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RESEARCH ARTICLE

EVALUATING USE OF ICTS IN ACCESSING e-EXTENSIONSERVICES AMONG SMALLHOLDER FARMERS IN NAKURU COUNTY, KENYA

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Abstract

Smallholder farmers in Kenya are faced with low agricultural productivity which has been attributed toa number of factors among them being lack of access to agricultural information. This has been further exacerbated by shrinking number of public extension staff and underfunding of the extension system in the country. ICTs can play a crucial role in bridging this gap. This study determined ICTs accessed, and the extent of use of the ICTs to access e-Extension services among smallholder farmers in Nakuru county, Kenya. Data was collected from randomly selected sample of 130 smallholder farmers in a descriptive survey, using structured questionnaires and focus group discussions. Over 70 percent of the respondents had access to mobile phones, radio and TV while only 27.7 percent had access to the internet. The respondents that had access to YouTube, twitter and computers however, were less than 20 percent. The findings of the study revealed that mobile phones, radio and TV were the most accessed and utilized ICT tools in accessing e-Extension services among smallholder farmers.Social media platforms such as WhatsApp and Facebook were on average used by the farmers to access e-Extension services while computers and twitter were the least used.The findings further revealed that e-Extension services that were most sought for by the farmers included production, market, pest and disease information.The major constraints in the use of ICTs tools in accessing e-Extension services were reported to include lack of ICTs such as computers and the internet, lack of awareness of availability of e-Extension services, lack of relevant information and lack of infrastructure such as electricity. The study concludes that accessible ICTs could be used to supplement other extension methods. There is need for improving access to ICTs particularly the internet and computers and creating awareness on use of platforms such as YouTube, Twitter and Farmer Call Centres in accessing agricultultural information among farmers.

Introduction:-

World population is expected to surpass the 9 billion mark by 2050, and agriculture has to increase the production of nutritious food to meet the growing demand and ensure food security for all. Most of the increase in food production will have to take place in developing countries (Food and Agriculture Organization [FAO], 2017a). African

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countries rely heavily on the agricultural sector as the mainstream for economic growth, employment creation and foreign exchange earnings.

There are approximately 1.5 billion smallholder farmers in the world and they provide approximately 80 percent of the food in many developing countries Kenya included. Despite this fact, these farmers tend to be under-resourced and lacking access to improved inputs, rural services and markets, leading to low productivity and a lack of opportunity to break the cycle of poverty. Smallholders in many developing countries remain disadvantaged when it comes to accessing quality Extension and Advisory Services (EAS) (Davis &Franzel, 2018).The importance of improving agricultural extension service delivery in relation to enhancing access to agricultural information in Kenya has been underscored in the Strategy for Revitalizing Agriculture(SRA) report. The report identifies declining effectiveness of public extension service as one of the factors impeding agricultural growth in the country. In these regard, SRA suggests reforms in the extension systems to create more effective linkages between research, extension and farmers (Government of Kenya [GOK], 2017).One innovative way of achieving this is through the use of Information Communication Technologies (ICTs) in extension service delivery. This involves the transfer of practical knowledge and exchange of agricultural information through ICT platforms for improved agricultural productivity and economic growth (FAO, 2017b).

