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INFLUENCE OF EDUCATIONAL AND SOCIAL FACTORS ON UPTAKE OF AVOCADO IMPROVED PRODUCTION TECHNOLOGIES: CASE OF KISII AND NYAMIRA COUNTIES REGION, KENYA

(Research article)

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Abstract

The study was carried out to evaluate influence of social factors on uptake of avocado improved production technologies by small scale avocado farmers for increasing avocado production. The study was carried out in Kisii and Nyamira counties region, Kenya.The general objective of the study is to improve avocado production in the study region. The specific objective evaluated influence of farmer's social factors; gender roles, age and level of formal education on uptake of the technologies respectively. Low avocado production in the region could be due to low uptake of its improved production technologies by small scale farmers. The study hypothesized that the low uptake could be due to chance and there is no significant influence of the farmer's social factors; gender roles, age and level of formal education on the uptake hence the study. Descriptive survey research design was used. Stratified and purposive sampling procedures and Morgan's table of sample size determination were applied in sampling of respondents.1 sub county was purposively sampled from each of the 4 agroecological zones in the region. Thus from 4 sub counties with 1,211 households, a sample of 291 respondents was accessed using Morgan's table. Reliable structured questionnaires with Cronbach Alpha, α=0.724 were used to collect field data from 291 small scale avocado farmers. The data was analyzed using statistical package for social sciences computer software. Descriptive analysis of variance, least significant difference and regression outputs were obtained. Results show that where male farmers control family resources more than females, influence of the gender roles has more significant mean difference and positive correlation on uptake of avocado improved production technologies hence better for the uptake. Although influence of farmer's age of over 70 years has more significant difference on uptake of the technologies, their correlation is not significant. Thus, farmers' uptake of the technologies non-significantly decreases with both decrease and increase in age. Influence of farmer's secondary level of formal education has more significant difference and positive correlation on uptake of avocado improved production technologies hence better for the uptake. Gender inclusivity should be encouraged and there is room for offering extension services even to the aged farmers involved in production of improved production technologies such as avocado. Secondary level of formal education should be prioritized for the citizenry for increased uptake of avocado improved production technologies.

Keywords: Influence, farmer's social factors, avocado improved production technologies

1. Introduction

Avocado (*Perseaamericana*) is a tropical fruit tree of Lauraceae family. Rudimentary production of the fruit tree originatedin Mexico around 10,000 BC. It spread fast to northern and southern hemispheres then to tropical and subtropical countries courtesy of European settler influence (Human, 1987; Gaufa *et al*.,2011). Globally, farmers are now applying avocado improved production technologies to increase production. The technologies are researched ideas, innovations and products developed by researchers on avocado. These include; improved avocado varieties, certified sources of improvedavocado seedlings, farm husbandry hygieneand access to market (Whittaker *et al.*, 1989).

Empirical evidence shows that application of improved production technologies including that of avocado creates opportunities, efficiency and benefits for farm producers (Gurel, 1998). The application is a major tool in rural development (Mapila, 2011; Mulayim, 1995). It also increases farm yields and growth (Pinstrup, 1982; Nin *et al.,* 2003; Emongor, 2010) and reduces costs, poverty and increases rural development (Stoorvogel *et al.,* 1990). Avocado is the healthiest fruit (Guinness Book of Records, 2010); the crop yields highest returns per acre as compared to other crops and fruits (FAO, 2005); provides shade, windbreaks, posts and ornamentals (Albertin and Nair, 2004). Avocado plantations play a role in carbon storage and sequestration that mitigates on environmental pollution (Kirby and Potvin, 2007).

Despite these benefits, application of avocado improved production technologies and that of other enterprises is low in Sub-Saharan Africa while it has rapidly increased in other parts of the world. This explains the slow growth of agricultural productivity in Sub-Saharan Africa including Kenya (Morris *et al.,* 2007). Avocado production was introduced in Kenya by Europeans in early 18th century. By 1939, they had planted improved avocado seedlings in the highlands and were spreading to other parts of the country (Griesbach, 2005). Kenya is a leading avocado producer in Africa and eighth in the world. Besides, it has a huge avocado production potential that has not been exploited (FAO, 2011). It's a major crop in Kenya's national economy both for food security and income (Griesbach, 2005). Avocado production has been prioritised in the study region. For example, in Kisii County, it's a flagship project where planting of improved Hass avocado seedlings, marketing promotion and training farmers are major activities (Kisii county county integrated development plan 2013-2017, 2013).

Despite avocado's enormous economic importance, high production potential and documented benefits in application of improved production technologies, yields obtained in smallholder avocado farming are low. Other challenges faced by avocado farmers in Kenya and other similar regions include; premature fruit harvesting, losses due to root rot fungal disease (MOA, USAid & HCDA Annual report, 2012; Dirou and Stovold, 2004) and planting of local varieties (MOA, USAid & HCDA Annual report, 2012; Gaufa *et al*., 2011). Local avocado varieties take long to mature, bear low fruit yields, the fruits are of poor quality and prone to high post-harvest handling perishability, have undesirable qualities and unmanageable growth vigour, utilize large land space and are not disease and pest resistant (The Royal Horticultural Society, United Kingdom, 2014).

Farmers and other enterpreneurs operate in an environment of natural and socio-economic factors (Elemo *et al.,*1984). Interaction of these factors lead to increased production costs, low production and other risks which make the actors to shy away from engaging in economic activities (Trieschmann & Gustavson, 1998). According to Rogers (1995), the factors may influence enterpreneurs including farmers to take up enterprise improved production technologies including avocado for increased production.

This study considers influence of farmer's socioal factors on uptake of avocado improved production technologies. Social factors affect the life styles, personality and attitude of farmers. Rogers (1995) found that farmers who are valued in society are early takers of improved production technologies. The farmer's social factors considered in this study are; gender roles, age and level of formal education.

