International Journal of Agricultural Extension and Rural Development Studies
Vol.6, No.3, pp.11-25, May 2019
Published by European Centre for Research Training and Development UK (www.eajournals.org)

ASSESSMENT OF TECHNOLOGY ADOPTION IN MAIZE PRODUCTION BY SMALL SCALE FARMERS: CASE OF PERKERRA IRRIGATION SCHEME, BARINGO COUNTY, KENYA

Timothy Lenjiling, *Mwikamba Kaibui

ABSTRACT: *Maize is one stable food grownall over Kenya including Perkerra Irrigation Scheme. However, over the years, its production has been on decline due to many challenges including; decrease in land as result of increase in population, loss of soil fertility, use outdated technologies which in return would sustain or increase production. Despite the availability of these technologies, small scale farmers in Perkerra irrigation scheme had not yet adopted them. The purpose of study was to determine the influence of the extension services, access and utilization of available information on modern techniques and social economic factors hindering the adoption. The study targeted 798 farmers from Loropil, Ng'oswe,Ng'ambo and Labos. Multi stage sampling was applied to draw a total of 100 participants. Data was collected by the use of questionnaires which applied both closed and open ended questions. Data was analyzed by the use of Multiple Linear Regression method so as to get the coefficients of the independent variables and the importance on the adoption of technology. Spearman's method was also used to determine the correlation coefficient. The results showed that 53% and 43 % of the respondents were males and females respectively. 47% whose education level was 57% attained primary level. Social economic factors were significant in determining the level of technology adoption at 95% level of significance and it had a p-value of 0.03 and hence statistically important. Most farmers (58%) received extension services from the Kenya Seed Company. Radio and public assembly (Baraza) was the main source of information. Based on these findings, both the county and national government should employ more extension officers and ensure subsidization of the basic farm inputs like seeds and fertilizers.*

KEY WORDS; technology, adoption, productivity

INTRODUCTION

Background Information

Maize is the most widely grown staple crop in Africa and more so in Kenya. Due to increasing demand for food and bio-energy, the demand for maize is growing at higher rate and is expected to double by 2050 (Rosegrant et al. 2009). In Africa, maize yield (output per acre) have fallen in the last decade making it impossible to feed the growing population adequately (Suri 2011). In addition to low adoption of modern agricultural technologies, climate variability and change have always presented a threat to food security in Kenya through increasing temperature and unpredictable weather patterns (Rose grant et al, 2009).

The maize sub-sector in Kenya has changed drastically in terms of quantity produced over the last 40 years. These changes are mainly attributed by presence of modern production techniques which are however identified by Hassan and Karanya (2009). They are grouped into three phases. Phase 1 occurred in1964-1973 and was characterized by the release and adoption of the first hybrid maize

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107

in high potential zones. This phase led to improved productivity in maize production. phase 2 (1974-1983) was characterized by the intense spread of the high hybrid maize seeds to small scale farmers in both the high and medium potential areas zones and increased mechanization. Phase 3 (1984-1992) was featured by greater adoption of technology among the small scale farmers and large scale farmers in Kenya. It is important to note most of the farming is done by the small scale farmers.

Over the years, new technologies have been introduced and disseminated by the agricultural research centers in the county including the 29 KARI research centers. Examples of modern agricultural technologies that have been disseminated to farmers in Kenya today include; improved maize open pollinated varieties, hybrid seeds, chemical packages, improved on farm storage techniques, postharvest handling techniques, methods of small scale Irrigation such as treadle pumps, Greenhouse farming, drip irrigation, fertilizer application through fertigation systems, in-vitro tissue culture plant breeding and many others. Low adoption of modern agricultural production technologies amongst farmers in Kenya and in many other developing nations has been identified as one of the main reasons for the low agricultural productivity (Mamudu *et al,* 2012; Umeghalu *et al*, 2012).

Droesch (2015) and Singh *et al* (2014) also notes that low technological adoption by the small scale farmers has been the main hindrance to the realization of higher agricultural productivity.Karlen and Kasperbauer (2006) noted that, advanced methods of production in USA and other European countries are responsible for the high maize yield throughout. Precision agricultural technologies are believed to have numerous benefits in production agriculture, with a potentially large economic impact. It tends to improve the efficiency of the farm operations by reducing the overlap of inputs thus saving money, on inputs cost (smith *et al*. 2013; Shockley *et al*. 2012).

