Chaudhry (2011; Glasson *et al.*, 2010) observed that AIPs are locally developed farming system and are adopted by farmers in a particular agro-ecological zone. Agroforestry, crop rotation, intercropping, organic manure, and minimum tillage are widely applied AIPs.

Agroforestry and minimum tillage promote soil carbon enrichment (Lorenz & Lal, 2014) and reduce soil erosion (Sepúlveda & Carrillo, 2015). Crop rotation and intercropping, unlike monoculture, discourages soil degradation, crop pests and diseases, and vulnerability to impacts of climate variability (Andres *et al.,* 2016). Additions oforganic manure have also been confirmed to boost soil nutrient such as phosphorus availability in the soil (Rick *etal.* 2011). Despite the benefits of AIPs, research has shown that AIPs have been less popular among farmers in the recent times (Godfray *et al.,* 2010). Andersson and D'Souza (2014) posited that contextual factors are key determinants in the adoption of farming technologies within smallholder farms. Among the socio-economic factors influencing application of AIPs include access to advisory services (ASs). Farmers receive agricultural information from a variety of sources; informal, private, and public advisory service systems (Elahi *et al.,* 2018).

Contact to agricultural information through extension services enables farmers to analyze and adopt farming technologies (Al-Hassan *et al.,* 2013). Therefore, poor access to ASs is a major constraint to the adoption of various AIPs (Mwase *et al*., 2015). Better access to ASs implies improved access to information resource hence, better adoption rate (Faure *et al.,* 2012). As observed by Al-Hassan *et al.* (2013 exposure to agricultural information enabled farmers to effectively analyze and adopt better agricultural innovations to improve their farm productivity (Ketema & Bauer, 2012). Radio, television, and farmer-to-farmer contacts are some of the media of communication to farmers. They are perceived to be cheaper, and readily available in most homes (Chhachhar *et al*., 2014).

In Kenya, previous research demonstrated positive and negative effects of various socio-economic factors on adoption of AIPs (Alufah *et al.,* 2012; Nyaga *et al.,* 2015; Recha *et al.,* 2015). Previous studies also indicated that determinantsofAIPsadoption,variedconsiderablydependingonthespecificregionshence,location-specific studies would be more appropriate (Tambo & Mockshell, 2018). However, a gap exists in regard to the relationship between access to advisory services, and adoption of AIPs; crop rotation, agroforestry, intercropping, organic manuring, and minimum tillage in Chuka sub-County. Therefore, the current study intended to gather factual information that would help to address this gap and improve the adoption of AIPs among smallholder farmers for agricultural and environmental sustainability in the said sub-County.

ConceptualFramework

This study reflected that access to advisory services is a fundamental aspect in the adoption of AIPs. The term advisory and extension services can be used interchangeably as synonyms (Faure *et al*., 2012). Thus, ASs are systems that increase access of farmers, and other actors to knowledge, information and new technologies. Notably, these services can be obtained from various sources; public, private, and farmer-based organizations. Further, the levelofaccessvaries withthe typeofinformationsources(Prager *etal*.,2016;Dunne *etal*.,2019).Therearequitea number of communication tools; radios, television, internet, and mobile phones (Abid *et al*., 2016; Ishida *et al*., 2018; Ragasa *et al*., 2016; Temba *et al*., 2016), and that they have different levels of coverage in terms of information needs. Poor access to extension services among farmers is thought to be a latent hinderance to adoption of AIPs (Mtega, 2012), as shown in Figure 1.

Figure1:ConceptualFramework

ResearchObjective

Thestudywasguidedbythefollowingobjective;

To determine the relationship between access to advisory services and adoption of agricultural indigenous practices among smallholder farmers in Chuka sub-County.

RESEARCHMETHODOLOGY

StudyAreaandParticipants

The study was carried out in Chuka sub-County. Majority of farmers apply AIPs in various forms. The sub-Countyis an agro-ecological zone located on upper midland with an altitude of about 1,500mabove sea level (Okeyo *et al*., 2014). The area is characterized by smallholder livestock and crop farmers (Mucheru-Muna, 2007). A study sample of 100 farmers was used. According to Fraenkel *et al*. (2015) a sample size of 100 participants is essential for a survey study. Farmer population was stratified into Wards (Mugwe, Karinagni, and Magumoni) from which the study participants were randomly selected.