Various research findings support selection of these factors or variables including:
Gender roles: Abunga *et al.*(2012) in a study on adoption of modern agricultural production technologies by farm households in Ghana: what factors influence their decisions? found that male farmers adopt modern technologies more compared to female farmers because men control critical productive family resources and make production decisions. Gebre *et al*. (2019) in a study on gender differences in the adoption of agricultural technology: the case of improved maize varieties in southern Ethiopia found that where decisions are made jointly by men and women, the intensity of technology adoption is higher for male-headed households compared to female headed households. Venkatesh and Morris (2000) in a study on gender, social influences and their role in technology acceptance and usage behaviour in Virginia, United States found that technology use is mostly associated with perceptions of usefulness among men compared to female. Orser and Riding (2018) in a study on the influence of gender on the adoption of technology among small medium enterprises in Canada found that male are more likely to understand what they want and need from technology compared to females.

Age: Abunga *et al.*(2012) in a study on adoption of modern agricultural production technologies by farm households in Ghana: what factors influence their decisions? found that age has a quadratic function on adoption of modern technology; implying that farmers' rate of adoption of technology decrease with both at young and old ages. Caswell *et al.*(2001) in a study on adoption of agricultural production practices: lessons learned from the United States Department of Agriculture area studies project and Khanna (2001) in a study on sequential adoption of site-specific technologies and its implications for nitrogen productivity: a double selectivity model in Midwestern states, United States found that at young age, farmers may not be able to adopt new technologies, especially capital intensive ones because they may not have adequate resources to do so. At old age, farmers' volume of economic activities is reduced and may not be able to pay for the technologies. Besides, older farmers have resources and have accumulated years of experience in farming through experimentation and observations and may find it difficult to leave such experiences for new technologies. Atsan *et al.* (2009) in a study on factors affecting agricultural extension services in Turkey found that older farmers do not usually want to change their way of life styles hence not easy to learn new technology and programmes even when resources are available. Alternatively, at young age, farmers want to improve their farming activities for increased incomes if resources are available. Omoro *et al.* (2014) in a study on determination of farmer's choice of fertilizer application rate and its effect on the greenhouse technology performance in Gusii highlands of Kenya found that adoption of greenhouse technology by young age farmers is on the rise hence youths are flexible in increasing adoption of technologies with quick economic gains. According to United Nations Development Programme, UNDP (2011), agriculture is not a core attraction for the youth.

Level of formal education: World Bank (2007) in a study on beating the odds: sustaining inclusion in a growing economy; a Mozambique poverty, gender and social analysis, found that completion of at least lower primary school implies a much higher propensity of adopting improved technology than lower or zero levels of formal education. Abunga *et al.(*2012) in a study on adoption of modern agricultural production technologies by farm households in Ghana: what factors influence their decisions? found that maximum level of formal education within the farm household enhances adoption of technology. This is because farm households with well educated members are more likely to adopt improved technologies than those without because educated members bring home improved technologies, especially improved crop varieties and livestock breeds for relatives to adopt. Atsan *et al.* (2009) in a study on factors affecting agricultural extension services in Turkey show that farmer's level of formal education enhance receiving of agriculture extension services for adoption. This is so because education makes farmers to; realize the importance and benefits of adopting new technologies, easily access and learn new technologies and programs and makes them enthusiastic and willing to adopt the technologies. Caswell *et al.*(2001) in a study on adoption of agricultural production practices: lessons learned from the United States department of agriculture area studies project found that formal education creates a favourable mental attitude to adopt new technology, especially information and management intensive ones.

Ministry of Agriculture,United States Aid and Horticulture Crops Development Authority horticulture performance report (2010-2012) rates production of major fruits and avocado per major producing county in Kenya in terms of percetage share by value. Fruits production are: 38% bananas, 22% mangoes, 16% pineapples, 6% pawpaw, 5% avocado, 4% melon, 3% oranges, 2% passion fruits and 1% tangerines. Avocado production per county are: 45% Nyamira, 11% Kisii, 11% Kiambu,7% Tharaka Nithi, 5% Migori and 4% Kirinyaga.
The data shows that despite avocado's documented high nutritive and economic value, its share by value nationally is unfortunately low at only 5% share by value.The value of avocado is low despite Kenya being the leading avocado producer in Africa and having a huge unexploited production potential (FAO, 2011). This implies that having strategies to increase uptake of avocado improved production by farmers, Kenya will achieve a comparative production advantage in Africa.The data also shows that Kisii and Nyamira counties (study region) account for 56% share by value which is more than half of the national production.This is in agreement with the findings of Food and Agriculture Organization, FAO (2011) that Kenya and in extension the study region has a huge and under-utilised avocado production potential.

Low avocado production in the study region; Kisii and Nyamira counties, could be due to low uptake of avocado improved production technologies by small scale farmers.A study was carried out in the study region to evaluate influence of farmer's social factors on uptake of avocado improved production technologies. The general objecive of the study is to improve avocado production in Kisii and Nyamira counties region, Kenya. Thespecific objective is to evaluate how the farmer's social factors; gender roles, age and level of formal education influence uptake of avocado improved production technologies. The study hypothesised that low uptake of the technologies by the farmers could be due to chance and that there was no significant influence of the their social factors on the uptake. This is the knowledge gap that this study sought to address. Therefore, the farmer's social factors were evaluated for their influence on the farmer's uptake of avocado improved production technologies in Kisii and Nyamira counties region, Kenya.