The rapid climatic changes, availability of advanced technologies in production and the need to meet the food security policy forced the government to come up with irrigation schemes. Perkerra irrigation scheme is located in Baringo county was then formed (KARI 2008). The main objectives of the scheme were to ensure adequate food supply and employment creation to the locals. The scheme grew onions, chilies, watermelons, pawpaw and cotton. This later change in 1996 due to marketing challenges of these horticultural crops. Maize was then introduced to the scheme in contract with the Kenya Seed Company. This ensured better and prompt payments and assured markets to the growers. The government has always been supportive to the scheme but the adoptions of modern technologies used in production remain low. The scheme is 5,800acres and due to water shortages, it has to be irrigated to fully exploit the land (Irungu 2015).The scheme farmers tend to employ manual labour in the weeding, fertilizer application, plant protection and harvesting of the maize. This has hindered the productivity of the land leading to low yield and eventually low incomes and food insecurity challenge (Dillon 2013).

Justification for the study

Food insecurity in Kenya has become a worrying developmental problem and a major concern to the government. Yields in maize, the staple diet has fallen drastically, though new technologies on how to improve its production and productivity were being developed and released to the farmers

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107

by the researchers (Oganda, 2013). Byerlee (2010) noted that, intensification of agricultural production in Kenya through the development of modern technologies is necessary if the current problem of food insecurity is to be reversed.

Adoption and optimal use of these modern technologies by the farmers is the key to improve maize production. This study was based on the factors that influence the adoption of modern agricultural techniques in production of maize. There was therefore need to identify and understand the various factors that affect the adoption new techniques by farmers in Baringo County and Kenya at large. This would guide the agricultural policy makers, researchers, farmers and extension workers to identify areas that require intervention in order to bring the desired change in as far as food security is concerned.

LITERATURE REVIEW

Social economic factors tend to determine the rate of technology adoption by farmers in many parts of the world. These socio-economic factors include; age, educational levels, income and provision of extension serves. For instance Udimal et al (2017) and Mignouna et al (2011) found a positive relationship to exist between age and adoption of new technology. Older farmers were found to adopt new technology easily due to their long time experience on farming as compared to the young farmers. Similarly, Bawa (2014) found a positive relation to consist as he argued that innovation increases with age of the farmers such that younger farmers are more eager to adopt but with increasing age their eagerness declines. A contrary opinion was found by Mwangi and Kariuki (2015) that as farmers grow older, they avoid taking risks and even decline to take long term investments. Their adoption of technology declines as younger farmers tend to be risk takers and tend to make use of modern techniques in farming and income of farmers (Smollo 2017). As far as education is concerned, Obayelu *et al* (20017) and Bawa (2014) observed that education was a strong determinant of technology adoption. They further explained that more educated people had different perception and thoughts on new technology. They tend to be rational and look into benefits of new techniques of farming. Similarly, Lavison (2013) and Namara *et al* (2014) expounded that more educated farmers are in a better position to make use of the modern technology due to their ability to acquire, process and utilize the information concerning the new methods of farming. On income, Sezgin *et al* (2011) noted that there is a positive relationship to exist between income of the farmers and the adoption rates of the modern technology. They explained that farmers with higher incomes have a higher purchasing power especially on the modern inputs used in the production of maize. Mellese. B. (2018) agrees on the same and stated that farmers with higher revenue are in a better position to acquire the services of skilled and trained experts and this majorly concerns the modern methods of farming.However, Wang *et al* (2016) found a negative relationship to exist. They explained that as the income of the farmers increases, they shift their investments to other projects such as apartment constructions and off farm activities. A study carried out in Ghana concerning adoption of modern technology on cereal production by Udimal (2017) also found a negative connection to exist. This therefore calls for research concerning the same to be carried out so as to get consistent results which this study wants to bridge the gap that exist.

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107

Wekesa *et al* (2003) found that extension agents helps in passing the technology from the researchers to the local farmers and similar results found by Yu et al (2011) that extension agents encourage the use of more efficient and effective techniques and reduces the fear of taking risks amongst the farmers and hence making use of modern technology.

Onono et al (2013) and Berge (2013) also found a positive relationship between extension and technology adoption. Availability of this extension services and agents determines the adoption. The frequency of access to the services by the farmers and the training of the farmers by the extension agents help in increasing the adoption rates of modern farming technology. Training and practical carried out in the fields also aid in the usage of new techniques.

