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The Use of Agricultural Extension Information Services in enhancing Maize Productivity among Smallholder Farmers in Tana River County, Kenya

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Abstract

Food security assessment reports have demonstrated that, most food insecure people live in rural areas, with no access to information and technology geared towards enhancing agricultural productivity. This suggests that agricultural information is relevant for agricultural productivity, especially for millions of smallholder farmers, who remain the bedrock for food supply chains in developing countries. This research was carried out with a purpose of evaluating the relationship between the Use of Agricultural Extension Information and Maize Productivity among smallholder farmers in Tana River County. The main objective of the study was to ascertain whether increased use of agricultural extension information correlated with increased maize productivity. The location of the study was Tana River County where a sample of 30 maize farming households was purposely chosen for the study. Data was captured using questionnaires and both qualitative and quantitative data was captured. The research took a correlational study design and through statistical analysis using the Pearson Correlation Coefficient (r) and the simple Linear Regression analysis the relationship between use of extension information services and maize agricultural productivity was evaluated. The research findings revealed that, there was a strong correlation (r=0.7) between use of agricultural extension information services and Maize productivity in Tana River County. The strong relationship was significant in qualifying the research hypothesis. The study also underscored the role of ICT in enhancing the effectiveness of agricultural extension information services and recommended the need to streamline agricultural extension service delivery to ensure seamless access to information. The study was significant in that, its findings are expected to enable agricultural stakeholders appreciate the role of extension information services in enhancing agricultural productivity, besides adding credibility to the agricultural extension information policy agenda for smallholder farmers all over the world.

Keywords: e-extension, Agricultural Extension Information, Agricultural Productivity, Food Security, Information Accessibility

1. Introduction

This research was carried out with a purpose of evaluating the relevance of agricultural extension information services in enhancing maize productivity among smallholder farmers in Tana River County and underscored the effectiveness of e-extension in the dissemination of agricultural information.

1.1 Background to the Study

The 2022 Global Report on Food Crises, (WFP, 2022) highlights the scale of the current global hunger and malnutrition crisis, with an expected 345.2 million people projected to be food insecure which is more than double the number in 2020. This constitutes a staggering rise of 200 million people compared to pre-COVID-19 pandemic levels. This highlights the need for an effective agricultural extension information system that will contribute to improving the efficiency of decision making among smallholder farmers who play a crucial role in boosting agricultural productivity, increasing food security, improving rural livelihoods, and promoting agriculture as an engine of pro-poor economic growth (FAO, 2019).

Unlike in East Africa, the State of Israel has closed the gap from being a developing country in the 1950s to becoming an OECD member country (OECD, 2017), Israel has done so despite difficult climatic conditions, scarce land, shortage of water and other national challenges. The achievement is mainly attributed to the close collaboration and interaction between agricultural research, extension service and growers, which has resulted in the promotion of advanced technologies in all agricultural sectors.

In Kenya, maize farming is one of the most important agricultural activities, contributing significantly to food security and the national economy. According to FAOSTAT database (FAO, 2022), Maize production accounts for roughly 85% of total cereal production in Kenya, however between the year 2020 – 2021 production dropped by an estimated 550,000 metric tons due to fertilizer price increases resulting in lower application rates, persistent failed rainfall, and uncoordinated agricultural extension information services among other factors.

In Tana River County, 75% of the entire agricultural harvest and 70% of traded agricultural yield is produced by smallholder farmers, however, the county's production potential is yet to be achieved especially in most staple crops such as maize and therefore a need to investigate the role of extension information services in enhancing maize productivity where productivity is a low as 0.5mt per hectare against the potential of 4mt per hectare per year. The decline in productivity is of great concern considering that smallholder farmers are responsible for sustained the food requirements of the County (CIDP, 2018-2022).

1.2 Statement of the Problem

Food security assessments by IFAD, (2012) and FAO, (2017), have demonstrated that, between two thirds and three quarters of the food insecure people live in pastoral areas, with limited access to technology and information geared towards enhancing agricultural productivity. In Kenya smallholder famers depend on maize as the main food crop, but its production has been on the decline with an estimation of 0.5 to 1.5mt per hectare per year (Ouma et al., 2002) in contradiction of a production potential of 4mt per hectare per year. The major cause of this could be ascribed to insufficient agricultural information to maintain the maize farming practice.