DataCollection

Adescriptive correctional design was used to describe the relationship between access to ASsand adoptionof AIPs. Lodico *et al.* (2010) observed that descriptive design is useful where the research has no control on the independent

variable. The study utilized a structured questionnaire to collect data from farmers practicing AIPs. As observed by Muchunku(2014), the questionnaire gives considerable advantage inapplicationand provides a stimulus capacityto a large audience. Before the actual study, a pilot study was conducted in Muthambi Ward where farmers have the samesocio-economiccharacteristicsasthoseinthestudyarea.Thepilotstudysamplewas15%offullsample,(*n* =18). According to Hazzi & Maldaon (2015) in social sciences, a sample of 10-20% of full sample is acceptable. Results from the pilot study were used to ensure validity and internal consistency of research instrument. The alpha values of adoption of AIPs was 0.68 while that of access to advisory services was 0.89. Moorthy *et al*. (2012)posited that in social sciences, Cronbach alpha coefficient of at least 0.60 is acceptable.

DataAnalysis

The dependent variable was adoption of AIPs and the independent variable was access to advisoryservices.Access to advisory services was measured using a five-point Likert- type items; *1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree* (Garson, 2012).Adoption of AIPs was measured using a summated score of fiveitemsona scale; *1 =notatall,2 =verylow,3 =low,4 =high,5 =veryhigh*.Themean scoresoftheconstruct items were statistically analyzed to determine the relationship between independent and dependent variables.

Data was analyzed using statistical package for social sciences (SPSS V.22). Descriptive (frequencies, percentages, mean, and standard deviation) and inferential (simple Pearson correlation and multiple linear regression) statistics wereusedtoanalyzedata.Todeterminethe directionandthestrengthoftherelationshipbetweenaccesstoadvisory services and adoption of AIPs, a Pearson's correlation was used. Pearson correlation coefficient indicates the strength of linear relationship between two variables, denoted by *r* (Liu *et al*., 2004; Puth *et al*., 2014). The correlations were checked at 95% level of significance level, $p < 0.05$. Linearity was assessed using a scatterplot (Garson, 2012). It was found that adoption of AIPs was a linear function of access to advisory services.

RESULTSANDDISCUSSION

This section presents results and their discussion on the relationship between access to ASs and adoption of AIPs in Chuka. The main themes were; sources of ASs, relationship between access to ASs and adoption of AIPs,descriptive statistics for access to ASs versus adoption of AIPs, and adoption of AIPs in the sub-County.

SourcesofAdvisoryServices

Access to advisory services from various sources among farmers has been very diverse in terms of effectiveness, convenience, and efficiency. To confirm these findings, farmers were asked to indicate their sources of advisory services. Table 1 presents sources of advisory services in the sub-County.

Table1.SourcesofAdvisoryServicesinChukasub-County(N=100)

Sources	Frequency	Percentage
Radio	30	30.0
Otherfarmers	25	25.0
Television	16	16.0
Extensionagents	14	14.0
Agriculturalbooks	7	7.0
Radio/television	6	6.0
Agriculturalbooks/manuals	1	1.0
None	1	1.0

Farmers received advisory services from various sources ranging from interpersonal contacts to mass-media. The radio (*n* = 30, 30%) was the most common source of advisory services to farmers. Other mass-media sources were television(*n* = 16,16%),agricultural books (*n* =7,7%), radio and television(*n* = 6,6%), and agricultural books and manuals (*n* = 1, 1%). Radios were easily available, accessible, and provided reliable information (Ronald *et al*., 2015). Personal media included farmer contacts (*n* = 25, 25%) and agricultural extension agents (*n* = 14, 14%).

A very slight proportion of farmers had never received advisory services from any of the sources (*n* = 1, 1%), which may have had negligible effect on AIPs adoption. Farmers pointed out that farmer-to-farmer contacts were less reliable in information sharing while advisory service delivery from agricultural extension agents was untimely hence, irrelevant to farmers' information needs (Casmir *et al*., 2012).

