Influence of access to extension services on smallholder farmers' use of Certified Seed potatoes (CSPs) in Kipipiri Sub-County, Kenya''

ABSTRACT

Extension services delivery remains a key driver in farmers' uptake and use of improved farming technologies in rural areas which are predominantly occupied by poor farmers. The use of certified seed potatoes (CSPs)increases yield and potato productivity. Most smallholder farmers lack knowledge of how to use CSPs while others are not even aware of their existence. This has given farmers an opportunity to use and re-use their own seeds saved from their local storage facilities. The paper sought to determine whether access to extension services influenced smallholder farmers' use of CSPs in Kipipiri Sub-County, Kenya. A structured, researcher-administered, questionnaire was used in collecting data from one hundred and six smallholder potato farmers randomly selected from the area. Descriptive statistics and a binary logistic model were used for statistical analysis. The findings indicated that there was a significant relationship between access to extension services and the use of CSPs. 85 per cent of the respondents were found to have access to extension services while 21 % had no access. Additionally, on the frequency, the majority of the respondents (64%) rarely accessed the services and 36% reported accessing the extension services always. These findings suggest that extension services are a major component that drives farmers' use of CSPs in the study area. Therefore, for farmers to benefit fully, extension agents need to increase their service delivery to smallholder potato farmers. County governments also need to improve the existing farmer training centers to assist farmersto acquire knowledge on the use of CSPs. This would increase potato productivity in the area.

Keywords: Extension Services; CSPs; smallholder farmer; Productivity

INTRODUCTION

Potatoes are a valuable and nutritious staple crop that contributes to global food security and GDP growth. However, between 2015 and 2019, the rate of food insecurity increased, reaching an estimated 25.9 percent of the world's population in 2020, with smallholder households more likely to face severe food insecurity [1]. Asia, particularly China, is estimated to produce half of the world's potatoes, followed by Europe, which produces about a third. Africa produces approximately 7% of the world's potato crop, primarily in Egypt and South Africa [2]

The majority of Sub-Saharan Africans (SSA) live in rural areas where agriculture is their primary source of income. The region faces significant challenges such as rapid population growth and food insecurity, necessitating the development of a more capable and productive agriculture sector. However, productivity in SSA is low due to insufficient agricultural inputs such as fertilizers and seeds, as well as a lack of knowledge [3]. Due to inefficient distribution systems, the use of improved seeds has remained low. The International Potato Center (CIP) introduced rooted apical cutting technology to increase the availability of high-quality seed potatoes in Kenya. Scientists from CIP and the Vietnamese Research Center for Experimental Biology developed and tested the technology.

According to Okello et al.,[4] the primary threat to potato smallholder farmers and the potato sector in Kenya is the use of low-quality seed potatoes that are highly contaminated with seed-borne diseases and pests. The phenomenon is caused by the scarcity and inadequacy of certified seed potatoes. Most smallholder potato farmers do not use certified seed potatoes for a variety of reasons, including a lack of knowledge about their potential value, high prices, and a lack of seed dealers. According to Mariita [5] informal seed systems are disproportionately impacted by the lack of quality control in seed

potatoes, hence, many tubers have a low phytosanitary status. These seeds are saved on farms or exchanged between farmers. They account for more than 95% of potato farmers' seed consumption [6].

LITERATURE REVIEW

2.1 Access to Extension Services by smallholder farmers

Antwi-Agyei & Stringer [7] and Kassem et al. [8] highlighted that agricultural-extension services were globally introduced as an institutional input for revolutionizing agriculture and stimulating rural development. It also links farmers with research agencies and other agricultural value chains such as input providers. A high-quality agricultural-extension service is one that is useful, well-managed, and accountable to farmers. It also meets the needs of farmers in different agro-ecological environments through regular contact between farmers and extension providers [9].

As noted by Ragasa and Mazunda [10], in many African countries, extension agents are an essential source of information for farmers and play a key role in convincing farmers to adopt agricultural modernizations. Agricultural extension and advisory services help in promoting rural development and supporting the revolution to modern farming [11]. Through extension services, farmers can solve farming-related problems as well as making better farming decisions by the provision of timely information. Extension workers facilitate farmers' networking with various partners in the value chain [12].

Ampaire et al., [13] identified agricultural extension services, input suppliers, and credit facilities as vital institutions that bring smallholder farmers together, forming farmer organizations for a common gain. Maertens et al., [14], noted that, through agricultural extension services, farmer overcomes information constraints consequently encouraging adoption of improved agricultural technologies, thereby increasing yields and incomes. The success of agricultural extension depends on the model of extension employed. Primary models include systems of training and visits, demonstration plots, farmer field days, and field schools. Farmers are made aware and informed about enhancements to the production process, including the optimal use of inputs [15].