The Kenya Interim Poverty Strategy Paper (I-PSP, 2000–2003) reveals that even though Tana River County has good soils, suitable climate, adequate rainfall and is endowed with the largest river in Kenya, food security has continued to be a challenge with an incidence of poverty at 62%. This foregoing shows that, despite decades of investment in agricultural production endeavors, Tana River County is yet to achieve sustainable production especially in staple crops such as maize with production being very low. The essence of this research was therefore to investigate how the use of agricultural extension information services can improve maize productivity among smallholder farmers in Tana River County in Kenya.

1.3 Objectives of the Study

The Specific Objectives of the Study were to:

1. Ascertain whether the use of extension information services improves maize crop productivity among smallholder farmers in Tana River County, Kenya.

2. Evaluate how the use of e-extension in the dissemination of agricultural information improves maize productivity among smallholder farmers in Tana River County.

3. Determine the required number of information dissemination sessions for optimal maize yield per acre among smallholder farmers in Tana River County

1.4 Research Hypotheses

This study was based on the Alternative Hypothesis (H1) that there is a relationship between use of agricultural extension information services and maize productivity among smallholder farmers in Tana River County, Kenya.

1.5 Theoretical Framework

The study adopted the Information Search Process (ISP) theory by Caroline Kuhlthau. This theory enumerates six relevant stages that can be applied in information seeking, acquisition and use. Theory proposes different but appropriate information seeking methods from the user's perspective using six simple steps starting with task initiation, selection, exploration, focus formulation, collection, and presentation (Kuhlthau, 1991). The relevance of this theory to this study is exemplified by the fact, smallholder farmers require the support from agricultural extension services providers in applying knowledge and skills gained through innovation, adoption and application of good agricultural practices that will eventually enhance productivity.

1.6 Literature Review

Transformation of public agricultural extension information services has become an essential part of strategic development agendas, with the role of agricultural extension information service providers being regarded as essential in food security endeavors. It is for this reason that the United Nations Sustainable Development Goals (SDGs) agenda aim to achieve food security by promoting sustainable agriculture for smallholder farmers by the year 2030, (UN General Assembly, 2015).

According to KALRO (2023), Maize (Zea mays L.) provides basic diet to millions of people in Kenya. The total land area under maize production is about 1.5 million hectares, with an annual average production estimated at 3.0 million metric tons, giving a national mean yield of 2 metric tons per hectare. Typically, yields range from 4 to 8 T/Ha in the high potential highlands of Kenya, representing only 50% (or less) of the genetic potentials of the hybrids. While maize production has not kept pace with the population increase in Tana River, yields could go up to 10 metric tons per hectare, if farmers practiced good crop husbandry, used the right inputs and had access to relevant agricultural information, this kind of increased yield can turn around the economic fortunes of the County (Ndii, 2020).

In Kenya the proportion of public extension worker to farmers is about 1:1000 as equated to the required level 1:640 in an agro-pastoral farming system (NASEP, 2012, MoALF, 2017), this has made it difficult to reach many farmers., however according to a report by FAO (2017), use of ICTs in agriculture has the potential to bring significant benefits through increased access to information, that will enable farmers better plan production and investments, based on supply-and-demand fundamentals. These factors therefore show that the usefulness of extension information services has an influence on enhancing agricultural productivity and hence the need to establish whether this pronounced influence is widespread to include smallholder maize farmers in Tana River County.

1.7 Summary and Research Gap

From the literature reviewed, prominent gaps in access to agricultural extension information services continue to be experienced by smallholder farmers, characterized by the cyclic global food insecurity resulting from decreased productivity, raising cases of malnutrition and increased wastage. While it is evident that ICTs can enhance smallholder's access to timely extension information by increasing communication connections between farmers, extension agents, and research centers, major gaps exist in exploiting ICTs, as a result seamless flow of information has been elusive giving rise to the need to evaluate the infrastructure in place for the development of an effective e-extension system in Tana River County.