RelationshipBetweenAccesstoAdvisoryServicesandAdoptionofAIPs

A Pearson correlation analysis was performed to illustrate the relationship between access to advisory services and

adoption of AIPs. There was a strong, positive correlation between access to advisory services and AIPs adoption, which was statisticallysignificant(r=0.51, p =0.01).Thisimplied thatincreased accessto advisoryservices would enhance high adoption of AIPs. Accessibility to advisory services could be achieved through regular extension education and trainings based on the farmers' information needs and the use of relevant communication media.Table 2 presents the results for the relationship between access to advisory services and adoption of AIPs.

Table2.RelationshipbetweenAccesstoAdvisoryServices[a]andAdoptionofAIPs[b](N=100)

Variables	1	2
Accesstoadvisoryservices	0.51	
AdoptionofAIPs		0.51

Note [a] = 1 = Stronglydisagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Stronglyagree; [b]= 1 = Not at all, 2 = Very low, 3 = Low, 4 = High, 5 = Very high

DescriptiveStatisticsforAccesstoAdvisoryServicesVersusAdoptionof AIPs

Therelationship between accessto advisoryservices and adoptionof AIPsamong smallholder farmers wasassessed onafive-point Likerttypescale;1 denoted stronglydisagreeand 5 meantstronglyagree. Table3 showstheaverage scores for descriptive statistics of access to advisory services and AIPs.

Table3.DescriptiveStatisticsforAccesstoAdvisoryServices[a]andAdoptionofAIPs[b](N=100)

Statement	*M*	*SD*
Theextensionworkerprovidesrelevantinformationthathelpsmeinadoptionofagricultural indigenouspractices.	2.16	1.37
ExtensionprogramtrainingIusuallyattendisusefulinadoptionofagriculturalindigenous practicesonmyfarm.	2.07	1.31
Extensionworkerusestrainingmaterialsrelevanttoadoptionofagriculturalindigenouspractices	2.01	1.24
Extensionworkersareapproachablehencepromoteadoptionofagriculturalindigenouspractices.	1.97	1.11
Iamawareofextensiontrainingonadoptionofagriculturalindigenouspracticesinmy Ward.	1.80	1.08
Theextensionworkerisalwaysreadilyavailablehenceenablingadoptionofagricultural indigenouspracticesonmyfarm.	1.58	0.89
Theextensiontrainingserviceisusuallytimelyhenceusefultoadoptionofagricultural indigenouspractices.	1.54	0.70
Ifrequentlyattendextensiontrainingpertainingadoptionofagriculturalindigenouspractices.	1.49	0.58

Note:[a=] 1 = Stronglydisagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Stronglyagree; [b]= 1 = Not at all, 2 = Very low, 3 = Low, 4 = High, 5 = Very high

Though the government of Kenya has dedicated huge funding into agricultural sector, a majority of farmers had never attended any useful extension program training (M = 2.07, SD = 1.31) or received any useful and relevant extensionservicepertainingto AIPs(M=2.16,SD=1.31).Lackoffarmertrainings,field demonstrations,andnon-participatory nature of agricultural extension programs were the constraints. In particular, both public and private agricultural extension were characterized by inability to provide adequate service due to lack of consideration of prevailing needs of the farmers (Abura *et al*., 2012; Abid *et al*., 2016). Majority of farmers did not get anopportunity to participate in agricultural extension programs. Any agricultural advisory service programs that had been conducted in the sub-County, did not focus on AIPs hence, low adoption. This inadequacy of agricultural extension systems was brought about by unavailability of agricultural extension agents (M = 1.58, SD = 0.89). This implied that farmers lacked extension education on the adoption of AIPs that could promote soil health (Etwire*et al*., 2013). There were no regular farm visits, neither did they visit any extension office for consultations. Failurewas also due to agricultural extension services was due to lack of timeliness in service delivery (M = 1.54, SD = 0.70), low training frequency (M = 1.49, SD = 0.58), and irrelevant training materials (M = 2.01, SD = 1.24).Farmers argued that for a successful agricultural extension service delivery, emphasis should be laid on frequent extension contacts and the use of hands-on activities. This would increase farmer satisfaction hence, effective AIPs adoption (Ishida *et al*. 2018; Hamisu 2017; Ragasa *et al*., 2016).