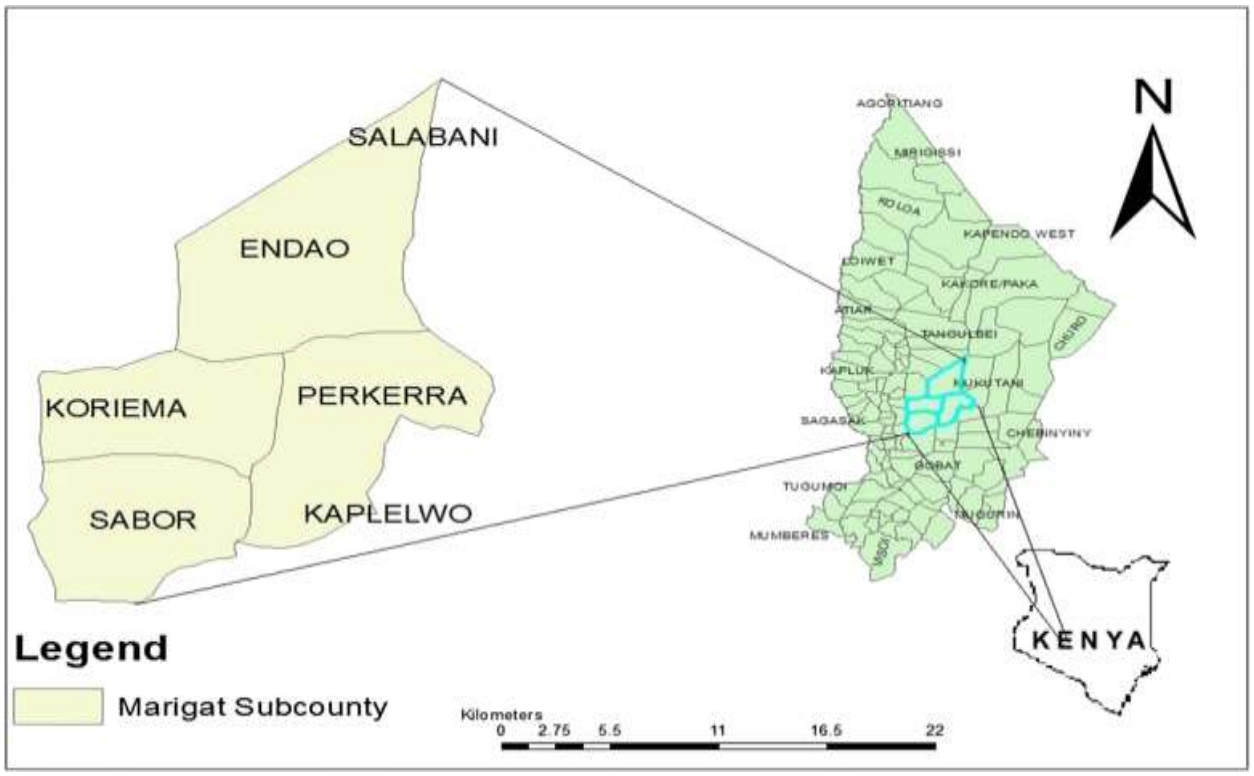
MATERIALS AND METHODS

Study Area

Perkerra irrigation scheme is located in Baringo County. It's bounded by Turkana county and West Pokot County to the North, Samburu County and Laikipia County to the East, Nakuru and Kericho Counties to the South and UasiGishu County to the South West and Elgeyo Marakwet County to the West. It's located at a longitude of 35 30′ and 36 30′ E and between latitude 0 10′ and 1 40′ south.

Perkerra irrigation scheme is about 5840 Acres and 2500 Acres are under irrigation. River Perkerra, which is a permanent, acts as the main source of water used for irrigation since the region receives a rainfall of 700-1000 mm p.a. The scheme serves 789 households feeding a total of 11,300 persons and are spread through Marigat sub county, Loropil, Ngoswe, Ngambo and Labos location. The scheme consisted of small scale farmers growing maize under irrigation for consumption and selling largely to the Kenya seed company who contracts them to grow the crop. The study targeted the farmers who were carrying out farming activities in the scheme. These farmers had not yet adopted the available technologies in farming and therefore there was need to encourage the adoption rates.

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107



Data Collection

This study was carried out between September 2018 and January 2019. This project majorly relied on the use of questionnaire. Simple random sampling was also applied to assure each farmer the chance of being selected as it lack biasness. Both the open and closed ended kind of questions was used to ensure sufficient information collected for analysis and recommendations. The questions were administered to hundred farmers and for the purposes of reducing biases on trust and misinterpretation of questions which leads to incorrect answers they were hand delivered. The data collected was on the factors affecting the adoption of modern agricultural technologies; social economic factors, access to information on modern technologies, influence of extension services to the adoption.

Interviews were also used to help in gathering of more information alongside probing. Probing is a technique used in interviews for collection of more data and ensuring that the respondents remain objective. They tended to motivate the respondents as they gave room for clarity or explanation. The literacy level in Baringo County especially those within Perkerra irrigation scheme was estimated to be 64% (FAO STAT, 2018) and hence questionnaire is appropriate to collect data on factors affecting adoption of modern technology in farming.

Data Analysis and Presentation.

Multiple linear regression (MLR) model was used to analyse data collected. MLR method was used to test the hypothesis about the relationship that exist between adoption of technology which is a dependent variable and social economic factors, access to information concerning modern techniques and influence of extension services to the adoption which are independent variables. The multiple linear regression model {MLR} was:

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107

$$\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \mu}$$

Y = adoption of modern technology

$\mathbf{X_1}$= Social economic factors, $\mathbf{X_2}$= Access to information and $\mathbf{X_3}$= Influence of extension services)

$\boldsymbol{\beta_0}$ = the intercept/ constant. It's the value of dependent variable when independent variables are fixed.