2. Research Methodology

2.1 Setting

The study was conducted in Kisii and Nyamira counties region in Kenya. The region covers a total area of 2,230.4 Km^2 out of which approximately 80% is arable land. The counties lie between longitudes 34^0 58'E and 35^0 05'E and latitudes $0^0$35'S and 0^0 58'S. The region has 13 subcounties and 65 wards where Kisii has 9 subcounties and 45 wards while Nyamira has 4 subcounties and 20 wards. The total population is approximated at 1,750,534 persons with an average of 6 persons per farm family thus giving 291,756 farm families or households. Most of the households owned less than 3 acres of land each on average and are thus small scale mixed farmers (Kenya national bureau of statistics-KNBS, 2012; Independent electral and boundaries commission-IEBC, 2012).The altitude of the study region ranges between 1400-2250 meters above sea level. Based on temperatures, amount of rainfall and distribution, soil and enterprises types, enterprise growing periods and production potentials,Jaetzold*et al*. (2009) stratified the region into four agro-ecological zones, AEZs or farm types. The AEZs are: 1) Lower highland one, LH_1 or tea-dairy zone covers 30%, 2) Lower highland two, LH_2or wheat-maize-pyrethrum zone covers 5 %, 3) Upper midland one,two,three, $UM_{1,2,3}$or coffee-banana zone covers 60 % and 4) Lower midland one, LM_1or sugar cane zonecovers 5 %. Farms in each AEZ have similar farming conditions but each AEZ has different and unique farming conditions from another in same region and across regions with similar situations (Jaetzold *et al*.,2009). With thedifferent and unique defining climatic characteristics, each of the four AEZs was used as sampling site for a diverse study population. The region has fertile and well drained soils, reliable rainfall and tropical temperatures. The suitable clmate is ideal for production of diverse crops and livestock enterprises making farming the major economic activity of the region.

2.2 Research Design

A research design is an overall strategy within which a research is conducted. It ensures that research problem is addressed. It involves collecting, measuring and analysing data (Kothari, 2004).Descriptivesurvey research design was used for the study where quantitative data which describes situations hence descriptive, was collected from a sample of respondents (Kothari, 2004) through administering questionnaires hence survey (Orodho, 2009). Analysed information was used to make un-biased, reliable, factual descriptions and predictions on the sample and target population.Structured, reliable, closed ended itemized (Mugenda and Mugenda, 2003; Kumar, 2011;Mulusa, 1990) questionnaireswith an acceptable reliability Cronbach Alpha, α=0.724 (Cronbach *et al.,* 1955) were used to collect data.

2.3 Target Population

Target population is total number of individuals with common observable characteristics from which a random sample size for study is accessed (Mugenda&Mugenda, 2003). Target population for this study were the small scale avocado farmer households. The target population grow avocado for home consumption and could at least have excess to sell and they were 15% of the number of stratified farmer households per sub county (Ministry of Agriculture, 2012).Thus target population was 3731 which was an aggregate of 15% on ratio of area of each subcounty to that of the region of number of farmer households per sub county. However, based on largest avocado hectarage of each subcounty in each agro-ecological zone (AEZ), the targeted farmer households in the study were: 1) 513 in Bobasi subcounty in lower hghland one AEZ, 2) 391 in Borabu sub county in lower highland two AEZ, 3) 144 in Kitutu Chache North sub county in upper midland one,two,three AEZ and 4) 163 in Bonchari sub county in lower midland one AEZ giving a total of 1,211 farmer households.

2.4 Sample size and Sampling procedure

Sample size for the study was 291 farmer house holds (HHs). Stratified sampling was used to apportion farmer households to ensure uniform farmer representation per sub county in the study region. Sub counties were the data collection sites for the study. Purposive sampling was used to select 1 sub county with their respective farmer households (HHs) from each agro-ecological zone (AEZ) for all the 4 AEZs based on largest avocado hectarage as criteria for the sampling. Purpose of purposive sampling was to provide representative and reliable data, reduce time, cost of study and repetitions. Sub counties in each AEZ have similar farming conditions but each AEZ has different and unique farming conditions from another in same region and across regions with similar situations (Jaetzold *et al*.,2009). Thus the total farmer households from the 4 purposively sampled sub-counties was 1,211 HHs from where the sample of 291 respondents was accessed using Morgan’s table of sample size determination (Krejcie & Morgan, 1970). Morgan’s table of sample size determination states that, “ no calculations are needed when using the table and as target population size increases the sample size increases at a diminishing rate and remains relatively constant at slightly more than 380 cases” (Krejcie & Morgan, 1970). Thus Morgan’s table summarizes population sizes and approves sample sizes to be used for a study.

2.5 Instrumentation

The study used structured questionnaires with closed ended items or questions to collect primary data. The questionnaires,formualted by the researcher, had set of coded questions addressing the study objectives and coded responses to the questions which were expected to assist in arriving at expected study outputs. Responses had provisions of yes, no, not applicable and likely and agree on Likert scale ratings. Form of responses was ticking on yes, no, not applicable or on a selection from a list of options on the Likert scale ratings which respondents selected and ticked the answer that best described their situation, attitude or opinion. Secondary data was obtained through desktop survey through gathering and analyzing information already available in print or published form.

2.6 Validity

Validity is the extent to which the research instrument measures what it is designed to measure (Mugenda&Mugenda, 2003; Kombo & Tromp, 2006). Thus the instrument and the study objectives were examined and assessed by an expert from Kenya Agricultural and Livestock Research Organization,Kisii and Kisii University supervisors. The experts examined and assessed face and content validity of the instrument to gauge if there was a logical link between the questions and objectives of the study and that it would assist in data collection.

Input for improvement from the experts was incorporated thence making the instrument appropriate for data collection (Mugenda&Mugenda, 2003).