Agricultural extension service delivery whose core mandate is to disseminate agricultural information to farmers can benefit significantly through the use of ICTs (Nyarko&Kozari 2021). e-Extension is a system which depends on ICT's such as mobile telephony, innovative community radio and television programs, mobile phones in combination with radio, video shows, information kiosks, web portals, rural tele-centers, farmer call centers, video-conference, offline multimedia CDs and open distance learning (Asenso-Okyere&Mekonnen, 2012). Kenya has embraced the provision of e-Extension services in thedelivery of extension and advisory services to farmers' due to increased mobile penetration and internet connectivity which stands at over 90 percent as at 2019 (Communications Authority [CA],2019). The government has tapped into this create opportunity through the introduction of e-Extension programme nationally in 2014 to support agricultural extension service in the country. Through the Ministry of Agriculture, 654 e-Extension agents were trained nationally and equipped with a smartphone, a laptop and a modem to enable then reach farmers efficiently using innovative approach such as SMS, farmer training, WhatsApp messaging and social networking. Extension agents were expected to be placed at the county and ward level and use push and pull method to disseminate information. The farmers were also expected to incur a cost in the cause of this in the form of airtime to be able to make calls send SMS inquiries or buying internet bundles to access information online (Gichamba et al., 2017). The government listed various online and mobile based platforms that its extension officers can use and were issued with mini-laptops and internet modems, and were trained on how to get content from the various platforms and disseminate them to farmers. They were then expected to provide e-Extension services to farmers to enable them to get efficient and effective extension service delivery. Four major platforms which include ikilimo, National Farmers Information Service (NAFIS), the Infonet-Biovision Platform and the Plantwise platform have been used by the extension agents working in the national and the county governments in Kenya. Other enormous number of e-Extension models have also been developed in the country by private and non-governmental organizations and are providing farmers with different customized e-Extension services for farmers (Gichamba et al., 2017).Access and usage of e-Extension services among smallholder farmers in Kenya has however, not been evaluated empirically.The objectives of this study were specifically to:

1. Determine the level of access to ICTs among smallholder farmers in Nakuru county, Kenya.
2. Determine the level of use of ICTs in accessing e-Extension services among smallholder farmers in Nakuru county, Kenya.
3. Determine the challenges of using ICTs in accessing e-Extension services among smallholder farmers in Nakuru county, Kenya.

Materials andMethods: -

Study Site

The study was carried out in Nakuru county,Kenya.The County is cosmopolitan with farming communities carrying out diverse agricultural activities hence having varied agricultural information needs and sources for accessing e-Extension services. The County has also initiated a farmer call center which is serving farmers in the entire county by providing e-Extension services majorly through their mobile phones and social media platforms. Three sub counties namely; Molo, Subukia and Gilgil were selected to represent the three agro-ecological zones of high, medium and low potential in the county.

Research design and data collection and analysis

Data required was obtained in a descriptive survey in which simple random sampling technique was applied to obtain a representative sample of 130 smallholder farmers. The study targeted farmers with small farm holdings of 2 hectares and below. A structured questionnaire was administered to the farmers to obtain data on level of access to ICT tools, level of use of ICT tools in accessing e-Extension services and challenges of using ICTs in accessing e-Extension services. For each ICT tool accessed, respondents rated on a Likert scale of 1 to 5 (1 = low Access 5 = Very high access) the level of access to ICT tools and 1= Never 5=Alwaysthelevel of use of ICT tools in accessing e-Extension services as well as the type of agricultural type of agricultural information accessed by smallholder farmers.Data was analyzed to obtain frequencies, percentages, means and standard deviations.

Results andDiscussion:-

Table 1 shows the characteristics of the smallholder farmers in the study area.

Table 1:- Characteristics of The Sampled Smallholder Farmers.

Scale	Characteristic	Percentage
Gender	Male	43.1
(n = 130)	Female	56.9
Age	Less than 25 years	5.4
(n = 130)	26-35	20.8
	36 – 45	19.2
	46 – 55	27.7
	56-65	12.3
	65 years and above	14.6
Highest level of education (n = 130)	None	5.0
	Primary	66.1
	Secondary	45.2
	Tertiary	9.0
	University	9.0
Farm Size(n = 130)	0.1-1.99	53.3
	2-3.99	39.2
	4-6.99	6.2
	7-10	1.5
Farmer Group Membership	Yes	63.0
(n=130)	No	37.0