$\boldsymbol{\beta_1}$= shows the change in the Y when X_1 changes by one unit.

$\boldsymbol{\beta_2}$= shows the change in the Y with a unit change in X_2

$\boldsymbol{\beta_3}$= show the change in Y with a unit change in X_3

$\boldsymbol{\mu}$= the error term/ disturbance. It consists other factors affecting Y not included in the model .Both descriptive and inferential statistics were also used in representation of the results in frequencies and percentage of occurrences. Inferential stats were explained by the used of spearman's rank correlation coefficient and student T-test to test the hypotheses.

RESULTS

On demographic Information of the respondents,the results showed that the female respondents were 47(47%) and the male were 53 (53%), an indication that most of the farmers in the scheme were male. This is true as most of the women took part in the casual jobs like grocery where most of them were selling the vegetables and fruits in Marigat town. They also participate in the burning of charcoal especially of the ***jully flora*** tree which was abundant in the area. This leads to men taking part in farming and leaving women participating in other activities creating income for the household.A similarresults were obtained by Nmadu *et al* (2015) in their study on social economic factors' affecting the adoption of technology in Ondo city, Nigeria. Issa (2016), Nuhu *et al* (2014) and Smollo *et al* (2017) also concluded that gender plays a role in the adoption of modern techniques in the production of maize.

Data collected on the age group of the respondent indicated that who were below 40 years(66%) and a large percentage was between the ages of 18-30(44%), an indication that most of the farmers were youth and energetic and were therefore expected to be innovative and hence adopt modern techniques in production as Onono *et al* (2013), in his study on how social economic factors affect the adoption of technology found out that an average of the small scale farmers in Taita-Taveta is 36.3years.

The low levels of education especially among the youth seemed to be the driving factor towards their huge participation in the farming. The elderly respondents were only 14% of the total interviewees and they were shunning off from farming in the scheme and hence the youth taking up the role of farming. This was advantageous to the youth to participate in farming.The study therefore indicated that most of the farmers were young enough to adopt the recommended technologies of production. Jamilu et al (2014), in their studies also concluded that most of the farmers are young people. For instance, Ogola (2010), found a mean age of 38.4 years among the small scale farmers in Ugenya, Siaya County.

Data on education showed that, 25% were illiterate, 32% got primary education,17% secondary education and 26% college and university level. These results were an indication of low level of

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107

education which seemed to have an effect on the farmers' ability to get information especially from internet and newspapers and therefore adoption remains a challenge to the farmers not to mention training services to offered by the extension officers. These finding seem to be inline with study done by Mwangi *et al* (2009), on "exploring Kenya's inequality, Baringo County", they found) out that 53.4% of the total population only got primary education as their highest level. Ogola *et al* (2010) in his studies on the education level of small scale farmers in Nyanza, Coast and Rift Valley found a mean of 51.9% as farmers having primary education as the highest level. They also concluded that level of education determines the adoption of technologies in production. When marital status was considered, 78%were marriedwhile only 19% were not.The high percentage of married farmers can be associated with the culture of the Ilchamus and Tugen communities neighboring the scheme. The findings seem to be line with what Mwangi*et al* (2009), found on the effects of social economic factors to the adoption of technology in Perkerra irrigation scheme, that the culture of the farmers played a key role. Respondents then, deemed a taboo for a farmer to be single but rather need to be married to work together in the farm and also stability of the family which is the smallest unit in the society.

Data on the monthly income of the farmers showed that 44% earns less than Ksh 10,000 and form the highest level among the respondents, while those who earn between Ksh. 11,000 and 20,000 represented 20% and only 36% of the respondents earn over Ksh. 21,000. This low incomes is a pointer to high poverty levels which stands at 41.4% according to a report by Mwangi *et al* (2016). Drought and famine which hits the region frequently affects the earning and the livestock reared. Low income among the farmers affect their capacity to seek and try modern techniques of production and as Kinyanjui et al (2012) in his study on the effects of income on the adoption of technology in Kakuzi area found that most of the farmers are poor as they are highly exploited by the middlemen and the concerned buyers of their produce. Kenya Seed Company pays little to the farmers and it takes time for them to be paid and hence they end up taking loans having huge interest rates hence low incomes.

Decision making at the household level was majorly made by the father as 77% of the respondents indicated so while 23% of the respondents stated that mother made decision at the house. The high percentage of male making decision is strongly associated with the culture of the community as husbands are the sole decision makers. This implied that male could easily make decision on the adoption of technology as women are not allowed to decision especially concerning the economic activities. This was inline with Abuom et al (2017) studies on how culture affects the adoption of technology by the small scale farmers in Perkerra irrigation scheme, in that it influenced the decision making process.