2 Methodology

The research applied a correlation study design and evaluated the relationship between use of extension information services and Maize productivity among smallholder farmers in Tana River County. The results from the correlational analysis were used to determine the associations, forecast occurrence of relationship among the variables and make predictions using the data and knowledge gathered.

The study targeted 30 maize farming households with an average of three acres of land under the crop through two production seasons during the year 2022. Through questionnaires the sampled maize farmers were requested to provide information on the number of extension visits made to their farms by public agricultural extension information service providers and the corresponding yield during the year 2022, the unit of study being household head

3. Findings for Objectives

3.1.1 Relationship between Use of Agricultural Extension Information Services and Maize Crop Productivity.

Out of the targeted 30 households, 28, (93.3%) participated in the study. This return rate was acceptable in reference to The American Association for Public Opinion Research (AAPOR, 2016), which considers 60% as the acceptable minimum response rate for published research.

To equate extension visits to the use of information disseminated, the study only considered the number of interactions when farmers applied the extension information on enhancing maize production, the number of visits where information not relevant to maize farming was disseminated were disregarded. From the data collected the value of extension visits was the independent variable, denoted as ***x,*** while the yield was the dependent variable, denoted as ***y***.

For the 28 maize farming households who responded, extension information visits per household ranged between 10 and 79 times per year with a corresponding mean maize yield of 11.8 bags per acre. However, farmers who received more than 70 extension information dissemination visits during the year produced over 30 bags per acre signifying that use of extension information correlated with increased maize productivity.

This analyzed information was corroborated by figures sourced from FAO (2015), by the International Maize and Wheat Improvement Centre (IMWIC) report which acknowledged that Kenya's smallholder maize production potential ranged between 27-30 bags per acre, but could yield up to 40 bags an acre, if farmers had access to relevant agricultural information as shown in table 1.

To measure the strength between the two variables; use of extension information (x) and maize productivity (y), a Pearson Correlation Coefficient (r) formula was applied on the data analyzed in table 1 to calculate the correlation coefficient. A covariance of the two variables was calculated and then divided by the product of their standard deviations as shown below: -

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{n(\Sigma x^2) - (\Sigma x)^2} * \sqrt{n(\Sigma y^2) - (\Sigma y)^2}}$$

r =28(40810) – (871× 987) / [√ {[28(39155) – (871^2)] × [28(51225) – 987^2]}

r = 1,142,680 – 859,677/√ {[1,096,340 – 758,641] × [1,434,300– 974,169]}

r = 283,003/√ (337,699× 460,131)

r = 283,003 /√ 155,385,778,569

r = 283,003 / 394,190.03

r = 0.718

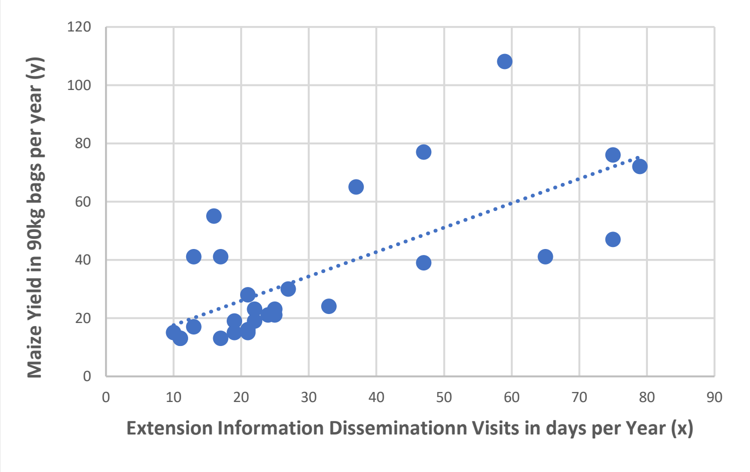
From the calculation, the numerical value of the correlation coefficient was **0.718** and on a scale of −1 to +1 this figure was closer to 1.0, therefore suggesting a strong positive relationship between the use of extension information services and maize productivity. The sign of the correlation coefficient being positive also suggested that increased use of agricultural extension information strongly increased maize production and vice versa.