2.7 Reliability

Pre-testing or piloting of the instrument for reliability was done by administering the questionnaire for data collection to 20 farmers randomly sampled from small scale avocado farmers in Nyaribari Chache sub county. Sample size for pre-testing should be between one and ten percent of calculated study sample (Mugenda and Mugenda, 2003) in this case 291 farmer households. Farmers from this sub-county in study region were not taking part in the actual study. Piloting assist in detecting weaknesses, vague questions and ommissions and establishes the period it takes to be completed by respondents in the actual study (Hair *et al.*, 2007; Muijs *et al*., 2008). Reliability is the ability of a research instrument to produce consistent results when used in different areas on similar conditions (Mugenda and Mugenda, 2003; Kumar, 2011;Mulusa, 1990). Correlation or internal consistency of items or questions of the instrument confirms its reliability thus Cronbach Alpha coefficient indicates how the items correlate and a high coefficient indicates high correlation hence the data collection instrument is consistent and reliable (Cronbach *et al.,* 1955). The collected pre-testing data was cleaned, organized, coded and entered into statistical package for social sciences version 22. Reliability analysis was carried out and Cronbach Alpha showed that the questionnaire reached an acceptable reliability, α=0.724 indicating that the questionnaire was reliable.

2.8 Data Collection procedures

After approval of the proposal, the researcher obtained a letter of introduction from Kisii university addressed to the national commission for science, technology and innovations as required by law requesting for a research permit to facilitate the data collection. The research permit was granted and issued. Through sub county agricultural officers of the data collection sites, the researcher and 2 research assistants held focussed group discussions at strategic sites to draw modalities for data collection. The researcher gave a brief on; purpose of the study and clarified any unclear issues on the questionnaire. Modalities of seeking respondent's consent for the data collection, ensuring their ethical and confidentiality and respect measures were discussed. It was emphasized that the data to be collected was purely for research purposes. The research assistants were asked to cascade the same briefing to the respondents on the data collection day. Researcher handed over the questionnaires to the respective research assistants after the briefing. On the data collection day, respective research assistants met the respondents at the strategic sites. After briefings, each respective research assistant randomly availed the questionnaires using drop and pick method to the respondents for filling. Then the respondents returned the questionnaires to the research assistants after completion. Confidentiality of the respondents was observed in that their anonymity was ensured.

2.9 Data Analysis

The collected data was cleaned,organized, coded and entered into statistical package for social sciences-SPSS Version 22 software in the computer for analysis (Field, 2013). Using SPSS; quantitative and social-demographic characteristics data was subjected to descriptive statistics for frequencies and descriptives. The outputs included frequencies, frequency distribution charts and tables, percentages and means thus allowing visual and accurate reflections on data variations. The data was subjected to analysis of variance-ANOVA test. The test analyses the predictive statistically significant variations or means of one independent variable at a time on the dependent variable based on their respective responses. Least Significant Difference post-hoc multiple comparisons of the variations or means test was used to state where the statistically significant mean differences occured among the various responses. The Least Significant Difference is a computed value, in this case by the software, which shows how much two means must differ to warrant rejection of the null hypothesis and concluding they are significantly different. The differences between all possible pairs of means are computed by subtraction. These mean differences are compared to the Least Significant Difference value. Any two means that differ at least by the LSD value or amount will be judged to be significantly different at the 0.05 level (Arkkelin, 2014). Lastly, the data was subjected to Spearman's rho regression analysis test to explore any statistically significant correlation between each independent and the dependent variable.

3. Results

3.1 Influence of farmer's social factors on uptakeof avocado improved production technologies

a) Gender roles

Respondents rated three responses on gender roles and its influence on farmer's uptake of avocado improved production technologies as disagree to agree on a three point likert scale ratings. Gender roles state that male farmers take up improved technologies more compared to female farmers because they control family resources. Analysis of variance test (Table 1)show that there is a statistically significant influence of gender roles on uptake of avocado improved production technologies at the $p< .05$ level for the three groups, $F(2,288)=6.18$, $p(p< .05)= .002$.Thus the study hypothesis Ho, which hypothesized for non-significant influence of farmer's gender roles on uptake of avocado improved production technologies, tested at 0.05 level of significance, is rejected.

Least significant difference post-hoc comparisons test (Table 2) show that all the three mean differences are significantly different from each other.The influence of agree rating is more significant than neutral and disagree ratings as ranked (Table 1). Meaning, influence of agree rating has more significant mean difference and descriptive mean (MD=0.386; M=1.53) on uptake of the technologies than neutral (MD=0.245; M=1.39) and disagree (MD=-0.245; M=1.14) ratings. Respondents who agree on the gender roles take up avocado improved production technologies more than the other ratings. Spearman's rho regression analysis test (Table 3) show that the correlation between the two variables at the $p< .01$ level ((2-tailed) is positive and statistically significant at N-2 degree of freedom, $r_s(288)= .206$,$p= .000$.

Table 1:Descriptives, Least significance difference test mean difference ranking and Analysis of variance findings on influence of farmer's gender roles on uptake of the improved technologies

Dependent variable: Uptake of avocado improved production technologies											
Independent variable: Male farmers uptake improved technologies more compared to female farmers because they control family resources (gender roles)											
Descriptives				LSD Mean Difference (MD)		ANOVA					
Response	Mean	Std. Dev.	Std. Dev.	LSD MD	MD Rank		Sum of Squares	df	Mean Square	F-value	P-value (Sig.)
Disagree	1.14	0.52	0.52	-.245*	3	Between Groups	6.633	2	3.317	6.18	.002
Neutral	1.39	0.73	0.73	.245*	2	Within Groups	154.487	288	.536		
Agree	1.53	0.83	0.83	.386*	1	Total	161.120	290			
Total	1.39	0.75	0.75								

*. The mean difference is significant at the 0.05 level.