Land ownership plays an important in the production practices and its utlisationas a resource and factor of production. The study therefore sought to know how affected adoption of modern technologies in farming. On ownership, result showed that 85% owned land and only 15% did not own. This implied they could make important decision on how to utilize it. Most of the respondents indicated that they own land as it gave a frequency of 85% and 15% of the respondents indicated that they don't own land.Ownership of land allows people to adopt desired techniques, Smollo *et al* (2017). Mwangi *et al* (2009), in their study on how culture determines production concluded

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107

that, land ownership is associated with the culture of the people which discourages land selling as it's considered as a taboo to sell it.

Regarding the size of land ownership,the results were showedthat farmers own land ranging between 0 to 3 acres were 60% and while those with more than 4 acres accounted to 40%, indicating that most the farmers were indeed small scale farmers with amean size was 2.88 acres. Aboum *et al* (2017) in their study also found that most of the farmers in Perkerra irrigation own small pieces of land. Limited land size affects adoption of technology as small scale farmers view it as risky and ending up failing to take up the available techniques Onono *et al* (2013).

On production results indicated that 59% of the respondents got 30 bags per acre in season and only 4% of the respondent's harvested more than 62 bags in a season. This was to mean that about 38% were getting less than 30 (90kg) per acre and this a fairly big percentage and could be an indicator as to why there was low income among the farmers noting that they had to pay loan and contribution to the cooperative from the same as they were contracted farmers. Adoption of desired technologies so as to increase the small scale farmers' income and in turn reduces the poverty level as observed by Mwangi *et al* (2009). This would need appropriate application of fertilizers and use of pesticides to reduce the adverse effects of the Fall Army Worm.

When access to extension services was considered 72% indicated that they are able to receive extension services and Kenya Seed Company (KSC) was specified as the main source of extension services among the larger proportion of farmers providing 58% of the service and Kenya Agricultural and Livestock Research Organization (KALRO) had provided 15%.Kenya Seed Company was in a better position to offer extension services as they play critical role in the production of maize in the scheme. This was because offer marketing services and contract farming to the small scale farmers and therefore they tend to encourage quality seeds to be produced through training of the farmers. Similar findings were observed by Mwangi*et al* (2009) and Aboum*et al* (2017) in their studies concerning the impact of extension services to the farmers in Perkerra irrigation scheme concluded that Kenya Seed Company offers much of the services to the farmers. The result further showed that the frequency of interaction between the farmers and the extension officer varied between once a year (38%) and once in 3 months (22%) while 28% never got extension service.

On the methods used by the extension officers, the findings indicated that seminars and public "baraza" were most (61%) used while field training and demonstration were 30% and 9% respectively. The furthermore the results 51% of the farmers strongly agreed that extension visits play a significant role in the use of fertilizers and hybrid seeds by the farmers and only 3% felt that they did not influence them. Smollo *et al* (2017) in their study also noted the impotency of extension officers. Moreover, 98% of the respondent agreed adoption of new techniques resulted in higher production and higher returns. The results are in line with the conclusion made by Ebojei*et al* (2012) in their study on the adoption of hybrid seeds by small scale farmers in Kanuda state, Nigeria. The authors observed a significant relationship between yields and technology adoption.

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107

The study observed that the commonest challenges faced by farmers included; lacks of capital for purchasing these inputs like pesticides, inorganic fertilizers and even the hybrid seeds remains the commonest challenge with a frequency of 94%, higher cost of these inputs (82%) and lack of clear information concerning the modern techniques of production (67%). Same results were found by Onono *et al* (2013) and Mwangi *et al* (2009).
Low levels of education (43%), inadequate research and development (40%) and inadequate extension services (34%) remain to be the least challenges facing farmers in the scheme.

HypothesisTesting.
One of the hypothesis was that social economic factors have no impact on the modern agricultural technologies. The dependent variable was adoption while social economic factors which included the age, income and level of education are the independent variables.
From theoretical point of view, income affects adoption of technology as most of the farmers in the scheme earn less than Ksh. 10,000 accounting to 44% and a mean of 2.26 which is like Ksh. 12,600 as indicated in the table 1. Hence income is significant.

Table 1Descriptive Statistics on Income of Respondents.

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Income	100	1	7	2.26	1.502	2.255
	100					

Education was another social factors. Farmers who are illiterate find it difficult to understand and comprehend the available information available in most of the internet and newspaper which are some sources of information. A larger percentage of respondents (57%) indicated primary education as their highest level of education attained. Table 2 gives a descriptive statistics and a mean of 2.44 which falls under primary level category.

Table 2 Descriptive Statistics of Education Level of Respondents.