As seen in Table 1 findings reveals that 43.1 percent of respondents were male and 56.9 percent were female.Past studies have been used to show gaps in the adoption of ICTs due to the influence of gender differences. Majority of the respondents (27.7%) were between ages 45 - 55 years with a mean age of 48 years. This thus shows that most of the respondents were middle aged which may imply possibility of little dependency since they are more robust and productive and can actively participate in farming and other economic activities and are more likely to adopt ICT tools. The distribution of respondents by education level indicates that 66 percent had attained primary level of education, 45 percent having attained secondary level and only 9 percent reaching the tertiary and university level. However, 5 percent of the respondents had no education at all. The overall findings therefore, shows that majority of the respondents had attained primary level of education and are able to read and write which could influence their ability to use ICT tools to access agricultural information. The average farm size where the farmers practiced their farming activities was 1.9 acres with 92.3 percent of the respondents' farms falling between 0.1-3.99 acres. Only 7.7 percent had land that was more than 4 acres while 1.5 percent had farms that were more than 7 acres. This suggests that a large majority of the respondents were smallholders. Group membership as depicted by the results indicated that 63 percent of respondents were members of a farmer group organisation while 37 percent were not affiliated to any farmer group organisation.

Accessibility of ICTs among Smallholder farmers

The study sought to determine the ICTs tools accessed by smallholder farmers. Accessibility to ICTs provide the basis in which digital content can be received and also e-Extension services can be accessed. ICTs that were studied included mobile phone, computer, radio, TV, internet, YouTube, WhatsApp, Facebook and Twitter. In order to use the ICTs, for personal or agricultural use, one has to have access to them. Table 2 presents the findings.

Table 2:- Access to ICTs Among Smallholder Farmers.

ICT	Accessible (%)	Not Accessible (%)
Mobile Phone	75.4	24.6
Computer	9.2	90.8
Internet	27.7	72.3
Radio	86.9	13.1
TV	72.3	27.7
YouTube	19.2	80.5
WhatsApp	33.1	66.9
Facebook	26.2	73.8
Twitter	5.4	94.6

(n=130)

The information from Table 2 indicates that most of the respondents more than 70 percent had access to mobile phones (76.2 percent), radio (86.9 percent) and TV (72.3 percent). These shows that mobile phones, radio and television are the most accessed ICTs among the smallholder farmers in the study area. This therefore, implies that these ICTs could provide opportunities for reaching farmers with various e-Extension services. The results are consistent with Gwademba et al., (2019) who reported that, ICT tools such as mobile phones, the internet, radio, and television when properly applied in agricultural extension can help enhance the farmers' access to information relevant for their agricultural production. O'Dea, 2020, also reports that mobile phones particularly those with internet connectivity being the most widely used ICT tool in the globe. Internet connectivity however, still remains a challenge among smallholder farmers in the study area with only 27.7 percent of them indicating to have access. Accessibility to the to the other ICTs also is still low with 19.2 percent for YouTube while twitter and computers (desktop and laptop) having the lowest frequency percentages of 5.4 percent and 9.2 percent respectively. Kenya National Bureau of statistics household survey reports that 8.4 percent of the adult population in Kenya have access to computer and its use increases with age with its peak at 20-24 years then gradually declines (CA, 2018).

Level of Accessibility to ICT Resources among Smallholder Farmers

Table 3presents the results of the respondent's level pf access to the various ICT tools scored at a 5 point Likert Scale of 1 = No Access to 5 = Very high access.

Table 3:- Level of Farmers' Accessibility to ICT Resources.

ICT Resource	N	Mode	Median	Mean	Std. Dev
Mobile Phone	98	5	5.0	4.4	0.84
Computer	12	3	3.0	2.6	1.16
Internet	36	4	4.0	3.5	1.03
Radio	113	4	4.0	4.2	0.70
TV	94	3	3.0	3.1	0.84
YouTube	25	2	3.0	2.9	1.26
WhatsApp	43	4	4.0	3.7	1.14
Facebook	34	3	3.0	3.1	1.05
Twitter	7	1	2.00	2.7	1.60

Table 2 gives the central tendencies for the level of accessibility of each ICT tools under study. Results indicates that mobile phone was the most accessible ICT with a mode and median of 5 and a mean of 4.4 (Very high access); the internet, radio and WhatsApp also scored high with mode and median of 4 (high access) for both of them. Accessibility to TV, computers and Facebook, were moderate with all the three having a mode and median of 3. YouTube had a low level of access with a mode of 2 and a median of 3 indicating low to moderate access to the ICT resource. Twitter had the lowest level of accessibility with a mode of 1 and a median of 2 indicating very low access among the respondents. The high accessibility to ICT resources such as radio, mobile phones and TV and applications like WhatsApp as depicted by the results regardless of the rural nature of the populace is an indication that these resources could provide opportunities for utilizing them to provide e-Extension services to farmers.