Table 2: Least significant difference test results on influence of farmer's gender roles on uptake of the improved technologies

Multiple Comparisons				
Dependent variable: Uptake of avocado improved production technologies				
LSD				
(I) Male farmers take up improved technologies more compared to female farmers because they control family resources	(J) Male farmers take up improved technologies more compared to female farmers because they control family resources	Mean Difference (I-J)	Std. Error	Sig.
Disagree	Neutral	-.245*	.115	.033
	Agree	-.386*	.110	.001
Neutral	Disagree	.245*	.115	.033
	Agree	-.141	.099	.157
Agree	Disagree	.386*	.110	.001
	Neutral	.141	.099	.157

*. The mean difference is significant at the 0.05 level.

Table 3: Spearman's correlation coefficient findingon influence of farmer's gender roleson uptake of the improved technologies

Correlations				
			Uptake of improved avocado production technologies	Male farmers uptake improved technologies more compared to female farmers because they control family resources (gender roles)
Spearman's rho	Uptake of improved avocado production technologies	Correlation Coefficient	1.000	.206**
		Sig. (2-tailed)	.	.000
		N	291	291
	Male farmers uptake improved technologies more compared to female farmers because they control family resources (gender roles)	Correlation Coefficient	.206**	1.000
		Sig. (2-tailed)	.000	.
		N	291	291

**. Correlation is significant at the 0.01 level (2-tailed).

b) Age

Respondents rated four age brackets and its influence on farmer's uptake of avocado improved production technologies. Analysis of variance test (Table 4) show that there is a statistically significant influence of age on uptake of avocado improved production technologies at the *p*< .05 level for the four groups, *F* (3,287) =5.47, *p* (p< .05)= .001.Thus the study hypothesis Howhich hypothesized for non-significant influence of the farmer's age on uptake of avocado improved production technologies, tested at 0.05 level of significance, is rejected.

Least significant difference post-hoc comparisons test (Table 5) show that all the four mean differences are significantly different from each other. The influence of age over 70 years rating is more significant than age brackets 36-55, 56-69 and 18-35 years ratings as ranked (Table 4). Meaning, influence of age 70 and over years hasmore significant mean difference and descriptive mean (MD=0.544; M=1.78) on uptake of the technologies than age brackets 36-55 (MD=0.235;M=1.47), 56-69 (MD=-0.235; M=1.27) and 18-35 (MD=-0.513; M=1.24).Thus respondents aged 70 and over years take up avocado improved production technologies more than the other age brackets. Spearman's rho regression analysis test (Table 6) show that the correlation between the two variables at the *p*< .01 level ((2-tailed) is not statistically significant at N-2 degree of freedom, r_s(288)= .061, *p*= .299.

Table 4: Descriptives, Least significance difference test mean difference ranking and Analysis of variance results on influence of farmer's age on uptake of the improved technologies

Dependent variable: Uptake of avocado improved production technologies											
Independent variable: Age in years											
Descriptives				LSD Mean Difference (MD)		ANOVA					
Response	Mean	Std. Dev.	Std. Dev.	LSD MD	MD Rank		Sum of Squares	df	Mean Square	F-value	P-value (Sig.)
18-35	1.24	0.62	0.62	-.513*	4	Between Groups	8.708	3	2.903	5.47	.001
36-55	1.47	0.81	0.81	.235*	2	Within Groups	152.412	287	.531		
56-69	1.27	0.63	0.63	-.235*	3	Total	161.120	290			
Over 70	1.78	0.91	0.91	.544*	1						
Total	1.39	0.75	0.75								

*. The mean difference is significant at the 0.05 level.

Table 5: Least significant difference test results on influence of farmer's age on uptake of the improved technologies

Multiple Comparisons				
Dependent variable: Uptake of avocado improved production technologies				
LSD				
(I) Age in years	(J) Age in years	Mean Difference (I-J)	Std. Error	Sig.
18-35	36-55	-.204	.120	.091
	56-69	.031	.122	.802
	Over 70	-.513*	.161	.002
36-55	18-35	.204	.120	.091
	56-69	.235*	.102	.023
	Over 70	-.310*	.147	.036
56-69	18-35	-.031	.122	.802
	36-55	-.235*	.102	.023
	Over 70	-.544*	.149	.000
Over 70	18-35	.513*	.161	.002
	36-55	.310*	.147	.036
	56-69	.544*	.149	.000

*. The mean difference is significant at the 0.05 level.

Table 6: Spearman's correlation coefficient results on influence of farmer's age on uptake of the improved technologies

Correlations				
			Uptake of improved avocado production technologies	Age
Spearman's rho	Uptake of improved avocado production technologies	Correlation Coefficient	1.000	.061
		Sig. (2-tailed)	.	.299
		N	291	291
	Age in years	Correlation Coefficient	.061	1.000
		Sig. (2-tailed)	.299	.
		N	291	291

**. Correlation is significant at the 0.01 level (2-tailed).

c) Level of formal education

Respondents rated four levels of formal education and its influence on farmer's uptake of avocado improved production technologies. Analysis of variance test (Table 7)show that there is a statistically significant influence of level of formal education on uptake of avocado improved production technologies at the $p< .05$ level for the four groups, F (3,287) = 5.00, p (p< .05)= .002.Thus the study hypothesis Ho, which hypothesized for non-significant influence of the farmer's level of formal education on uptake of avocado improved production technologies, tested at 0.05 level of significance, is rejected.