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Education	100	1	4	2.44	1.131	1.279

Age of the respondents indicated a mean of 2.08. This shows that most of the respondents are between the ages of 31-40 years.

Table 3. Descriptive Statistics on the Respondents Age.

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Ageof_HH	100	1	5	2.08	1.186	1.408

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107

Regression results of Social Economic Factors.

The model used was the multiple regression model. Where adoption (**Y**) is the dependent variable while age, education, income, decision making, marital status and gender are the independent variables. $\beta_0$is the constant term.

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \mu$$

Table 4. Analysis Of Variance and Test for Significance.

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig. (at 95%)
1	Regression	.554	6	.092	3.644	.003[b]
	Residual	2.356	93	.025		
	Total	2.910	99			

a. Dependent Variable: ADOPTION

b. Predictors: (Constant), decision-making, income, ageof_HH, education, gender, marital status

The table 4.above indicated a significant relationship of the social economic factors to the adoption of technology. The p-value is 0.03 which is less than 0.05 which is significant level. A summary of the regression model shows some of the social economic factors which are significant when subjected to the 95% level of confidence so as to yield a 0.05 level of acceptance.

Table 5: Summary

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig. (at 95%)
		B	Std. Error	Beta		
	(Constant)	1.066	.097		10.950	.000
	Gender	.009	.033	.027	.282	.779
	Ageof_HH	.010	.014	.070	.718	.475
	Education	.033	.015	.217	2.258	.026*
	marital status	.009	.033	.028	.284	.777
	Income	-.029	.011	-.252	-2.560	.012*
	decision-making	-.126	.039	-.310	-3.262	.002*

*P<0.05

Table 5 is a summary of the social economic factors affecting the adoption of technology when regressed on the multiple regression model.

$Y= 1.066 +0.027X_1 +0.07X_2 +0.217X_3 +0.028X_4 -0.252X_5 -0.310X_6$

X1- gender of the farmer. One unit change in gender leads to 0.027 units increase in adoption.

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107

X2- age of the respondent. It's positive showing a positive relationship between it and adoption and one unit increase in the age leads to 0.07 unit increase in the adoption of technology.
X3- education level. It's positive and one unit increase in the education leads to 0.21 units increase in the adoption.
X4-marital status. One unit increase in marital status leads to increasing adoption by 0.028 units.
X5-income of the respondent. It shows a negative relationship.
X6- decision maker in the household and shows a negative relationship with adoption.
The constant term β_0 from the model is 1.066 which indicates the adoption level despite the social economic characteristics. Income, decision making and education are important to the adoption of technology. Gender, marital status and age are not significant after being subjected to P value at 95% level of confidence.
The hypothesis is rejected as social economic factors are significant in the adoption of technology.

Regression Results and Testing of Hypothesis on the influence of extension services to the adoption of technology.

The dependent variable (Y) was the adoption of technology, the independent variables were the access to the extension services, role of extension services, method used by the extension officers and frequency of interaction with the extension officers. The general model will be;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \mu.$$

Table 6 gives a summary of the model and from the model, the extension services is significant in the adoption of technology. This is because at 95% level of significance, the P value is 0.025. This shows that it's less that 0.05 level of acceptance and hence the extension services is important in adoption of technology.

Table 6. Summary of the Multiple Regression Model

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.576[a]	.332	.668	.164	.142	2.556	6	93	.025

a. Predictors: (Constant), given limited lad can be realized by new tech in rural areas, do you access extension, farmers who adopt_realize higher higher yield, method used by officer for adoption, extension visit play role in use of fertilizer and hybrid seeds, frequency of interaction

Hypothesis Testing.

When the hypothesis extension services that it had no significant influence to the adoption of technology on maize production tested, the P value of 0.025 was observed, which is below 0.05 level of significance. This makes **this hypothesis to be rejected** as extension services plays a role in the adoption of technology. This results concurs with Abuom *et al* (2017) and Smollo *et al* (2017) in their studies on effects of extension services to the adoption of technology.
Table 7 gives the coefficients of the dependent variables and independent variables.

$$Y = 1.165 - 0.169X_1 + 0.021X_2 + 0.063X_3 - 0.140X_4 - 0.228X_5 - 0.151X_6$$

X_1- access to the extension services. Negatively related with adoption of technology.
X_2-frequency of interaction with extension officers. It's positively related with adoption.
X_3- methods used by the extension officers in the field. Positively related.

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107

X_4- role of the extension to the use of fertilizers and hybrid seeds by the farmers. Negatively related with the adoption of technology.
X_5- higher yields realized when one uses modern technology. Negatively related.
X_6- technology as the means of increasing yields given limited land.
1.165 is the constant term. It shows even without extension services, the adoption of technology is 1.165 units.