The coefficient of determination defined as r^2 showed that the percentage maize production could be predicted from the relationship between the two variables. For r = 0.718 the r^2 is 0.516, which implies that 51.6% of the variation in maize productivity was credited to the utilization of extension information services. Conversely, 48.4% of the variation in maize production could not be explained as resulting from utilization of extension Information. To understand the nature of relationship, a scatter graph of data points was drawn to represent the correlation between two variables: extension information dissemination visits (x) and maize production (y). as shown below in Figure 1.

Table 1: Relationship between use of Extension Information Services and Maize Productivity

Maize Enterprise				n=28		
Extension Visits in days per Year (x)	Maize Yield in 90kg bags per year (y)	(xy)	(x^2)	(y^2)	Acreage (a)	Mean Maize Production per acre in 90kg bags (y/a)
79	72	5688	6241	5184	2	36.0
75	47	3525	5625	2209	1.5	31.3
75	76	5700	5625	5776	2.5	30.4
65	41	2665	4225	1681	2	20.5
59	108	6372	3481	11664	4.5	24.0
47	39	1833	2209	1521	2	19.5
47	77	3619	2209	5929	4.5	17.1
37	65	2405	1369	4225	5.5	11.8
33	24	792	1089	576	3.5	6.9
27	30	810	729	900	2.5	12.0
25	21	525	625	441	5	4.2
25	23	575	625	529	2	11.5
24	21	504	576	441	3.5	6.0
22	19	418	484	361	2.5	7.6
22	23	506	484	529	3	7.7
21	28	588	441	784	4	7.0
21	15	315	441	225	2	7.5
21	16	336	441	256	3	5.3
19	19	361	361	361	2.5	7.6
19	15	285	361	225	2.5	6.0
17	13	221	289	169	2.5	5.2
17	41	697	289	1681	5	8.2
16	55	880	256	3025	5	11.0
13	17	221	169	289	4.5	3.8
13	41	533	169	1681	5	8.2
11	13	143	121	169	3	4.3
11	13	143	121	169	4.5	2.9
10	15	150	100	225	2.5	6.0
$\Sigma x=871$	$\Sigma y=987$	$\Sigma xy=40810$	$\Sigma x^2=39155$	$\Sigma y^2=51225$	$\bar{x}=3.3$	$\bar{x}=11.8$

Source: Research Data, 2022



Source: Research Data, 2022

Figure 1. Maize yield and Extension Information usage scatterplot

The scatter graph in figure 1 above shows that there is a positive correlation between the number of extension information dissemination visits and maize yield, implying that use of agricultural extension information proportionately increased maize productivity. However, since correlation does not imply causation and cannot be used to make predictions, (Rohlfing, and Schneider, 2018), this implied that while the data plotted on the scatter graph showed correlation, the study did not assume that the increase or decrease in one of the sets of data caused the increase or decrease in the other set of data considering the probability that other causes may have contributed to increase or decrease in maize productivity. This therefore pointed to the need for a regression analysis which was evaluated in the next objective on the relationship between use of ICT in the dissemination of extension information and agricultural productivity as elaborated below.

3.1.2 Relationship between Use of ICT in the Dissemination of Extension Information and Maize Productivity.

To assess this objective, the research compared the performances of the maize enterprise in Tana River County, where a sample of 28 maize farming households were grouped into two clusters each of 14 households through an evaluation of those accessing agricultural information through e-extension (mobile phone) and those only accessing information through the convectional direct Farmer Field Schools (FFS) and training and farm visit. Data on number of times the farming households interacted with extension information service providers and the corresponding maize production was captured using questionnaires. The data collected is shown in Table 2 and 3 where, ***y*** is the dependent variable (Maize Yield in 90kg bags), while ***x*** is the independent variable (number of information dissemination interactions between Extension officers and farmers)

Table 2: Maize production data for non-ICT information Accessing Households (Direct Training and Farm visit extension Method)