Least significant difference post-hoc multiple comparisons test (Table 8) show thatall the four mean differences are significantly different from each other. The influence of secondary education rating is more significant than post-secondary, primary and none formal education ratings as ranked (Table 7). Meaning, influence of secondary education has more significant mean difference and descriptive mean (MD =0.415; M=1.52) on uptake of the technologies than post secondary (MD =0.386; M=1.49), primary (MD= -0.288; M=1.21) and none formal education (MD=-0.386;M=1.11). Thus respondents with secondary level of formal education take up avocado improved production technologies more than the other levels. Spearman's rho regression analysis test (Table 9) show that the correlation between the two variables at the $p<$ .01 level (2-tailed) is positive and statistically significant at N-2 degree of freedom, $r_s(288)$ =.197, p=.001.

Table 7:Descriptives, Least significance difference test mean difference ranking and Analysis of variance results oninfluence of farmer's level of formal education on uptake of the improved technologies

Dependent variable: Uptake of avocado improved production technologies											
Independent variable: Level of formal education											
Descriptives				LSD Mean Difference (MD)		ANOVA					
Response	Mean	Std. Dev.	Std. Error	LSD MD	MD Rank		Sum of Squares	df	Mean Square	F-value	P-value (Sig.)
None	1.11	0.46	0.08	-.386*	4	Between Groups	7.997	3	2.666	5.00	.002
Primary	1.21	0.56	0.07	-.288*	3	Within Groups	153.124	287	.534		
Secondary	1.52	0.83	0.08	.415*	1	Total	161.120	290			
Post secondary	1.49	0.82	0.09	.386*	2						
Total	1.39	0.75	0.04								

*. The mean difference is significant at the 0.05 level.

Table8: Least significant difference test results on influence of farmer’s level of formal education on uptake of the improved technologies

Multiple Comparisons				
Dependent variable: Uptake of avocado improved production technologies				
LSD				
(I) Level of formal education	(J) Level of formal education	Mean Difference (I-J)	Std. Error	Sig.
None	Primary	-.098	.149	.513
	Secondary	-.415*	.139	.003
	Post secondary	-.386*	.146	.009
Primary	None	.098	.149	.513
	Secondary	-.317*	.113	.005
	Post secondary	-.288*	.121	.018
Secondary	None	.415*	.139	.003
	Primary	.317*	.113	.005
	Post secondary	.030	.108	.784
Post secondary	None	.386*	.146	.009
	Primary	.288*	.121	.018
	Secondary	-.030	.108	.784

*. The mean difference is significant at the 0.05 level.

Table 9: Spearman’s correlation coefficient result on influence of farmer’s level of formal education on uptake of the improved technologies

Correlations				
			Uptake of improved avocado production technologies	Level of formal education
Spearman's rho	Uptake of improved avocado production technologies	Correlation Coefficient	1.000	.197**
		Sig. (2-tailed)	.	.001
		N	291	291
	Level of formal education	Correlation Coefficient	.197**	1.000
		Sig. (2-tailed)	.001	.
		N	291	291

**. Correlation is significant at the 0.01 level (2-tailed).

4. Discussion

4.1 Influence of farmer's social factors on uptake of avocado improved production technologies

a) Gender roles

Results show that farmer's gender roles significantly influences them to take up avocado improved production technologies as revealed by analysis of variance (Table 1). Gender roles state that male farmers take up improved technologies more compared to female farmers because they control family resources.Thus where male farmers control family resources more compared to female farmers, males show more uptake of avocado improved production technologies than females.The uptake significantly increases with significant increase in the gender roles(Table 3) where the influence of agree rating on the gender roles has more significant mean difference (Table 2) and descriptive mean (Table 1) than neutral and disagree ratings. Thus where farmers agree on the gender roles as stated, males show more uptake of avocado improved production technologies hence better for the technology uptake.However, this is gender disparity which limits women in terms of control, ownership and accessibility to productive resources thus limiting decision making in agriculture production hence needs mitigation through affirmative action initiatives.The finding is in tandem with Abunga *et al.* (2012) in Ghana, Gebre *et al*. (2019) in Ethiopia, Venkatesh and Morris (2000) in the United States and Orser and Riding (2018) in Canada.

b) Age

The results reveal that farmer's age significantly influences them to take up avocado improved production technologies as shown by analysis of variance (Table 4). However, the uptake non-significantly decreases with both decrease and increase in age (Table 6).Thus farmer's age show a quadratic response on uptake of the technology. Finding on quadratic response is collaborated by Abunga *et al.* (2012) in Ghana. Its noteworthy that age over 70 years has more significant mean difference (Table 5) and descriptive mean (Table 4) than age brackets 36-55, 56-69 and 18-35 years.

Though uptake improved production technologies non-significantly decreases with both decrease and increase in age, farmers over 70 have higher average scores than other age groups.This shows that elderly farmers with resources take up improved technologies more compared to the younger farmers of 56-69 and 36-55 age groups respectively.This finding agrees with findings of Caswell *et al.* (2001) and Khanna (2001) in the United States of America. Similarly, elderly farmers take up longer establishing improved production technologies which are also slow economic return technologies such as fruit tree crops (for example avocado) more compared to the younger farmers of 56-69 and 36-55 age groups respectively. This finding agrees with Omoro *et al.*(2014) in Kenya. Thus, with a mean age of 51.3 years as found in this study compared with 60 years according to another study (Izzy, 2018) in Kenya, there is still room for extension for the elderly.

c) Level of formal education

The results show that farmer's level of formal education significantly influences them to take up avocado improved production technologies as indicated by analysis of variance (Table 7). The uptake significantly increases with significant increase in level of formal education (Table 9) where the influence of secondary education has more significant mean difference (Table 8) and descriptive mean (Table 7)than post-secondary, secondary, primary and none education levels. Thus farmers that have secondary education show more uptake of avocado improved production technologies hence better for the technology uptake. Besides agriculture extension education, formal education is vital in rural development as it creates fertile mental attitude for uptake of improved technologies hence need for its prioritization. The finding is consistent with World Bank (2007) in a report on Mozampique, Abunga *et al.* (2012) in Ghana, Atsan *et al.* (2009) in Turkey and Caswell *et al.* (2001) in the United States of America.

