

## Factors Influencing the Use of Mobile Phone-Enabled Services in Accessing Agricultural Information by Smallholder Farmers in Bungoma County, Kenya

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### ABSTRACT

*The agriculture sector is the backbone of Kenya's economy, contributing approximately 33 percent of Kenya's gross domestic product (GDP). The agriculture sector employs more than 40 percent of the total population and 70 percent of the rural population. Kenya's agriculture is predominantly smallholder farming and is carried out on farms averaging 0.2–3 ha, mostly on a subsistence basis. The objective of this study was to determine factors influencing the use of mobile phone-enabled services in accessing agricultural information by smallholder farmers in Bungoma County, Kenya. The study adopted a cross-sectional and correlational research design. Using simple random sampling, 400 respondents were selected to participate in the study. Data was collected using questionnaires, interview guides, and focus group discussions. Findings revealed that 71.1% of smallholder farmers indicated that it was costly to use mobile phone-enabled services to access agricultural information. Another 57% of the farmers perceived that socio-economic characteristics (age, education, and income) were factors determining the use of mobile phone-enabled services for accessing agricultural information. About 75.8% of the smallholder farmers did not use mobile phones to communicate agricultural information needed for their farming activities for various reasons, including: having no one to communicate with, due to the complexity of mobile phone technology, not being able to pay for the cost of both the purchase and use of mobile phones, and due to network problems. Further evidence showed that the factors affecting the use of mobile phone-enabled services have a significant impact on accessing agricultural information. The fact that socio-demographic factors significantly affect the use of mobile phone-enabled services in accessing agricultural information It is recommended that mobile phone service providers such as Safaricom, Airtel, and Orange need to understand the user's characteristics, their needs, dynamics, and challenges, as well as potential changes in the future.*

**Keywords:** Agricultural Information, Mobile Phone-Enabled Services, Smallholder Farmers

### I. INTRODUCTION

In both developed and developing nations, smallholder farmers' lives have become more reliant on the usage of mobile phones. A decrease in cost, an increase in connectivity, and greater awareness have all been linked to smallholder farmers' quick adoption and use of mobile phones (Balogun et al., 2022). The agriculture sector plays a vital role in the majority of African economies. A significant proportion of the African population, over 80%, is engaged in agricultural activities, primarily as small-scale farmers who rely on agriculture as their primary source of income and sustenance. Effective communication is crucial in the agricultural industry to facilitate the successful implementation of innovative farming practices necessary for agricultural advancement. Significant advancements have been observed in the utilization of mobile phone-enabled services for agricultural purposes, particularly in Africa, with a particular focus on market access and information retrieval (Gakuru et al., 2009). A number of African nations have developed programs aimed at facilitating the dissemination of market information through the use of mobile phones.

According to the International Fund for Agricultural Development (IFAD, 2011), the rural population in Kenya constitutes more than 70% of the total population, making it the predominant demographic. Furthermore, IFAD (2011) asserts that agriculture holds paramount significance as the primary sector within the country's economy. Hence, the sector assumes a crucial role in the alleviation of poverty. Despite the recognized significance of

smallholder farming in Kenya, the sector has seen suboptimal performance in recent years, primarily attributed to many challenges, including limited access to pertinent and up-to-date agricultural information (Barret, 2009).

In recent years, there has been a growing effort to address the issue of agricultural information accessibility through the utilization of mobile phones (Aker, 2011). Mobile phones enhance the efficiency with which farmers access, exchange, and utilize agricultural information. According to Ilhiane (2007), these tools facilitate the ability of farmers to concentrate, locate, and retrieve relevant and current agricultural information via social and business networks. The advent of mobile phones has resulted in a substantial reduction in communication and information expenses for individuals residing in rural areas. Technological advancements have facilitated the acquisition of knowledge and information pertaining to agricultural matters, as well as their practical application, thereby enabling small-scale farmers to contribute to the progress and growth of the agricultural sector (Lehr, 2007).

Despite the widely recognized significance of the agriculture industry, smallholder farmers face challenges in realizing their full productivity potential. Indeed, the agricultural industry is confronted with a substantial disparity in production levels between the current output and the maximum achievable yields of several vegetable crops. Numerous studies have found a range of difficulties associated with the existing yield gap, one of which is the non-adoption of the latest farm technology (Rehman et al., 2015). As a result, it is important to investigate the factors influencing the use of mobile phone-enabled services in accessing agricultural information by smallholder farmers in Bungoma County, Kenya.

## II. LITERATURE REVIEW

The literature study identified several characteristics that influence the utilization of mobile phones by farmers for both social and agricultural purposes. The prevalence of mobile phone ownership in developing nations remains relatively limited, although it has experienced a gradual rise over the preceding years. Nevertheless, the ownership and utilization of mobile phones are influenced by gender. In summary, according to a report by the GSMA in 2013, women exhibit a 21% lower likelihood of mobile phone ownership compared to men. This disparity further rises to 23% for women residing in Africa. The closure of the gender gap in mobile phone ownership has the potential to extend the advantages of mobile phones to an estimated 300 million women. This expansion of mobile phone ownership among women can contribute to the advancement of various social and economic objectives (GSMA, 2013).