2022 Non-ICT-Extension (Direct Training and Farm visit)						n=14
Extension Training and Farm Visits (x)	Maize Yield in 90kg bags (y)	(xy)	(x^2)	(y^2)	Acreage (a)	Mean Maize Production per acre in 90kg bags (y/a)
24	21	504	576	441	3.5	6
21	28	588	441	784	4	7
13	17	221	169	289	4.5	3.8
25	21	525	625	441	5	4.2
19	19	361	361	361	2.5	7.6
21	15	315	441	225	2	7.5
11	13	143	121	169	3	4.3
27	30	810	729	900	2.5	12
22	19	418	484	361	2.5	7.6
11	13	143	121	169	4.5	2.9
10	15	150	100	225	2.5	6
19	15	285	361	225	2.5	6
21	16	336	441	256	3	5.3
22	23	506	484	529	3	7.7
Σx=266	**Σy=265**	**Σxy=5305**	**Σx^2=5454**	**Σy^2=5375**	**x̄=3.2**	**x̄=6.3**

Source: Research Data, 2022

Table 3: Maize production statistics for ICT Accessing Households (Use of e-extension)

2022 ICT-Extension						n=14
No. of Extension information Dissemination through Mobile phone (x)	Maize Yield in 90kg bags (y)	(xy)	(x^2)	(y^2)	Acre age (a)	Mean Maize Production per acre in 90kg bags (y/a)
33	24	792	1089	576	3.5	6.9
17	13	221	289	169	2.5	5.2
47	39	1833	2209	1521	2	19.5
25	23	575	625	529	2	11.5
47	77	3619	2209	5929	4.5	17.1
59	108	6372	3481	11664	4.5	24
17	41	697	289	1681	5	8.2
13	41	533	169	1681	5	8.2
16	55	880	256	3025	5	11
37	65	2405	1369	4225	5.5	11.8
65	41	2665	4225	1681	2	20.5
75	47	3525	5625	2209	1.5	31.3
79	72	5688	6241	5184	2	36
75	76	5700	5625	5776	2.5	30.4
Σx=605	**Σy=722**	**Σxy=35505**	**Σx^2=33701**	**Σy^2=45850**	**x̄=3.4**	**x̄=17.3**

Source: Research Data, 2022

As shown in in table 2 and 3, the average maize production for farmers under e-extension was higher in contrast to those under direct training and farm visit. To draw comparison between use of extension services information and Maize yield, the study used linear regression to forecast the value of ***y*** (maize production) for a given value of ***x*** (extension information use), by determining, the line ***y = mx + b***. According to Lial, Greenwell, and Ritchey (2016), the "least squares" method is a form of linear regression that gives the relationship between the data points.

From the data analyzed, extension information visits and maize production values were summed up and squared and the mean production calculated by dividing the maize yield by the acreage. The sum of extension visits (∑x), sum of maize yield (∑y), sum of extension visits multiplied by the corresponding maize yield (∑xy), the sum of the squares of extension visits ($\sum x^2$), and the sum of the squares of maize yield ($\sum y^2$) were calculated as shown above in Table 2. Based on the analyzed data in table 2 and 3, the equations below were used to solve for ***m*** first, and then solve for ***b***.

$$m = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{n(\Sigma x^2) - (\Sigma x)^2} \qquad b = \frac{\Sigma y - m(\Sigma x)}{n}$$

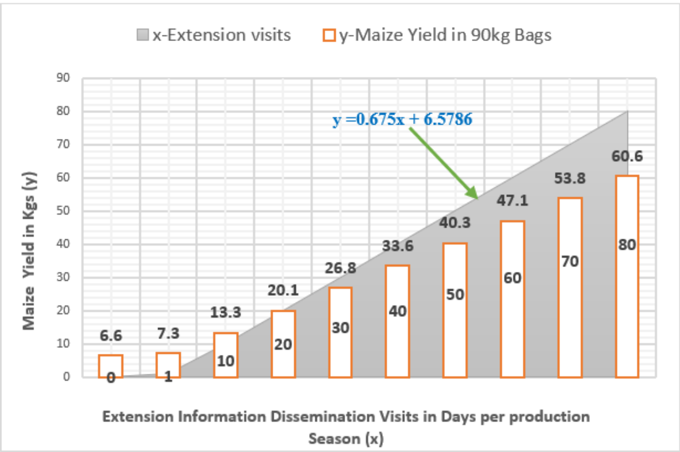
Based on the collected and analyzed data, the above linear regression function was applied to generate an equation used to predict maize production for non-ICT information accessing Households as shown below.