Level of usage of ICTs in accessing e-Extension services among smallholder farmers'

The researcher sought to find out the level of usage of ICTs in accessing agricultural information. The respondents were asked to give the frequency at which they use the ICTs to access agricultural information which was scored at a five point Likert Scale of 1 = Never to 5 = Always. Since the respondents were smallholder farmers it was expected that they would use, to some extent, these ICTs to access agricultural information. Table 4 presents the results on the level of usage of ICTs among the respondents.

Table 4:- The Average Scores of Farmers' Level of Usage of ICTs.

ICTs	N	Mode	Median	Mean	Std. Dev.
Mobile Phone	98	5	4.0	3.9	1.07
Computer	12	3	3.0	2.8	1.14
Internet	36	3	3.0	3.4	0.94
Radio	113	4	3.5	4.0	0.81
TV	94	3	3.0	3.6	1.00
YouTube	25	2	3.0	3.2	1.34
WhatsApp	43	3	3.5	3.4	1.22
Facebook	34	2	3.0	3.4	1.29
Twitter	7	1	1.5	2.5	1.72

Table 4 shows that with a mode and median of 5 and 4 respectively, mobile phones are often to always used by the respondent to access agricultural information. Radio had mode of 4 and a median 3.5, this indicates a sometimes to an often usage to access agricultural information. The mean averages for level of usage of ICTs among the farmers to access was mobile phone (3.9), radio (4.0) and TV (3.5) shows that they are the often to always used by farmers to access agricultural information. This means that farmers use mobile phones, radio and TV majorly to access agricultural information ad compared to other ICTs. The implication means that farmers can be well targeted with e-Extension services through these ICTs. The farmers indicated that mobile phones were used for accessing agricultural information through making calls or writing SMSs to seek for various services across the food systems from production to storage and marketing. Radio and television was reported to be used also for accessing agricultural information such as weather forecast information, new crop varieties, pest and disease control among other and for learning new agricultural practices. This corresponds to other studies by Mtega&Msungu, 2013;Norberthet al., 2018; World Bank, 2017who found that radio, mobile phone, and television were still predominant ICTs among smallholder farmers. Findings by Krell et al., (2020) however, found that the type of mobile phone will determine the level of usage for accessing agricultural information. They report that according to their study, smartphone ownership is positively significant to usage of m-services among farmers and is not widespread in Kenya. The findings in this study further show that different number of respondents use internet, YouTube, Facebook and WhatsApp all having a mean average of 3 indicating that respondents use them on average to access agricultural information. Computer and Twitter just like level of access had the lowest score with a mean of 2.8 and 2.5 respectively which clearly shows that it is rarely used by smallholder farmers to access agricultural information.

Type of Agricultural Information Farmers Seek for Using ICTs

The researcher aimed to understand the type of agricultural information that farmers search for using ICT resources. The respondents made selections from five categories namely; Production information, processing and value addition, weather information, pest and disease control and market Information. They were also allowed to make multiple selections for each ICT resource used. The findings are presented in Table 5.

Table 5:- Type of Agricultural Information Accessed from ICT Tools.