5.Conclusion

There is a significant influence and positive significant correlation of farmer's gender roles (F[2,288]=6.18, p [p<.05]= .002; r_s[288]= .206,p= .000) and level of formal education (F [3,287]=5.00, p [p< .05]= .002; r_s[288]= .197,p= .001) on and between uptake of avocado improved production technologies respectively. Where male farmers control family resources than female farmers, male farmers take up the improved technologies more significantly than female farmers. Farmer's with secondary eduction level of formal education more significantly take up the improved technologies more significantly than farmer's with the other levels of formal education.Though influence of farmer's age on the technology uptake is significant (F [3,287] =5.47, p [p< .05]= p= .001, the correlation is not significant, r_s(288)= .061, p= .299. Interestingly, farmers aged 70 years and above take up avocado improved production technologies more significantly than farmers of the lower age brackets.

6. Recommendations

The study reveals that farmer's gender roles, age and level of formal educationinfluence farmers to take up avocado improved production technologies. Thus where male farmers control family resources than female farmers, male farmers take up avocado improved production technologiesmore significantly than female farmers. This is gender disparity limits women in terms of control, ownership and accessibility to productive resources. This limits decision making in agriculture production hence needs mitigation through affirmative action initiatives by policy makers.Farmers aged 70 years and above take up avocado improved production technologies more significantly thanfarmers of lower age brackets.This is contrary the perception that aged farmers aren't enthusiastic towards farming. In tandem with similar studies, elderly farmers with resources in the region take up longer establishing and slow economic return technologies such as fruit tree crops compared to the youth. Thus, with a mean age of 51.3 yearsas found in this study compared with 60 years for farmers in Kenya (Izzy, 2018), there is still room for extension for the elderly. Stakeholders in the sector should ensure that extension services is formulated to cover all age cadres.

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REFERENCES

Abunga, M.A.; Emelia, G. &Kwesi, D. (2012).*Adoption of Modern Agricultural Production Technologies by Farm Households in Ghana: What Factors Influence their Decisions?* Tamale, Ghana.Journal of Biology, Agriculture and Healthcare, Vol 2, No.3.

Albertin, A. & Nair P.K.R. (2004).*Farmers' Perspectives on the Role of Shade Trees in Coffee Production Systems: An Assessment from the Nicoya Peninsula.* Costa Rica, Human Ecol. 32:4.

Arkkelin, D. (2014). *Using SPSS to Understand Research and Data Analysis*. Psychology Curricular Materials. Book 1. http://scholar.valpo.edu/psych_oer/1.

Atsan, T.H.; Bayram, Isik;Fahri, Yavuz&Ziya, Yurttas. (2009). *Factors affecting agricultural extension services in Northeast Anatolia Region.*Turkey. African Journal of Agricultural Research Vol. 4 (4), pp. 305-310.

Caswell, M., Fuglie, K., Ingram, C., Jans S. &Kascak C. (2001). *Adoption of Agricultural production practices: Lessons learned from the US. Department of Agriculture Area Studies Project.*US Department of Agriculture, Resource Economics Division, Economic Research Service, Agriculture Economic Report No. 792. Washington DC.

Cronbach, L.J. &Meehl, P.E. (1955).*Construct Validity in Psychological Tests*. Psychological Bullettn, 52(4), 281-302.

Dirou, J.N.& Stovold, G.E. (2004). *Avocado diseases.* Retrieved from: http://www.agric.nsw.gov.au.

Elemo, K.A., Fisher, N.M., Y.A. Abdullahi., O. Ajayi., A.B. Bello., H.L. Musa., Ogungbile A.O. & J.P. Voh. (1984). *An exploratory survey of the farming systems of southwest Plateau State of Nigeria.* Ibadan, Nigeria.

Emongor (2010).*ICRAF KARI Conference May 2010*. *End of Programme Report National Agriculture and Livestock Extension Programme*, *2011*. Manga District, Kenya.

FAO (2011). *World Avocado Production*: http://en.wikipedia.org/wiki/Avocado#cite_note-FAO-17.

FAO (2005).*Market Segmentation of Major Avocado Markets, Sugar and Beverages Group Raw Materials, Tropical and Horticultural Products Service Commodities and Trade Division*. FAO, United Nations.

Field, A.P. (2013).*Discovering Statistics using IBM SPSS Statistics: and sex and drugs and rock 'n', 4th edition.*Sage, London.

Gabre-Madhin, E.Z. &Haggblade S. (2001).*Success in African agriculture: Results of an expert survey*.International Food Policy Research Institute, Washington DC.

Gaufa, S. F., Notise, F. &Luaao, F. M. (2011). *Samoa Avocado Oils: Processing into Export Products and Commercialization Opportunities*. Scientific Research Organization of Samoa, pp 3-18.

Gebre, G.G., Isoda, H., Rahut, D.B., Amekawa, Y. & Nomura, H. (2019). *Gender differences in the adoption of agricultural technology: The case of improved maize varieties in southern Ethiopia.* Women's Studies International Forum 76.

Griesbach, J. (2005). *Avocado Growing in Kenya*. World Agroforestry Centre (ICRAF), Nairobi, Kenya.

Guinness Book of Records (2010).*Trippy Food, Holy Guacamole.* Carpentaria, California.

Gurel, A. (1998). *A Study on the Factors Affecting the Behavious of Sunflower Producers to Technologic Innovations in Malkara District.*Trakya University Tekirdag Faculty of Agriculture, Publication Number: 262, Research Number: 90, Tekirdag.

Hair, J.F., Arthur, H. M., Phillip, S. & Mike, P. (2007). *Research Methods for Business*. Chichester: John Wiley and Sons.