Inaddition,agriculturalextensionworkersweredeemednotapproachable(M=1.97,SD=1.11).Farmersnotedthat the agents, talked too much; thus, making them shy off from active participation in agricultural extension programs. Some agents gave a lot of details, rendering the program a one-way communication hence, low participation. This implied that a personal characteristic of the individual extension agent was of paramount importance with respect to effective extension training and adoption (Faure *et al*., 2012). Farmers also claimed that they were not aware of extensionprogramtrainingon adoptionofAIPs intheir respective Wards (M = 1.80,SD =1.08). Respondentsnoted that

they got awareness on training of AIPs adoption via television (*Shamba shape up show on Citizen Television, Kenya*), internet, and radios only. However, the coverage of these sources was not sufficient due to poor network, power outage, and costly charges (Kipkurgat *et al.*, 2016).

Adoptionof AIPs

Various AIPs have been shown to be common among smallholder farmers. This is because AIPs are locally developed hence, they are cheaper compared to modern technologies. However, AIPs adoption vary from place to placeperhapsduetosocio-economicfactors.ToassesstheAIPsadoptioninthesub-County,farmerswererequested to indicate the extent to which they applied AIPs as shown in Table 4.

Table4.AdoptionofAIPs[a]inChukaSub-County(N= 100)

AgriculturalIndigenousPractices	*M*	*SD*
Croprotation	4.01	0.88
Intercropping	3.92	0.75
Agroforestry	3.73	0.76
Organicmanuring	3.41	0.88
Minimumtillage	2.69	0.81

Note:[a]=1=Notatall,2=Verylow,3=Low,4=High,5=Veryhigh

Crop rotation was the most common applied practice (*M* = 4.01, *SD* = 0.88). A majority of farmers revealed thatcrop rotation had helped them overcome poor soil conditions associated with sole cropping. Farmers underscored various soil conditions; soil drainage, water holding capacity, texture, and organic matter as being the keydrivers of adoption(Lundy*et al.,* 2015).Crop rotationhad improved nitrogencycling, microbialcompositions,and minimized leachingofnitrates (Hansen *et al.*, 2010; Zhang *et al*., 2014;Andres *et al.*, 2016; Kuntashula *et al*., 2014). However, the findings implied that overdependence on staple cereals had deemphasized the importance of crop rotation forsoil health and productivity (Nyamangara *et al*., 2014; Sebukyu & Mosango, 2012; Armah *et al*., 2013). Farmers would not bother about improving soils on leased plots(Varble *et al*., 2016). Respondents pointed out that operating on plots that were less tenure secure, lowered the interest of conserving soils through crop rotations (Mabuza *et al.*, 2013). Inaccessibility to advisory services constraint adoption due to lack of knowledge of among most farmers about the practice and benefits of crop rotation programs on crop yield response (Johansen *et al.*, 2012).

The studyshowed that a majorityoffarmers intercroppedstaple cerealsand legumes onthe same piece ofland (*M* = 3.92, *SD* = 0.75). The most common intercrops were sunflower-maize and maize-beans (Hu *et al.*, 2015). Intercropping contributed to the ecological and economic sustainability and maintenance of soil fertility resulting in better crop yield (Min *et al*., 2017; Van Asten *et al.*, 2011; Duchene *et al.*, 2017). Intercropping had also closed the yield gap and this could be taken to mean that land and labor were used more efficiently under this cropping (Mueller *et al.*, 2012; Mucheru-Muna *et al*., 2010 & Chai *et al.*, 2013; Ngwira *et al*., 2012). However, intercropping had not been fully adopted by farmers. This was due to inadequate access to relevant information to facilitate effective adoption (Ketema & Bauer, 2012).