m=14(5,305) – (266) (265)/14(5,454) - (266)2,
=74,270-70,490/76,356-70756
=3780/5600
m=0.675

b=265-0.675(266)/14, =265-172.9/1, =92.1/14
b=6.5786

in the function y = mx + b
y =0.675x + 6.5786

From the calculations, predictions of ***y*** (Maize production) for non-ICT information accessing Households were made from the given values of ***x*** (Extension information use***)*** using the equation **y =0.675x + 6.5786** as shown in the graph in figure 2;



Source: Research Data, 2022

Figure 2 Maize Yield Production Predictions for Non-ICT Information Accessing

Households

From the graph in figure 2, the line starts out at 6.5786 bags and the y-values increase by 0.675 bags for every 1 visit that a public extension information service provider makes to a maize farming household in Tana River County. Using the function y =0.675x + 6.5786 predictions were made for the increase in maize yield (Production) because of increase or decrease in extension information use (visits).

The regression analysis also informed that households in Tana River County could still produce up to 6 bags of maize per acre using the previously acquired agricultural knowledge or information from other sources other than from public extension information service providers farm training and visits.

For comparison, the same linear regression function was applied to generate an equation used to predict maize production for ICT information accessing Households as shown below.

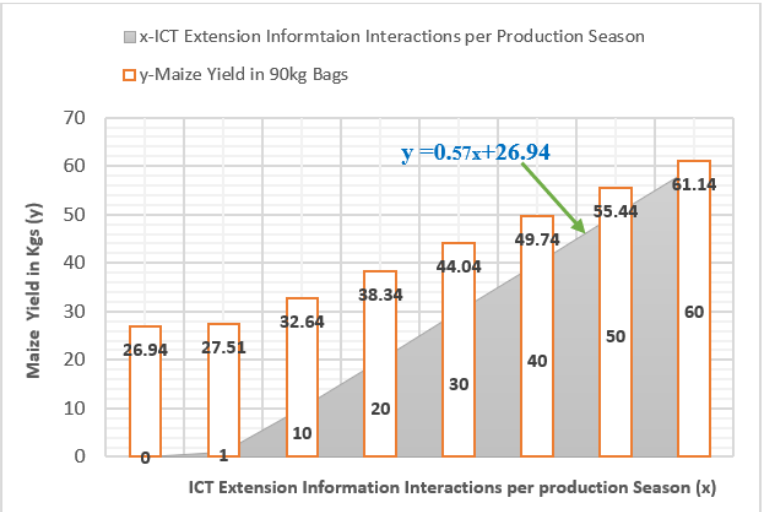
$$m = \frac{n(\Sigma xy)-(\Sigma x)(\Sigma y)}{n(\Sigma x^2)-(\Sigma x)^2} \qquad b = \frac{\Sigma y - m(\Sigma x)}{n}$$

m=14(35,505) -(605)(722)/14(33,701) -(605)2
m=497,070-436,810/471,814-366,025
m=60,260/105,789
m=0.57

b=722-0.5696(605)/14
b= (722-344.85)/14
b=377.15/14
b=26.94

in the function y = mx + b
y =0.57x + 26.94

Predictions of ***y*** (Maize production) were made from the given values of ***x*** (Extension information use***)*** using the equation: y =0.57x + 26.94***.*** as shown in the graph in figure 3; -



Source: Research Data, 2022

Figure 3: Maize yield production based on ICT Extension Information Use

From the graph in figure 3 the line starts out at 26.94 bags of maize and the y-values increase by 0.57 bags for every 1 ICT interaction with a maize farming Household in Tana River County. Using the function y =0.57x+26.94, predictions were made for the increase or decrease in maize yield (Production) because of increase or reduction in extension information usage (ICT interactions). The regression analysis informed that households accessing agricultural information through ICT could produce up to 26.94 bags of maize owing to prior knowledge without applying the knowledge disseminated by public agricultural extension service providers. Additional qualitative data gathered from extension information service providers informed that the selection of farming households for the e-extension program was based on literacy levels and the ability to use a smart phone where illiterate farmers were omitted. The high productivity among this category of farmers could therefore be attributed the selection criterion.