ICT Resource	Production information (%)	Processing and Value addition (%)	Weather Information (%)	Pest and Disease Control (%)	Market Information (%)
MobilePhone	71.4	1.0	29.6	33.7	52.0
Computer	58.3	16.7	0.0	16.7	50.0
Internet	63.9	5.6	2.8	22.2	33.3
Radio	87.6	6.2	31.9	35.4	48.7
TV	81.9	7.4	28.7	27.7	36.2

YouTube	60.0	8.0	16.0	28.0	16.0
WhatsApp	67.4	7.0	4.7	32.6	37.2
Facebook	61.8	2.9	14.7	14.7	32.4
Twitter	14.3	14.3	14.3	14.3	42.9
Average Percentage selection	**63.0**	**7.7**	**15.8**	**25.0**	**38.7**

(n=130)

Table 5 shows that production information was the most sort out information with 63 percent selection frequency. Market information came in second with a total selection frequency of 38.7 percent. Focus group discussions indicated that farmers sought to obtain production and market information to increase their production, secure reliable market and best prices for their produce. Pest and disease control information was selected 25 percent times while information concerning the weather had a selection frequency of 15.8 percent. Processing and value addition was least selected having only a 7.7 percent selection frequency. Mobile phone, radio and TV was the most frequently used ICT resources to access production information. The respondents through focus group discussions indicated that they either made phone calls or texted to receive information such as inputs availability and listened to radio and TV programmes on agricultural sustainable practices such as input application rates, weed control, soil conservation, diversification among others.

Challenges of using ICTs among Smallholder Farmers

Table 5 shows the results on the challenges that farmers experience when using ICT tools to access e-Extension services. The challenges were rated at a five point Likert scale of 1 to 5 (1=Not at all, 2=Low, 3=Moderate, 4=High, 5=Very High).

Table 6:- Average Scores of Farmers' Challenges inUsing e-ExtensionServices.

Challenges	Mode	Median	Mean	Std. Dev.
Lack of ICTs	4	4.00	3.7	1.80
Lack of awareness	4	3.00	3.3	1.10
Inaccessible internet	4	4.00	3.4	1.10
Lack of electricity	3	4.00	3.0	1.41
Lack of relevant information	3	3.00	3.0	1.10
Lack of content in local language	3	3.00	2.7	1.22
High cost of accessing information	4	3.00	3.1	1.18

Lack of ICTs and inaccessible internet were the main challenges faced by the farmers as both had a mode and median of 4 as shown in Table 5. Lack of awareness and the generally high cost of accessing information also provided moderate to high levels of challenge with both having a mode of 4 and a median of 3. The absence of electricity was also a challenge faced by the farmers at a moderate to high level with a mode and median of 3 and 4 respectively. Lack of relevant information and lack of content in local language also affected the farmers on a sensible level as both had a mean and mode of 3. During focus group discussions also the respondents indicated that the content available online is difficult to authenticate the source and was generally overloaded. A number of challenges that farmers face when using ICTs to access agricultural information have been cited in other studies and ranges from high costs of ICT tools and services, lack of ICT skills, poor network coverage, power shortage, language barrier and irrelevant content available online (Katunyo et al., 2017; Muhammad et al., 2019).

Conclusion:-

The study findings showed that mobile phones, radio and television were the most accessed ICTs among the smallholder farmers in the study area. This implies that these ICTs could provide opportunities for reaching farmers with various e-Extension services.The resultsalso revealed that mobile phones, internet, radio and TV were the most utilized ICT tools in accessing e-Extension services among smallholder farmers that had access to them. Social media platforms such as WhatsApp and Facebook were on average used by the farmers to access e-Extension services while computers and twitter were the least used. The findings further revealed that e-Extension services that were most sought for by the farmers included production, market and pest and disease information. The major constraints in the use of ICTs tools in accessing e-Extension services were reported to include lack of ICTs such as

computers and the internet, lack of awareness of availability of e-Extension services, lack of relevant information and lack of infrastructure such as electricity. The extension agents should therefore encourage farmers to subscribe to ICT platforms particularly those providing e-Extension services through mobile phones, radio and TVbecause these were the most accessed ICTs.There is need for improving access to ICTs particularly internet and computers and creating awareness on use of platforms such as YouTube, Twitter and Farmer Call Centres in accessing agricultultural information among farmers.

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