The age of the adopter is a significant factor in shaping patterns of mobile phone usage. Young people exhibit a higher level of dependence on technology, regardless of where they live, according to a study by Okello et al. (2012). Additionally, the study revealed a favorable association between young people and their utilization of mobile phones. Hence, it is anticipated that young farmers will exhibit a propensity to utilize this technology for the majority of their routine dealings.

According to Kirui et al. (2010), a low educational level among smallholder farmers presents obstacles in terms of their ability to accept and utilize modern technologies, such as mobile phones. According to Feder et al. (1993), it is posited that farmers must possess the requisite knowledge and information in order to effectively utilize technologies. Furthermore, the authors argue that there exists a positive correlation between the amount of knowledge and the adoption of new technologies among farmers. The findings of CIMMYT (1993) and Kirui et al. (2010) support the conclusions drawn by Okello et al. (2009) regarding the significance of farmers' literacy levels in relation to their utilization of mobile phones for accessing information. Furthermore, these findings suggest that farmers' literacy levels may have an impact on how challenging it is for them to use phone menus, which are typically in foreign languages like English. As a result, farmers' reading abilities have an impact on how frequently they use mobile phones and can influence how widely different communities in Sub-Saharan Africa adopt them.

In a research study on the factors influencing technology adoption, Baumüller (2012) found that an adopter's willingness to accept technology depends on a number of variables. First and foremost, the technology's adopter needs to be aware of its presence and be able to assess its hazards and suitability for their farming system. They must be able to afford and obtain the technology as well. Second, the adopter needs to be capable of managing any dangers that may arise from the technologies, as well as having the knowledge and abilities needed to use them effectively. Finally, with the use of technology, the user should be able to increase production and efficiency and earn additional revenue. The majority of the material examined in this area pertains to the many factors associated with the utilization of mobile phones for the purpose of disseminating agricultural knowledge. However, there is a dearth of research and publication in Kenya due to the prevailing limitations faced by rural smallholder farmers. In order to address this



information deficit, the present study aimed to determine the factors influencing the use of mobile phone-enabled services in accessing agricultural information in Bungoma County, Kenya.

### III. MATERIALS & METHODS

The research was conducted within three sub-counties located in Bungoma County, Kenya. The aforementioned sub-counties encompassed Tongaren, Mt. Elgon, and Bumula. The selection of the three sub-counties for this study was purposive and based on a specific criterion. Bumula was chosen due to its high population density and limited agricultural potential. Tongaren was selected as it represents a cosmopolitan area with a moderate to high agricultural potential. Lastly, Mt Elgon was included in the study as it is known for being a vegetable growing zone (Bungoma County Integrated Development Plan [BCIDP], 2013). The study adopted Cross sectional and Correlational research designs. The target population was 395,108 while the study population was 118, 533. Using Yamane’s formula, the sample size was computed to give a sample size of 400 respondents that were sampled using stratified random sampling as shown in Table 1

**Table 1**  
*Sample Size Proportions of the 3 Sub Counties of Bungoma County, Kenya.*

Sub county	Target population	Study population	Sample size
Bumula	215,892	64768	218
Mt Elgon	78,873	23662	80
Tongaren	100,343	30103	102
<b>Total</b>	<b>395108</b>	<b>118533</b>	<b>400</b>

The study used interviews, focus group discussions and questionnaires as the main research instruments. The data collected were analyzed using both descriptive and inferential statistics. The descriptive statistics includes; frequency, percentage, and mean scores while the inferential statistics includes; correlation, regression and chi-square test and findings presented in form of figures and tables.

### IV. RESULTS & DISCUSSIONS

#### 4.1 Agricultural Activities Practiced

The study sought to establish the type of agricultural activities that the smallholder farmers were practicing in their areas and presented the findings as shown in Table 1.

**Table 2**  
*Distribution of Agricultural Activities Practiced by smallholder farmers in Bungoma County, Kenya*

		Sub-county								X <sup>2</sup>	P
		Bumula		Tongaren		Mt. Elgon		Total			
Agricultural activities	Keeping animals	1	1.1%	0	0.0%	0	0.0%	1	0.5%	87.207	0.000
	Growing crops	10	11.1%	6	7.8%	34	75.6%	50	23.6%		
	Keeping animals and growing crops	79	87.8%	71	92.2%	11	24.4%	161	75.9%		