Table 7: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig. 95.0%
	B	Std. Error	Beta		
(Constant)	1.165	.131		8.906	.000
Access to extension	-.064	.053	-.169	-1.214	.028*
Frequencyofinteraction	.003	.017	.021	.155	.877
Method by extension officers to ensure adoption of tech.	.016	.026	.063	.615	.540
1 Extensionvisit play roleinuseoffertilizerandhybridseeds	-.034	.028	-.140	-1.239	.219
Farmerswho adopt tech. realizehigheryield	-.064	.028	-.228	-2.290	.024*
Givenlimitedland product. Can be realizedby new techinruralareas	-.026	.020	-.151	-1.337	.185

*P<0.05

The negatives signs indicate a negative relationship between adoption and the independent variable. For instance, a unit increase in the independent variable which is access to extension services leads to 0.169 units decline in the adoption of technology. Its only access to extension service and the effect of technology on yield production were significant. The other independent variable were insignificant.

Regression Resultson Influence on Adoption of Technology.
Adoption of technology (Y) was the dependent variables and the access of information, role of information in the adoption of technology and the channels of communication to farmers **(**X**)** are the independent variables.
The general model will be

$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \mu$. **μ**is the error term which caters some variables not included in the model. Table 4.8 gives a summary of the model.
From table 8, the regression of the adoption against the independent variable which was information gave a positive significant relationship of 0.042. This was below the accepted value of 0.05 (95% level of significance) and hence significant. The $R^2$is 0.508 which was 50.8%, it indicates the proportion of independent variable explained by the dependent variable (information). This showed that information plays a key role in the adoption of technology. Yu *etal* (2011), in their study on the cereal production and factors influencing adoption of technology also concluded that access of information by the farmers enables them to make ration decisions concerning the adoption of the available techniques of production. Similar results were found by Sezgin *et al* (2011) and Smollo *et al* (2011) on the impotency of appropriate medium of communication to the farmers.

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107

Table 8;Summary of the Regression Model.

Model	R	R Square	Adjusted R Square	df1	df2	Sig. F Change
1	.713[a]	.508	.492	4	95	.042

CONCLUSION

Based on the results, majority of the respondents were males (57%) and got little income per season and this affected the adoption of technology. On the results on the decision making, culture is a strong determiner in decision making process as male farmers were only the ones to make decisions and hence deciding whether to adopt or reject it.It was also concluded that farmers in the scheme are lowly educated as most of them mentioned primary level as their highest level of education attained. Inadequate education among the farmers affected the quality and quantity of information received. This is because information received from the extension officers remained meaningless to them and thus affecting the rate of up taking new technology in the production of maize. Education also limited acquisition of information from some sources of information like internet and newspaper. It was also established that most of the farmers inherited land from their fore fathers and hence permanent ownership.

Most of the respondents indicated that were able to access information relating to the adoption of technology through radio and group &organizations information with a percentage of 98% and 97% respectively.Kenya Seed Company (KSC)and Kenya Agricultural Research and Livestock Organisation (KARLO) was the major provider of extension and used several methods was to offer the information needed by the farmers.It is was noted that this was not sufficient. It was also concluded that lack of capital and high cost of inputs among the farmers were the main challenges facing the farmers and hence affecting their purchasing power these basic farm inputs.

Recommendation.

The County and National Government to create a more conducive environment for more youth to study more as this is likely to boost technology adoption uptake.

County and National government to create awareness gender inclusion so that both gender can contribute to increased production

Both the County and Nation Government need to employ more extension officers so as to reach all farmers rather than depending on the Kenya Seed Company to offer such crucial services to the many in need farmers.

Sensitize farmers to seek more extension services from the service provide and deploy more extension staff.

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107

REFERENCES.

Nmadu, J. N., Sallawu, H., & Omojeso, B. V. (2015). Socio-economic factors affecting adoption of innovations by cocoa farmers in Ondo State, Nigeria. *European Journal of Business, Economics and Accountancy*, *3*(2), 58-66.

Issa, F. O. (2016). Farmers perception of the quality and accessibility of agrochemicals in Kaduna and Ondo States of Nigeria: Implications for policy. *Journal of Agricultural Extension*, *20*(1), 81-95.

Jamilu, A. A., Abdul-Aziz, H. A., Jafaru, A. K., Sani, B. M., &Abudu, S. (2014). Factors Influencing the Adoption of Sasakawa Global 2000Maize Production Technologies among Smallholder Farmers in Kaduna State. *Journal of Agricultural Extension*, *18*(1), 62-72.

Ogola, T., Nguyo, W., &Kosgey, I. (2010). Dairy goat production practices in Kenya: Implications for a breeding programme. *Age*, *108*, 100-100.

Kinyanjui, S., Oloko, M. A., Gachunga, H. G., &Gathondu, B. G. (2014). Adoption of Technology as a Response Strategy to Globalization: A Study of Manufacturing Firms in Kenya. *International Journal of Business Administration*, *5*(6), 77.