Namyenya et al.,[16] identified accountability as a major challenge in agricultural extension service delivery in the public extension system. Weak upward accountability arises due to; the limited voice of the beneficiaries, such as a lack of farmer complaint channels, a lack of robust supervisory mechanisms, therefore making it difficult for the supervisors to monitor and evaluate the performance of large numbers of remotely located field officers and public bureaucracies were also noted. However, an increase in the capacity and incentives of the supervisors to adequately monitor field activities and improving the farmers' ability to demand better services would minimize the challenge [17].

In Kenya, the transfer of a new technology and innovation from research to farmers in Kenya is mainly carried out by the public agricultural extension services and hardly by the private extension providers. Characterized by insufficient funds for extension and rearrangement of public extension services, there has been a drop in the transfer of agricultural information and technologies as well as widening gaps between the extension staff to farmer ratio, thereby causing constraints in the delivery of extension services[18].

According to Hartmann et al., [19], skilled extension staff are mandated in developing useful extension programs that identify difficult problems and then design appropriate combinations of remedies. These provide the required information, including results of on-farm trials that demonstrate feasibility, and are essential for the timely transfer of technologies to farmers who are the end-users. It is therefore accepted that a well-designed and functioning extension system is vital for disseminating information and promoting the adoption of new farming technologies among farmers who otherwise may lack the knowledge of, and opportunities to obtain, new technologies on their own [20].

A study on access and the role of extension services [21] revealed that farmers had a low level of participation in the extension services offered. Nonetheless, they had access to high-quality extension services. Furthermore, farmers' satisfaction was significantly influenced by their participation in extension services. The study failed to demonstrate the impact of access to extension on farm input

use. As a result, this study will examine the impact of access to extension services on farmers' use of CSPs.

MATERIALS AND METHODS

Study Location

The study was conducted in Kipipiri Sub-County, Nyandarua County, Kenya. Kipipiri Sub-County is in the central region. The Sub-County covers 543.7 km2 with four administrative wards, namely, Wanjohi, Kipipiri, Geta, and Githioro. The Sub-County has a total population of 113,938 [22]. Agricultural activity is extensively carried out in the Sub-County, with potato being the leading crop. It is grown both for subsistence and commercial use. Other crops grown in the area are maize, cabbages, peas, and carrots. The farmers in the region also practice livestock production. The study area falls under the high-rainfall agro-ecological zone, characterized by a cool and temperate climate with reliable rainfall which is generally well distributed throughout the year, with two rainy seasons: long rains from March to May with a maximum rainfall of 1,600 mm and short rains from September to December with a maximum rainfall of 700 mm.

Sampling Procedure and Sample Size

The smallholder potato farmers were selected to participate in the study. Proportionate random sampling method was used to determine the number of smallholder potato farmers to be studied in each ward. A simple random sampling technique was used to obtain participants from the proportionate sample drawn from each ward. The following formula as stated by Nassiuma [23] was used to come up with an appropriate sample size for the study.

$$n = \frac{NC^2}{C^2+(N-1)e^2}$$

Where:

n **=** the required sample size,

N = the population within the study area,

C= Coefficient of Variation,

e = Standard error.

$$n = \frac{2500x(0.21)^2}{(0.21)^2 + (2500-1)x(0.02)^2} = 106$$

The sample was obtained using the coefficient of variation of 21%, a standard error of 2%. The population within the study area of 2500 smallholder potato farmers in Wanjohi, Kipipiri, Githioro and Geta wards. This meets Nassiuma's [23] contention that in most surveys a coefficient of variation occurs within the range of 21%≤C≤30% and that standard error occurs within the range of 2%≤e≤5%. Therefore, the stated coefficient of variation and standard error was preferred for this study. The lower limit for the coefficient of variation and standard error were selected to ensure low variability in the sample and minimize the degree of error.

The study expected 95% confidence (5% sampling error) to obtain a sample size of 106 smallholder potato farmers. The study obtained the sample size for each ward using proportionate to the population within the study area.

Instrumentation

The study was guided by its objectives to develop a structured questionnaire. Questionnaire was found to be appropriate for this study because it facilitated easy collection of data that were easy to analyze. Section A of the questionnaire covered general information of the smallholder farmer, section B extension services. The questionnaire was researcher administered.