From Table 1, more than three quarters 75.9% of the smallholder farmers were keeping animals and growing crops at the same time, nearly a quarter 23.6% of the smallholder farmers indicated that they were growing crops alone while only 0.5% of the farmers stated that they were only keeping animals. A chi-square test of variation was performed to establish whether there were statistically significant differences within agricultural activities practiced within and between sub-counties. It was established that there were statistically significant differences ( $p < 0.05$ ) in agricultural services practiced within and between sub counties of Bungoma county. Therefore, the county has a considerable capacity for the cultivation of various agricultural commodities. The primary agricultural produce cultivated in the region comprises of maize, beans, finger millet, sweet potatoes, bananas, Irish potatoes, and various types of vegetables. The county cultivates various economic crops, including sugar cane, cotton, palm oil, coffee, sunflower, and tobacco. The primary animal breeds found within the region encompass cattle, goats, donkeys, pigs, chickens, bees, and fisheries. Bungoma County is recognized as a prominent contributor to the national production of



maize and beans, making a substantial annual contribution to the overall output of these crops in the country. According to the Government of Kenya (GOK, 2011), this region ranks as the fourth largest producer of maize and beans, following Trans Nzoia, Uasin Gishu, and Nakuru Counties. The existence of a silo and traditional retail establishments under the ownership of the National Cereal and Produce Board (NCPB), boasting a storage capacity of 830,000 metric tons, serves as empirical proof of this fact.

### 4.2 Crops Planted and Animals Kept

The researcher sought to establish the crops that were planted and animals that were kept by smallholder farmers in Bungoma County the results are as shown in Table 3.

**Table 3**  
*Distribution of Crops Planted and Animals Kept by smallholder farmers in Bungoma County, Kenya*

		Sub-county									
		Bumula		Tongaren		Mt. Elgon		Total			
		F	%	F	%	F	%	F	%	X <sup>2</sup>	P
Cereals	Yes	82	46.1%	73	41.0%	23	12.9%	178	83.9%		
Legumes	Yes	45	47.4%	44	46.3%	6	6.3%	95	44.8%		
Roots	Yes	45	80.4%	7	12.5%	4	7.1%	56	26.4%		
Vegetable	Yes	89	42.8%	74	35.6%	45	21.6%	208	98.1%		
Fruits	Yes	23	46.9%	26	53.1%	0	0.0%	49	23.1%		
Fodder	Yes	1	11.1%	8	88.9%	0	0.0%	9	4.2%		
Cash crops	Yes	14	25.0%	33	58.9%	9	16.1%	56	26.4%	<b>2.365</b>	<b>0.621</b>
Cattle	Yes	75	54.3%	55	39.9%	8	5.8%	138	65.1%		
Poultry	Yes	46	43.8%	58	55.2%	1	1.0%	105	49.5%		
Sheep	Yes	23	52.3%	19	43.2%	2	4.5%	44	20.8%		
Goat	Yes	24	60.0%	13	32.5%	3	7.5%	40	18.9%		
Pigs	Yes	11	91.7%	1	8.3%	0	0.0%	12	5.7%		
Rabbits	Yes	5	62.5%	3	37.5%	0	0.0%	8	3.8%		

From Table 3, majority 98.1% of the smallholder farmers indicated that they were planting vegetables, 83.9% of the farmers were planting cereals and 65.1% of the farmers were keeping cattle. The inference from these findings is that the majority of the farmers cultivate mainly food crops as compared to cash crops that would have earned them huge income to enable them to live a better life. Chi-square test of variation in the distribution of smallholder farmers on crops planted and animals kept ( $X^2_{24,0.05} 2365$ ) showed that there was no significant ( $p > 0.05$ ) variation between smallholder farmers crops planted and animals kept and the sub counties.

### 4.3 Agricultural Information Needed About Farming Activities

Smallholder farmers were asked to state the specific agricultural information they needed about their farming activities, responses to this question were analyzed and presented as shown in Table 4.

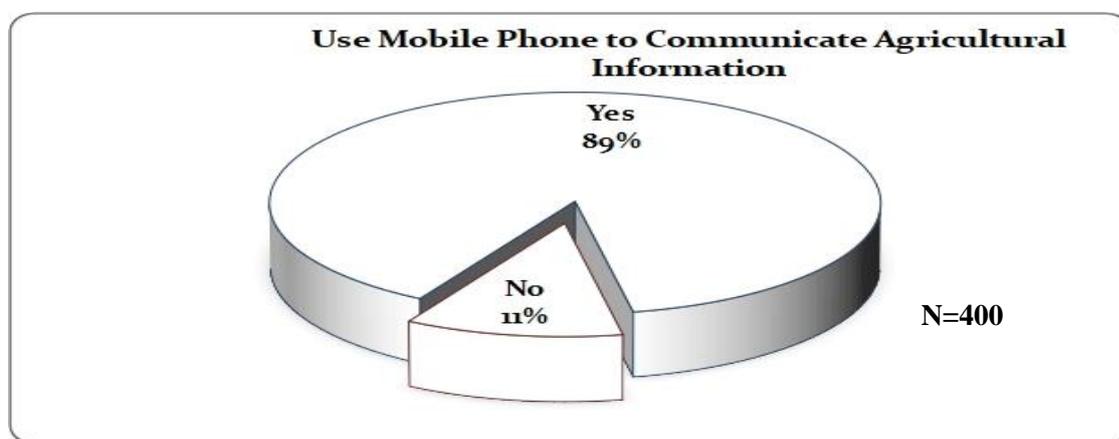
**Table 4**  
*Agricultural Information Needed About Farming Activities by smallholder farmers in Bungoma County, Kenya*