3.1.3 Relationship between the number of agricultural information dissemination sessions and optimal maize yield.

Qualitative data gathered from public extension service providers informed that certified maize seed sourced from Kenya Seed Company could yield up to a maximum of 60 bags per acre (Topfarmer, 2019), when farmers utilized agricultural information, and therefore a regression analysis was used to predict the maximum number of extension information dissemination visits required to attain optimal maize yields per acre using the linear regression analysis function: ***y = mx + b***

a) Maize Yield Production Prediction for Non-ICT Information Accessing Households

$y = mx + b$
$y = 0.675x + 6.5786$
$60 = 0.675x + 6.5786$
$60 - 6.5786 = 0.675x$
$53.4214 = 0.675x$
$x = 53.4214/0.675$
$x = 79.1428.$

This linear regression analysis implies that for a farmer to produce the optimal 60 bags of maize in a single production season from 1 acre of land, approximately 80 extension information dissemination visits would be required, however for any extra visits above the 80 the economic law of Diminishing Marginal Productivity would apply. Which implies that any extra visits beyond the optimal 80 will not yield any extra bags of maize

b) Maize Yield Production Prediction for ICT Information Accessing Households

$y = mx + b$
$y = 0.57x + 26.94$
$60 = 0.57x + 26.94$
$60 - 26.94 = 0.57x$
$33.06 = 0.57x$
$33.06/0.57 = x$
$x = 58$

This linear regression analysis implies that for a farmer to produce the optimal 60 bags of maize in a single production season from 1 acre of land, 58 ICT interactions would be required, nonetheless any extra visits above the 58 will not yield any extra bags of maize as the economic law of Diminishing Marginal Productivity would apply

Nevertheless, from the analysis it was determined that the use of ICT increased efficiency in agricultural information dissemination as depicted in the reduced number of interactions from 80 under the convectional direct training and farm visit as compared to 58 under e-extension using mobile phones to disseminate agricultural extension information to produce the same optimal quantity of 60 bags of maize from one acres of land other conditions remaining constant.

4. Conclusion

The purpose of this study was to evaluate the relationship between the use of extension information services and maize productivity among smallholder farmers in Tana River County in Kenya. The study resulted in three main conclusions. First, using the Pearson's Correlation Coefficient (PCC) the study calculated the statistical relationship between the two study variables i.e., use of extension information services and maize productivity (yield) among smallholder farmers in Tana River County and concluded that there was an increase in production for farmers who utilized extension information and vice versa.

Secondly, through the simple linear regression analysis, the study concluded that ICT was essential in enhancing efficiency in information delivery and complemented and modernized existing extension approaches and methods. Finally, the analysis determined the number of agricultural extension interaction required for optimal maize production per acre and concluded that ICT increased efficiency in agricultural information dissemination as depicted in the reduced number of interactions under e-extension sessions using mobile phone applications (Apps) to produce the same optimal quantity of maize from one acres of land other conditions remaining constant.

5. Recommendations

Recommendation made after research were dichotomized into those related to policy and to further research. The recommendations were generated based on negative findings from the concluded study with the aim of soliciting for viable interventions.

5.1.1 Theory, Policy, and practice Recommendations

The following recommendations made were directly linked to non-existent policies that needed to be formulated or policies that existed but were not being properly implemented and recommended that.

i) The County government of Tana River should review its agricultural extension policy, to give impetus to the use of ICT in transforming agricultural extension information.
ii) The Ministry of Agriculture Livestock and Fisheries (MoALF) in the county should provide proper guidelines and standards for agricultural extension information and advisory services besides putting in place a clear monitoring and evaluation system for extension activities.
iii) The County Government should allocate a sufficient budget to fully support extension activities including increased employment and retraining of extension service providers.

5.1.2 Recommendations for Further Research

The study recommended that further research should be conducted on: -

i) Applications of e-extension in the dissemination of information to smallholder farmers.
ii) Training needs of extension officers and constraints in transfer of agriculture information and technology to smallholder farmers.

6. Contributions of the Study to knowledge

The findings of this study are a major contribution to knowledge in general and literature on the relationship between use of extension information services and agricultural productivity. It is assumed that this study will add credibility to the policy agenda for agricultural extension information dissemination and communication for rural development with the purpose of helping address food security and income generation, for sustainable livelihoods of smallholder farmers.

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