3.4Validity

The validity is the ability of the instrument to measure what it is meant to measure [24].It manifests as content and face validity. Face validation of the instrument ensured that its contents appear relevant to the study objectives. The research tool was reviewed by the different research experts from Egerton University to check for the instrument's accuracy. Remarks from the experts was used to improve the instrument.

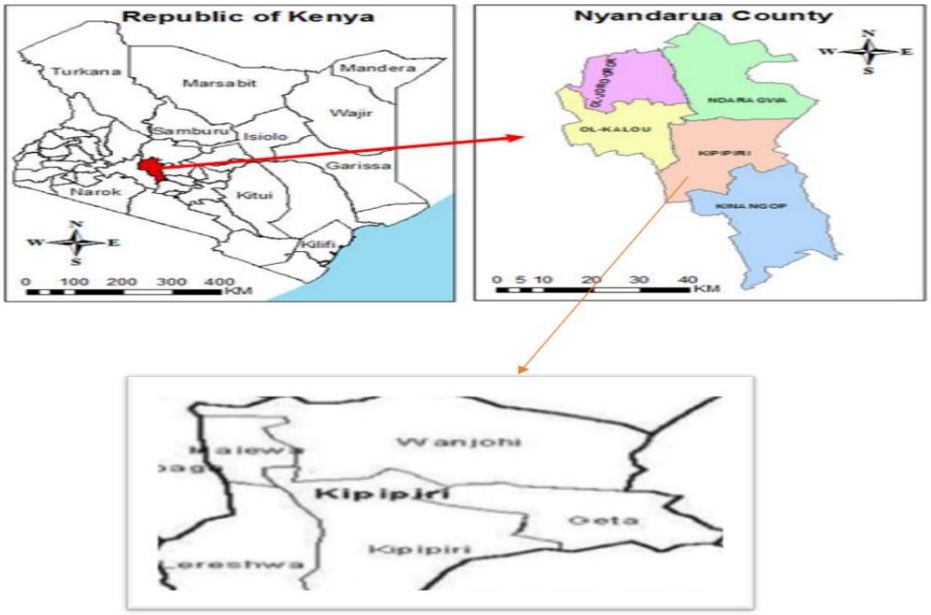

Fig. 1. Kipipiri Sub-County, Kenya

Table 1. Accessible population and sample size distribution

Population unit	Accessible population	Proportion (%)	Sample size
Wanjohi ward	800	32	34
Kipipiri ward	650	26	28
Githioro ward	600	24	25
Geta Eastward	450	24	19
Total	**2500**	**100**	**106**

1.5 Reliability

Reliability measures the degree to which a research instrument yields consistent results of data over repeated trials. The major reason to test reliability is to ascertain internal consistency of the instrument items [25]. A pilot test was conducted in Olkalou Sub-County, which has similar agricultural conditions. Smallholder potato farmers from the Sub-County has similar characteristics to those in Kipipiri Sub-County. The respondents for piloting were thirty randomly selected smallholder potato farmers selected in the Sub-County. The reliability coefficient was estimated using Cronbach Alpha Scale of 0.756α. The questionnaire was considered reliable after attaining the alpha coefficient above the threshold (0.70α) for acceptable reliability [24].

3.6 Data Analysis

The data collected were coded and cleaned using Statistical Package for Social Sciences (SPSS) Version 25 to enhance analysis.
Percentage, frequency, and binary logistic model were employed to analyze the data meaningfully.

RESULTS AND DISCUSSION

The study intended to describe the level of access to agricultural credit, sources of the credit, the approximate amount of the credit received, and the correlation between access to the credit and the use of ICT tools in agricultural extension. The results obtained from this study were analyzed and discussed as follows.

4.1 Access to extension services and Use of Certified Seed Potatoes

The first objective was as:

To determine the influence of access to extension services on the use of certified seed potatoes among smallholder potato farmers in Kipipiri Sub-County, Kenya

4.2 Access to extension services among Smallholder Farmers

Descriptive statistics was used to analyze smallholder potato farmers' access to extension and results are summarized in Table 2.

Table 2: Access to extension services among smallholder potato farmers

Access to extension services	Smallholder potato farmers	
	Frequency	Percentage
No	22	21
Yes	84	85
Total	106	100.0

Source: Own computation of survey data, (2022)

The study shows that 85% of the smallholder potato farmers had access to extension services, while 21% did not. Mwololo et al [26], highlighted the significance of extension services to farmers noting that extension services promote crop technologies such as use of CSPs among smallholder farmers. He however argued that despite famers accessing multiple sources of extension services, no significant effect on use of agricultural technologies was noted among the crop farmers.