	Sub-county								X <sup>2</sup>	P
	Bumula		Tongaren		Mt. Elgon		Total			
	F	%	F	%	F	%	F	%		
Information for better marketing of agricultural products	44	54.3%	17	32.1%	4	8.9%	65	36.3%		
Information about agricultural input supply	8	9.9%	2	3.8%	7	15.6%	17	9.5%		
Information about agricultural management practices	13	16.0%	22	41.5%	28	62.2%	63	35.2%	<b>3.417</b>	<b>0.613</b>
Information about new agricultural technologies	16	19.8%	12	22.6%	6	13.3%	34	19.0%		

From Table 4. The findings revealed that with access to agricultural information through mobile phones, the smallholder farmers in the three sub-counties (36.3%) are better connected to the markets. The chi-square test of variation in the distribution of smallholder farmers on agricultural information needed about farming activities showed that there was no significant variation between smallholder farmers on agricultural information needed about farming activities and the subcounties. The outcomes are consistent with Mittal et al.'s (2010) findings, which support the idea that, although smallholder farmers can access markets and build stronger relationships with the availability of information on prices and market opportunities, larger-scale farmers are the ones who gain the most in terms of actual price realization. The concept of constricted rationality, insufficient bargaining power, restricted access to credit, and other variables are among the main causes of this phenomenon that affects smallholder farmers. Furthermore, the study's findings showed that a sizable percentage of farmers use their mobile phones to get information about agricultural practices. The findings of this study are in line with those of Xiaolan et al. (2012), which indicate that mobile phones in India significantly contribute to smallholder farmers' access to production resources, knowledge, and technology for agricultural purposes.

#### 4.4 Use of Mobile Phone to Communicate agricultural information needed

With regards to the use of mobile phone to communicate agricultural information needed by smallholder farmers in their farming activities, the responses from farmers were as presented in Figure 1.



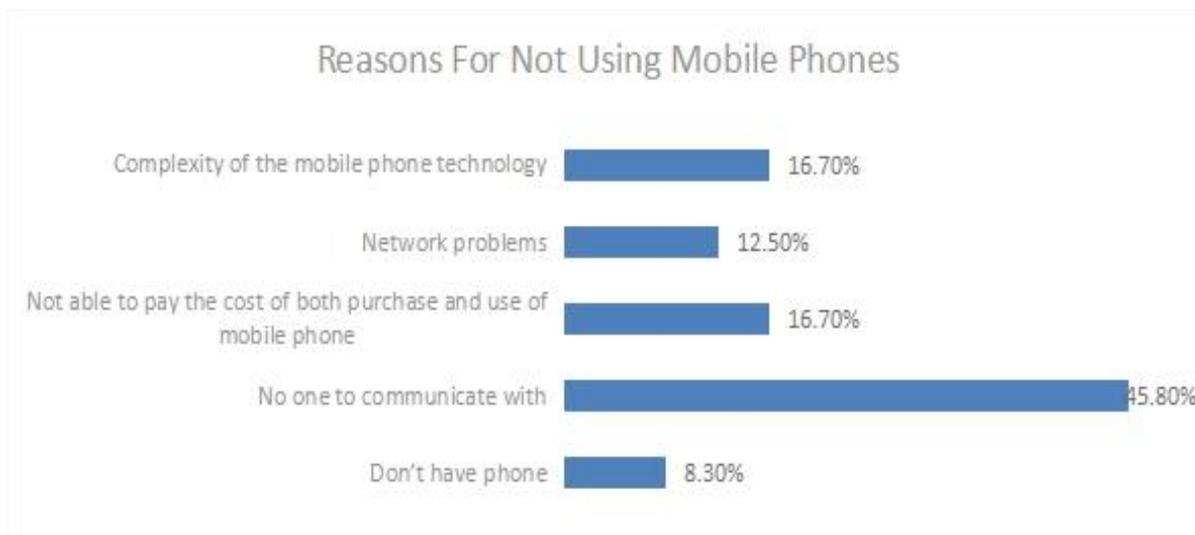
**Figure 1**

*Use of Mobile Phone to Communicate Agricultural Information Needed by Smallholder Farmers in Bungoma County, Kenya*

From Figure 1, it was observed that more than three quarters 89% of smallholder farmers used their mobile phones to communicate on agricultural information needed for their farming activities while only 11% of the farmers stated otherwise. This indicates that mobile phone technologies have highly diffused into most rural communities, implying that smallholder farmers that dominate the rural farming communities are in tune with the global trend in awareness of the existence of mobile telephony. This virtue is a good prospect for the use of cellular phone enabled services by farmers in the areas considered.