Mwangi, E., & Swallow, B. (2009). Invasion of Prosopisjuliflora and local livelihoods: Case study from the lake Baringo area of Kenya. *Nairobi, Kenya: World Agroforestry Centre*.

Abuom, P. O., Kosonei, R. C., J M, H., &Bosire, E. (2017). Effects of drought dynamics on vegetation cover in Marigat sub-county, Baringocounty, Kenya.

Onono, P. A., Wawire, N. W., &Ombuki, C. (2013). The response of maize production in Kenya to economic incentives. *International Journal of Development and Sustainability*, *2*(2), 530-543.

Nuhu, H. S., Donye, A. O., &Bawa, D. B. (2014). Barriers to women participation in agricultural development in Bauchi Local Government area of Bauchi State, Nigeria. *Agriculture and Biology Journal of North America*, *5*(4), 166-174.

Mwangi, M., &Kariuki, S. (2015). Factors determining adoption of new agricultural technology by smallholder farmers in developing countries. *Journal of Economics and sustainable development*, *6*(5).

BILALIIB, U. T. (2008). PA Ekunwe, SI Orewa and CO Emokaro. *Asian Journal of Agricultural Research*, *2*(2), 61-69.

Sezgin, A., & Kaya, T. E. (2011). Factors affecting the adoption of agricultural innovations in Erzurum Province, Turkey. *African Journal of Business Management*, *5*(3), 777-782.

Ogada, M. J., Mwabu, G., &Muchai, D. (2014). Farm technology adoption in Kenya: a simultaneous estimation of inorganic fertilizer and improved maize variety adoption decisions. *Agricultural and food economics*, *2*(1), 12.

Smollo, D. O., Mosi, R. O., &Watako, A. O. (2017). Analysis of factors influencing sustainable adoption of improved maize technologies among smallholder farmers in Ugenya sub-county, Kenya.

Wekesa, E., Mwangi, W., Verkuijl, H., Danda, K., & De Groote, H. (2003). *Adoption of maize production technologies in the coastal lowlands of Kenya*. CIMMYT.

Yu, B., Nin-Pratt, A., Funes, J., &Gemessa, S. A. (2011). Cereal production and technology adoption in Ethiopia. *Ethiopia Strategy Support Program II (ESSP II), ESSP II Working Paper*, *31*.

Ouma12, J., Bett, E., &Mbataru, P. (2015). Drivers of adoption of Improved Maize varieties in Moist Transitional zone of Eastern Kenya.

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107

Fazal, S. A., &Wahab, S. A. (2013). Economic impact of climate change on agricultural sector: a review. *Journal of Transformative Entrepreneurship*, *1*(1), 39-49.

Kinuthia, B. K., &Mabaya, E. (2017). The Impact of Agricultural Technology Adoption on Farmer Welfare in Uganda and Tanzania.

Mugenda, O. M., &Mugenda, A. G. (2003). Research methods. *Quantitative and qualitative approaches*.

Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International.

Olwande, J., Sikei, G., &Mathenge, M. (2009). Agricultural technology adoption: A panel analysis of smallholder farmers' fertilizer use in Kenya.

Melesse, T. M. (2015). Agricultural technology adoption and market participation under learning externality: Impact evaluation on small-scale agriculture from rural Ethiopia. *Maastricht School of Management*.

Bawa, A. S., &Anilakumar, K. R. (2013). Genetically modified foods: safety, risks and public concerns—a review. *Journal of food science and technology*, *50*(6), 1035-1046.

Ellis, T. J., & Levy, Y. (2009). Towards a Guide for Novice Researchers on Research Methodology: Review and Proposed Methods. *Issues in Informing Science & Information Technology*, *6*.

Boserup, E. (1975). The impact of population growth on agricultural output. *The Quarterly Journal of Economics*, 257-270.

Onur, M., Ulker, G., Kocak, S., &Gok, I. M. (2017). Interpretation and Analysis of Transient-Sandface-and Wellbore-Temperature Data. *SPE Journal*, *22*(04), 1-156.

Gok, T. (2015). An Investigation of Students performance After Peer Instruction With Stepwise Problem-Solving Strategies. *International Journal of Science and Mathematics Education*, *13*(3), 561-582.

Kipchirchir, K. O. (2010). *Effects of PROSOPIS JULIFLORA SeedPodMealL Supplement On Weight Gain Of Weaner Galla Goats* (Doctoral dissertation)

Cheng'ole, M. J., KARI-Perkerra, P. O., &Marigat, K. Revisiting adoption of soil conservation technologies: what can work and what cannot work for the arid and semi-arid areas of baringo. *Parameters*, *1*, 3.

Print ISSN: ISSN 2058-9093, Online ISSN: ISSN 2058-9107