4.3 Frequency of accessing extension services among Smallholder Farmers

Descriptive statistics was used to analyze smallholder potato farmers' frequency in accessing extension services and results are summarized in Table 3.

Table3: Frequency of accessing extension services among smallholder potato farmers

Frequency	Smallholder potato farmers	
	Frequency	Percentage
Always	30	36
Rarely	54	64
Total	84	100.0

Source: Own computation of survey data, (2022)

Although 85% of the respondents had access to extension services, the findings show that 54% rarely accesses the services while 30% frequently (at least once per month) receives the services. The findings are supported by Baloch & Thapa [27] who carried out a study in Panjgur district of Pakistan and recorded that despite most farmers (78%) having access to extension services, they could only meet extension worker once per year.Aphunu, & Otoikhian [28] contradicts the finding in their argument that, majority (61.7%) of the farmers have contact with extension agents monthly.16% of them are being contacted fortnight, while 22% reported being visited once in every two months.

4.4 Test of Hypothesis H_{O1}

Objective one was translated into the following hypothesis:

H_{01}: Access to extension services has no statistically significant influence on the use of CSPs among smallholder potato farmers in Kipipiri Sub-County, Kenya.

Binary logistic regression was used in testing the hypothesis, and the analysis of extension services as independent variables relating to the use of CSPs was statistically significant.

From Table 4, it was observed that the relationship between extension services and use of CSPs was statistically significant at a 5% level of significance ($\chi 2 = 10.219$, df = 4, $p < 0.05$).

Table 4: Omnibus tests of model coefficients for extension services

		Chi-square	df	P-value
Step 1	Step	10.219	4	0.037
	Block	10.219	4	0.037
	Model	10.219	4	0.037

This signifies that a relationship existed between extension services and the use of CSPs. The null hypothesis is therefore rejected. This inference is consistent with findings from previous studies [29;30] where institutional factors such as extension services were relevant for agricultural technologies such as use of CSPs.

Table 5: Extension Services' model summary

Step	-2 Log likelihood	Cox & Snell R Square	Square
1	124.741[a]	0.082	0.121

It was also noted that between 12.1% (Cox & Snell R Square) and 8.2% (Nagelkerke R Square) of the variance in the use of CSPs is explained by the extension services (Table 6).

Table 6: Institutional variables in the binary logistic regression equation

Institutional variables		B	S.E.	Wald	df	P-value	Exp(B)
Step 1[a]	Access to Extension services	1.072	0.504	4.524	1	0.033	2.922
	Access to certified seed multipliers	0.777	0.611	1.619	1	0.203	2.176
	Access to Credit	1.042	0.520	4.008	1	0.045	0.353
	Constant	0.423	0.301	1.970	1	0.160	1.526

a. Variable(s) entered on step 1: Access to credit, Access to Certified Seeds multipliers, and access to credit on use of CSPs.

4.8 Access to Extension Services

There is a positive relationship between access to extension services and the use of CSPs. This is statistically significant at a 5% level of significance (Wald $\chi 2 = 4.524$, df = 1, $p < 0.05$). Results show that smallholder farmers with access to extension services had 2.922 more chances of using CSPs than those with no access to extension services. This could be because access to extension services empowers the farmers with knowledge and creates awareness on the need to use CSPs. In support of this assertion, Nasereldin et al., [31] argued that the decision to use CSPs is positively associated with the variable of formal agricultural training. At 5%, the training coefficient was found to be positive and significant. This indicates that agricultural extension services increase smallholder farmers' chances of using CSPs.

CONCLUSION

From the results, there was a significant relationship between access to extension services and the use of CSPs. 85 per cent of the respondents were found to have access to extension services while 21 % had no access. However, on the frequency, majority of the respondents (64%) rarely accessed the services and 36% reported to access the extension services always.

RECOMMENDATIONS

The following recommendations were made:

(i) Policymakers should prioritize policies that support farmer trainings and creating awareness on the importance of using CSPs.

(ii) County governments should create a robust extension system that meet the demand of every smallholder farmer. Agricultural training centers should be made vibrant and demos done on how to use and multiply CSPs.

ETHICAL APPROVAL AND CONSENT

This research study ensures numerous ethical considerations which included presenting a research permit to the Kipipiri Sub-County Department of Agriculture, Livestock and Fisheries, Crops unit. Self introduction to the farmers and explaining the real purpose of the study was done. The study also respected the confidentiality, anonymity, dignity, norms, and culture of the farmers. Full consent was obtained from respondents before the data collection process.

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