#### 4.5 Reasons for Not Using Mobile Phones

Those that stated that they did not use mobile phones to communicate agricultural information were asked to state the reasons which are presented as shown in Figure 2.



**Figure 2**

*Reasons for Not Using Mobile Phones to Communicate Agricultural Information by Smallholder Farmers in Bungoma County, Kenya (N=400)*

From Figure 2, nearly a half 45.8% of the small holder farmers did not use mobile phones to communicate agricultural information needed for their farming activities for the reason that they did not have anyone to communicate to, 16.7% of the farmers stated that they did not use mobile phones due to complexity of the mobile phone technology and not being able to pay for the cost of both purchase and use of mobile phones. Another 10% of the smallholder farmers indicated that it was due to network problems and only 8.3% of the smallholder farmers was because they did not have mobile phones. The results presented here align with the findings of Chukwunonso's (2012) study conducted in Nigeria, which substantiated that a lack of knowledge serves as the primary deterrent for farmers in utilizing mobile phone-based agricultural information. A mere 3% of respondents cited farmers' socioeconomic features, such as age, income, and literacy level, as well as factors such as lack of interest, small scale production, and distrust, as reasons for their non-utilization of mobile phones for accessing market information pertaining to their agricultural goods.

**4.5 Extent to which Smallholder Farmers Have Market Information for Vegetables**

Using a Likert scale smallholder farmers were asked to Indicate the extent to which they have market information. Their responses were analyzed and presented as shown in Table 5

**Table 5**

*Distribution of Extent to which Smallholder Farmers Have Market Information for Vegetables in Bungoma County, Kenya*

	Very great extent		Great extent		Moderate extent		Low extent		Very low extent	
	F	%	F	%	F	%	F	%	F	%
Prices of vegetable crops	34	16.0%	57	26.9%	70	33.0%	48	22.6%	3	1.4%
Places where there is ready market for vegetable crops	35	16.5%	46	21.7%	78	36.8%	51	24.1%	2	0.9%
Buyers of vegetable crops	25	11.8%	57	26.9%	59	27.8%	68	32.1%	3	1.4%
Peak and off-peak season for crops	28	13.3%	41	19.5%	48	22.9%	71	33.8%	22	10.5%

From Table 5, the majority of the farmers (33.0%) received information on the prices of vegetables to a moderate extent, and another 36.8% of the farmers received information on places where there is a ready market for vegetable crops to a moderate extent. 32.1% of the farmers received information on buyers of vegetable crops to a low extent, while 33.8% of the farmers received information on peak and off-peak seasons for crops to a low extent. The

majority of farmers obtained information regarding locations with accessible marketplaces through the use of mobile phones, aligning with the findings of Tadesse et al. (2015), who asserted that mobile phone technology empowered Ethiopian farmers to engage in local market negotiations, resulting in enhanced profitability from their agricultural products. In a similar vein, the reduction in transportation costs is attributed to the practice of establishing agreements with local marketplaces before shipping their goods. According to Masuka et al. (2016), the results of the study indicate that the utilization of mobile phones by smallholder farmers in the study areas has enabled them to create connections with different stakeholders, such as dealers and consumers.

#### 4.6 Channels Used to Access Market Information

Smallholder farmers were asked to state among the various other communication tools/channels which one they used to access agricultural information and to what extent, their responses to this question were analyzed and presented as shown in Table 6.

**Table 6**

*Distribution of Channels Used to Access Market Information by smallholder farmers in Bungoma County, Kenya*

	<b>Very Great Extent</b>	<b>Great Extent</b>	<b>Moderate Extent</b>	<b>Low Extent</b>	<b>No Extent At All</b>	<b>Mean</b>	<b>Std. Dev.</b>
Farmers cooperatives	5.20%	8.50%	31.60%	24.50%	30.20%	3.66	1.147
Middle-men	9.90%	25.00%	28.30%	23.10%	13.70%	3.06	1.195
Radio	26.10%	21.80%	32.70%	14.20%	5.20%	2.51	1.173
Television	15.60%	17.50%	38.90%	19.90%	8.10%	2.87	1.145
Newspapers	2.40%	3.30%	15.20%	47.90%	31.30%	4.02	0.902
Computer internet	19.90%	10.40%	11.80%	29.40%	28.40%	3.36	1.487
Farmer field schools	6.60%	16.00%	38.20%	16.50%	22.60%	3.33	1.181
Extension agents	1.90%	20.90%	42.70%	21.80%	12.80%	3.23	0.983
Books	6.20%	6.60%	26.50%	38.90%	21.80%	3.64	1.084
Progressive farmers	10.40%	16.00%	55.20%	13.20%	5.20%	2.87	0.95