Human, T.P. (1987).*Oil as a byproduct of the avocado*.South African Avocado Growers Association Yearbook 10:pp159-162.

Indepent Electral and Boundaries Commission (2012). *Final Report of bounaries and wards*. Gazetted on 7/3/2012.pdf pp 196-203, Nairobi,Kenya.

Izzy, B. (2018).*Agricultural productivity in Kenya: barriers and opportunities. Average age of a farmer*. Accessed on 26/07/2021. https://assets.publishing.service.gov.uk › media.

Jaetzold, R., Schmidt, H., Hornet, Z.B. &Shisanya, C. (2009).*Farm Management Handbook of Kenya.Natural Conditions and Farm Management Information.*2nd Edition.Vol.11/ A. West Kenya, Nyanza Province.Ministry of Agriculture/GTZ, Nairobi, Kenya.

Kenya National Bureau of Statistics (2012).Nairobi,Kenya.

Khanna, M. (2001).*Sequential adoption of site-specific technologies and its implications for nitrogen productivity: A double selectivity model*. American Journal of Agricultural Economics, 83(1), 35-51.

Kirby, K. &Potvin, C. (2007).*Variation in Carbon Storage among Tree Species: Implications for the Management of Small-Scale Carbon Sink Project. For Ecology Management.* 246:208-221.www.elsevier.com/locate/foreco.

Kisii County (2013).*The First County Integrated Development Plan 2013 – 2017*. Kisii County Government.

Kombo, D.K. & Tromp, D.L.A. (2006).*Proposal Writing and Thesis Proposal; An Introduction.*Nairobi, Kenya. Pauline's Publications.

Kothari, C. R. (2004). *Research Methodology: Methods and Techniques*.Retrived from: http://www.2shared.com/document/CpY988Ro/2004__Kothari__Research_Method.html

Kumar, R. (2011) *Research Methodology; A Step by Step Guide for Beginners*, 3rd edition.

Krejcie, R. V. & Morgan, D. W. (1970). *Determining sample size for research activities.* Educational and Psychological Measurement, 30, pp.607-610.

Mapila, M. A. T. J. (2011). *Rural livelihoods and agricultural policy changes in Malawi. Agricultural Innovations for Sustainable Development.*In: Manners, G.andSweetmore, A., (Editors). Accra-Ghana, CTA and FARA, 3, 190-195.

Ministry of Agriculture., Horticulture Crop Development Authority & United States Aid. (2012). *Validated Data on Horticulture Performance.* Nairobi, Kenya.

Ministry of Agriculture (2012). Annual work plan: KisiiCounty/Nyamira County.

Morris, M., Kelly, V.A., Kopicki, R. &Byerlee, D. (2007).*Fertilizer use in African Agriculture*.Washington D.C., World Bank.

Mugenda, O. &Mugenda, A. (2003).*Research Methods: Quantitative and Qualitative Approaches.* Nairobi: Acts Press.

Muijs, D. & Lindsay, G. (2008).*Where are we at?.An empirical study of levels and methods of evaluating continuing professional development.* British Educational Research Journal, 34 (2): 195-211.

Mulayim, Z.G. (1995). *The Cooperative System*.Yetkin Publications, Ankara.

Mulusa, T. (1990).*Evaluating Education and Community Development programmes*. Deutsche Stitung for International Entwicklung and College of Adult and Distance Learning.

Nin, A., Arndt, C. &Precktel, P. (2003).*Is agricultural productivity in developing countries really shrinking? New evidence using a modified nonparametric approach.*Journal of Development Economics, 71, 395-415.

Omoro, P.A., Shitandi, A., Bitonga, R.O. &Basweti, E. (2014). *Determination of farmer's choice of fertilizer application rate and its effect on the Greenhouse Technology performance in Gusii Highlands, Kenya*: http://www.escijournals.net/IJAE

Orodho, A.J. (2009). *Element of Education & Social Science Reaersch Methods.*Kanezja Publisher, Maseno Kenya.

Orser, B.J., Riding, A. (2018).*The influence of gender on the adoption of technology among SMEs.* Int. J. Entrepreneurship and Small Business, Vol. X, No. Y, pp.8.

Pinstrup-Andersen,(1982). *World Food Prospects: Critical Issues for the Early Twenty-First Century.*

Rogers, E.M. (1995). *Diffusion of Innovations, 4th Edition*. Free Press, New York.

Stoorvogel, J.J. &Smalling, E.M.A. (1990).*Assessment of Soil Nutrient Depletion in Sub-Saharan Africa: 1983-2000.*Report 28, DLO-Winand Staring Centre, Wageningen, The Netherlands.

The Royal Horticultural Society, United Kingdom, (2014). *Rootstocks for Fruit Trees*. Retrieved from: http://ww.rhs.org.uk/advice.

Trieschmann, J.S. &Gustavson, S. F. (1998).*Risk Management and Insurance, 10th Edition*. South-Western College Publishing, Cincinnati, Ohio.

UNDP (2011). *Development of short term training modules to respond to selected skill gaps for agri-business.* Retrieved from: http://www.ke.undp.org

Venkatesh, V., Morris, M. (2000) '*Why don't men even stop to ask for directions' gender, social influences and their role in technology acceptance and usage behaviour'*.MIS Quarterly, Vol. 24, No. 1, pp.115–139.

Whittaker, D.A. & Ronald, H. Thieme. (1989). *Integration of Problem-Solving Techniques in Agriculture.*AI Magazine Volume 10, Number 2 (1989) (© AAAI).

World Bank (2007).*Beating the Odds: Sustaining Inclusion in a Growing Economy.A Mozambique Poverty, Gender and Social Analysis*. Report 40048/MZ.