Agroforestry practices were also ranked third based on the extent of application in the sub-County (*M* = 3.73, *SD* = 0.76). Agroforestry promoted interactive benefits of combining trees, shrubs, crops, and livestock (Lambert & Ozioma, 2012; Kaczan *et al*., 2013). Farmers experienced issues related to weak soils and strong winds thatdamaged crops such as bananas. All these challenges encouraged farmers to establish agroforestry trees to act as windbreaks,promoteorganicmatterformation,andpreventsoilerosion(Coulibaly*etal*.,2017;Lorenz&Lal,2014; Sepúlveda & Carrillo, 2015). Agroforestry was also preferred as farmers perceived that it created a rich source of a wide range of products and services for households (Mutambara *et al*., 2012). Most of the trees provided fuelwood (grevillea), building materials (eucalyptus), medicine (moringa), source of income, and fodder (Leucaena) in rural homes (He *et al*., 2015; Kaczan *et al*., 2013; Hong *et al*., 2017; Leakey *et al*., 2012).

Farmerspointedoutthattheywouldliketogrowtreesthat werefast maturingwithmultipurposebenefits(Mwase *et al*., 2015;Glover *etal*., 2013). Mangos, moringa, and avocados were verycommon owing to their multiple benefits; fuelwood, fruits, medicine, and building materials. However, agroforestry systems that required intensive management were rejected by farmers, who preferred less labor-intensive practices (He *et al*., 2015). Small farm sizes also discouraged farmers from incorporating many agroforestry tree species. However, improved access to extension services and credit would see farmers adopt better tree species that could not pose much competition against crops for resources (Kiptot & Franzel, 2012; Mwase *et al*., 2015; Jerneck & Olsson, 2013).

Organic manuring was moderately applied (*M* = 3.41, *SD* = 0.88). Manures were obtained from goats, chicken, and cattle(Adesope*etal*.,2012).Mostrespondentsreportedthattheyutilizedorganicmanurealongsidesynthetic fertilizers. This implied that manures were not entirelyrelied on for improved crop yield. Farmers who occasionally applied manures did not report any significant crop yield response. However, these findings were contrary to thosein Chatsika (2016) and Tiamiyu *et al*. (2012) that application of manures improve environmental and public health. Low adoption of organic manures in farming was linked to lack of access to essential agricultural extension education on the importance of organic manures (Adesope *et al*., 2012; Lavison, 2013; Jaleta *et al.*, 2013).

Minimum tillage was the least applied of the five AIPs in the sub-County (*M* = 2.69, *SD* = 0.81). However, A majorityof the respondents were knowledgeable of the concepts of minimum tillage; as a practice that was aimed at least soil disturbance. The practice involved the use herbicides to kill weeds, mulching, crop rotation, and early planting (Grabowski *et al*., 2016; Kuntashula *et al*., 2014). Farmers emphasized that reduced tillage operations had promoted soil productivity and reduced costs of production (Singh *et al*., 2014; Grabowski *et al*., 2016). Farmers noted that unlike minimum tillage, conventional farming practices; the use of jembes and tractors in tilling the land would exacerbate soil loss and costsofproduction. However, highcosts of herbicides and loworganic materials due to free-range livestock rearing led to poor adoption of minimum tillage (Herrmann *et al.*, 2014). Farmers suggested that financial incentives, agricultural extension trainings, and field demonstrations would be vital in the adoption of AIPs even if only modestly (Marenya *et al*., 2017).

CONCLUSIONANDRECOMMENDATIONS

Access to advisory services was a possible determinant of AIPs adoption. Based on this finding, it was found that most farmers received agricultural information from radios. Radios were cheaper, readily available, and reliable. A majority of respondents also expressed that accessibility to advisory services influenced adoption of AIPs owing to the significant relationship. Additionally, it was also evident that crop rotation was widely applied followed by agroforestry, intercropping, organic manuring, and minimum tillage in that order. It was thus, concluded that a few AIPs had been adopted by farmers perhaps due to low access to advisory services in the sub-County.

Farmers should adopt AIPs, which are cheaper to acquire and apply; they are locally developed, centuries old technologies. Ministry of agriculture should encourage application of AIPs which are environmentally and agriculturallysustainableand promotesoil structureand fertility. Countygovernment shoulddevise ways ofmaking advisory services more accessible to farmers. Agricultural extension agents should ensure that extension programs are relevant to the farmers' information needs. County government should provide extension agents with adequate support to facilitate mobility in order to reach out to farmers efficiently. Extension agents should prepare relevant extension programs adequately and publicize them properly. Extension agents should also adopt a variety of communication-media for wider population coverage.

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