From Table 6, more than a quarter 31.6% of the smallholder farmers acquired marketing information to a moderate extent from farmers' cooperatives. Another 28.1% of the smallholder farmers indicated that they acquired marketing information to a moderate extent from middle-men and slightly more than a quarter 26.1% of the smallholder farmers stated that they acquired marketing information to a very great extent from the radio. This suggests that progressive farmers, radio, television, and extension staff are the primary sources of knowledge for farmers. One possible explanation for this phenomenon is that farmers tend to heavily depend on these sources for acquiring fresh information regarding farming practices in their own regions, as there is no direct financial burden associated with obtaining such information. The results of this study are consistent with the findings of Ogidi (2014) and Babu et al. (2011), which indicate that farmers utilize many routes and sources to obtain agricultural market information. These include extension officers, progressive farmers, radio broadcasts, personal acquaintances, researchers, and newspapers. This observation further supports the conclusions stated by Lwoga et al. (2011) on the underutilization of advanced technologies, such as computer internet and printed media, despite their availability within the communities. The limited level of literacy among farmers contributes to a reduced utilization of computer internet and books, primarily due to their lack of awareness regarding internet usage and the associated high costs of access.

#### 4.7 Type of Agricultural Information Conveyed to Smallholder

The researcher sought to establish the type of agricultural information each source conveyed to them; this is presented as shown in Table 7.



**Table 7**

*Distribution of type of Agricultural Information Conveyed to Smallholder Farmers in Bungoma County, Kenya*

	Information about new agricultural technologies	Information about the prices of particular agricultural commodities	Information about better marketing	Information on some recommended management practices	Information about input supply and availability	Information about demand and supply situation of particular commodities
Radio	20.3%	18.4%	31.1%	18.9%	7.1%	4.2%
Progressive farmer	18.8%	11.5%	17.3%	38.9%	6.3%	7.2%
Extension staff	44.3%	4.0%	9.0%	33.8%	7.0%	2.0%
Researchers	73.4%	3.3%	4.9%	14.1%	4.3%	0.0%

From Table 7, more than a quarter 31.1% of the smallholder farmers revealed that information about better marketing was conveyed to them by radio. Another 38.9% of the smallholder farmers indicated that information on some recommended management practices was conveyed to them by progressive farmer, 44.3% of the smallholder farmers stated that information about new agricultural technologies was conveyed to them by extension staff while more than a half 73.4% of the smallholder farmers revealed that information about new agricultural technologies were conveyed to them by researchers. This phenomenon is anticipated, as previous research conducted by Ezech (2013) and Anselm et al. (2012) has also observed a comparable pattern. Specifically, the utilization of radio, extension agents, progressive farmers, farmer field schools, and researchers has been predominantly employed to acquire information pertaining to production technologies and management practices, rather than accessing market information.

**4.8 Factors Influencing Mobile Phone Usage**

Respondents were asked to state the factors that influenced mobile phone usage, their responses were analyzed and presented as shown in Table 8.

**Table 8**

*Distribution of Factors Influencing Mobile Phone Usage by Smallholder Farmers in Bungoma County, Kenya*

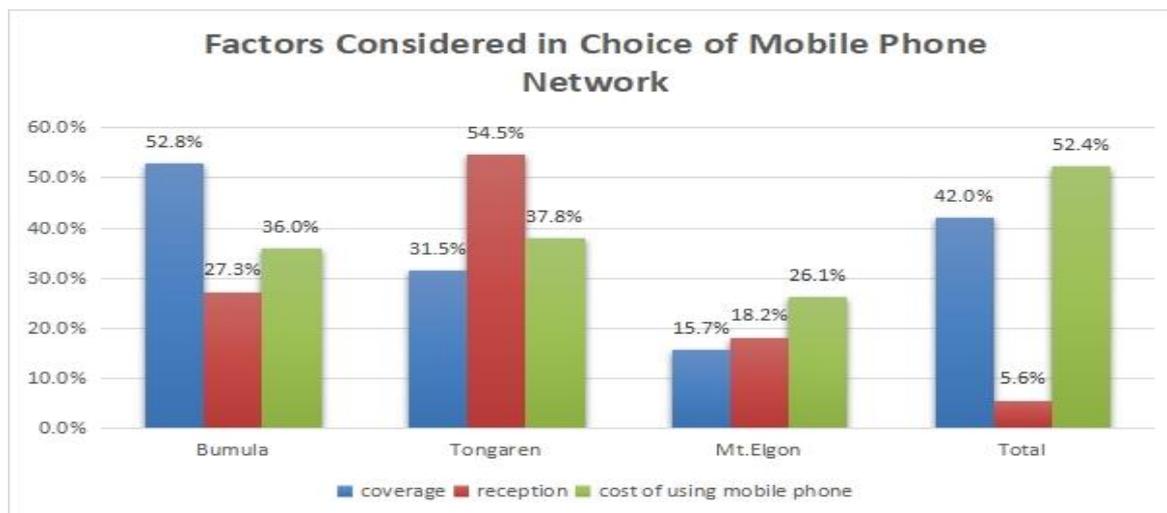
	Sub-county								X <sup>2</sup>	P
	Bumula		Tongaren		Mt. Elgon		Total			
	F	%	F	%	F	%	F	%		
Gender	18	41.90%	5	11.60%	20	46.50%	43	20.30%	25.307	0.000
Mobile phone usage knowledge	34	28.80%	55	46.60%	29	24.60%	118	55.70%	20.826	0.000
Education status	62	48.10%	40	31.00%	27	20.90%	129	60.80%	5.016	0.081
Age	35	32.70%	37	34.60%	35	32.70%	107	50.50%	18.433	0.000
Marital status	29	55.80%	1	1.90%	22	42.30%	52	24.50%	39.749	0.000
Farming as a source of income	26	38.80%	24	35.80%	17	25.40%	67	31.60%	1.107	0.580
Income level	39	35.50%	34	30.90%	37	33.60%	110	51.90%	21.069	0.000
Local market channels	13	25.00%	24	46.20%	15	28.80%	52	24.50%	8.662	0.010

From Table 8 it was observed that majority of the small-holder farmers 60.8% indicated that education status was the main factor influencing mobile phone usage. Another 55.7% of the smallholder farmers indicated that mobile phone usage knowledge was a factor influencing mobile phone usage. Income level accounting for 51.9% and age accounting for 50.5% of the responses were also identified as factors influencing mobile phone usage. Chi-square test of association results showed that there was a statistically significant association between sub counties and gender, mobile phone usage knowledge, age, marital status, income level and local market channels as factors influencing mobile phone usage as their p-values were less than 0.05. There was no statistically significant association between sub counties and education status and farming as a source of income. The study found no statistically significant impact of various parameters on the utilization of mobile phone enabled services among smallholder farmers for the purpose of sharing agricultural information.

Indeed, empirical investigations conducted by Abebe et al. (2018; 2016) and Mittal et al. (2015) have substantiated the positive correlation between farmers' educational attainment and their proficiency in comprehending and utilizing mobile phone technology. The findings shown in Table 8 demonstrate a significant positive link between the educational attainment of the respondents and their utilization of mobile phones for accessing agricultural information. This finding aligns with the research conducted by Obong et al. (2018), which substantiated that individuals with higher levels of education possess a more extensive understanding of agriculture and frequently utilize mobile phones as a means of accessing agricultural information.

#### 4.9 Factors Considered in Choice of Mobile Phone Network

Small-holder farmers were also asked to state some of the factors they considered to choose their mobile phone networks, their responses were analyzed and presented as shown in Figure 3.



**Figure 3**

*Distribution of Factors Considered in Choice of Mobile Phone Network by Smallholder Farmers in Bungoma Count Kenya*

From Figure 3, it was observed that majority 52.4% of the smallholder farmers in Bungoma County indicated that the cost of using the mobile phone network was one of the main factors they considered in choosing a network, another 42.0% indicated that they considered network coverage Chi-square test of variation in the factors considered in the choice of mobile phone network by smallholder farmers ( $\chi^2_{4,0.05} = 8.122$ ) showed that there was no significant ( $p > 0.05$ ) variation between smallholder farmers factors considered for choice of network and the sub counties while only 5.6% indicated that they used reception to inform their choices. The role of cost is of significant importance within the telecommunications business, particularly for mobile phone service providers. This encompasses not alone the initial purchase cost, but also the expenses associated with making phone calls. A company that provides more competitive pricing would be more likely to recruit a larger client base, since customers would be more inclined to commit to the company's network.

Price and value are fundamental factors in any consumer buying transaction. The willingness of consumers to allocate financial resources towards a specific service is positively correlated with their subjective evaluation of the service's worth. According to a study conducted by Bayes (2001) in Bangladesh, the utilization of mobile phones has the potential to enhance smallholder farmers' accessibility to agricultural inputs like as seeds, technologies, and fertilizers. This is achieved by mitigating the significant transaction costs associated with these resources. Bayes conducted a comparative analysis between two villages, one characterized by mobile phone coverage and the other lacking such coverage. The findings revealed that farmers residing in the village with cell phone coverage had a higher level of engagement in utilizing fertilizers and seeds, in contrast to their counterparts in the village without mobile phone service.

According to Bayes, the cell phone had a crucial role in enabling more convenient communication regarding the availability and costs of farm inputs, resulting in the reduction of certain pre-existing obstacles. Bayes additionally posited that, due to their access to relevant information, the traders and farmers possessed a comprehensive



understanding of the input availability conditions within their locality, thereby enabling them to preemptively mitigate unforeseen events. The width of a network should be determined by the specific requirements and demands of the user. Having reliable network coverage facilitates continuous connectivity. Nevertheless, the absence of mobile network coverage, particularly in rural regions, has been widely recognized as a contributing factor to the digital divide and an impediment to the progress of rural communities. This is consistent with the findings of Bharnani et al. (2008).

**4.10 Factors that affect use of mobile phone communication in accessing agricultural information**

Small-holder farmers were further asked to state factors that affect mobile phone communication when accessing agricultural information by smallholder farmers and their responses were analyzed and presented as shown in Table 9.

**Table 9**

*Distribution of Factors That Affect Use of Mobile Phone Communication in Accessing Agricultural Information by Smallholder Farmers in Bungoma County, Kenya*

	Sub-county								X <sup>2</sup>	P
	Bumula		Tongaren		Mt. Elgon		Total			
	F	%	F	%	F	%	F	%		
I am not aware of such technology	44	66.7%	13	19.7%	9	13.6%	66	31.1%		
It is difficult to use	68	56.7%	13	10.8%	39	32.5%	120	56.6%		
It is costly	63	41.4%	56	36.8%	33	21.7%	152	71.7%		
I have not been trained on how to use it	60	65.2%	10	10.9%	22	23.9%	92	43.4%	<b>4.041</b>	<b>0.691</b>
There is ready local market	9	20.5%	20	45.5%	15	34.1%	44	20.8%		
Socio-economic characteristics (age, education and income)	49	40.2%	44	36.1%	29	23.8%	122	57.5%		
I do not trust the information	16	42.1%	8	21.1%	14	36.8%	38	17.9%		

From Table 9, it was observed that majority of the smallholder farmers 71.7% indicated that it was costly to use mobile phones communication in accessing agricultural marketing information. Another 57.5% of the farmers felt that Socio-economic characteristics (age, education and income) were characteristics determining the use of mobile phones in accessing agricultural information. 56.6% of the farmers indicated that it was difficult for them to use mobile phones communication in accessing agricultural marketing information. Only 17.9% of the farmers indicated that they did not trust the information. Chi-square test of variation in the distribution of smallholder farmers factors influencing use of mobile phones communication in accessing agricultural information ( $X^2_{14,0.05} = 4.041$ ) showed that there was no significant ( $p > 0.05$ ) variation between smallholder farmers factors influencing use of mobile phones communication in accessing agricultural information and the sub counties.

The results of this study are consistent with the findings of Santosham et al. (2015), which suggest that the primary obstacle preventing women from owning and using mobile phones is the expense associated with them. This is attributed to women's relatively lower financial autonomy in comparison to males. The utilization of mobile phones for accessing agricultural information is significantly influenced by the socio-economic characteristics of the respondents. The results are consistent with the research conducted by Mascarenhas (2010), which indicates that women had a lower level of mobile phone accessibility compared to men. The utilization of mobile phone enabled services has been observed to be positively influenced by the level of education and literacy. Kiiza et al. (2012) and Kirui et al. (2010) conducted studies on the topic. In contrast, the research conducted by Kiiza et al. (2012) substantiated that there exists a negative correlation between the age of the household head and the probability of utilizing mobile phones for accessing agricultural information services.

**4.11 Correlation for Factors Influencing the Use of Mobile Phone-Enabled Services in Accessing Agricultural Information in Bungoma County, Kenya**

Scores from factors influencing the use of mobile phone enabled services as an independent variable and accessing agricultural information as dependent variable were used to compute Pearson Moment Correlation Coefficient.



**Table 10**

*Correlation for Factors Influencing the Use of Mobile Phone-Enabled Services*

		Accessing agricultural information
Factors influencing the use of mobile phone-enabled services	Pearson Correlation	.773**
	Sig. (2-tailed)	.000
	N	400

\*\*Correlation is significant at 0.01 level (2 tailed)  $r = 0.773$ ,  $N = 400$ ,  $P < .01$

The results in Table 10 clearly showed that there was a high positive association between factors influencing the use of mobile phone-enabled services and accessing agricultural information ( $r = .773$ ,  $n = 400$ ,  $p < .01$ ). This shown that accessing agricultural information is highly influenced by the factors influencing the use of mobile phone-enabled services.

**4.12 Regression Analysis for Factors Influencing Mobile Phone-Enabled Services**

To establish the level of influence of factors influencing mobile phone-enabled services and accessing agricultural information the study used a coefficient of determination ( $R^2$ ) using regression analysis as shown in Table 11

**Table 11**

*Model Summary*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.773 <sup>a</sup>	.597	.594	.57623

Predictors: (Constant), Factors influencing mobile phone-enabled services,  
 Dependent variable: Accessing agricultural information

From Table 11 the R value is at .773 which shows that there exists a strong influence of factors influencing mobile phone-enabled services in accessing agricultural information in Bungoma county.  $R^2$  shows .597 on variation of accessing agricultural information caused by factors influencing mobile phone-enabled services. This means that if factors influencing the use of mobile phone-enabled services are increased there will be a 59.7% increase in accessing agricultural information. Therefore, the county government and other stakeholders in the agricultural sector should improve on mobile phone-enabled services for the benefit of farmers in Bungoma county. Table 12 shows the analysis of variance.

**Table 12**

*ANOVA for Factors Influencing Mobile Phone-Enabled Services and Accessing Agricultural Information in Bungoma County, Kenya*

ANOVA <sup>a</sup>						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	142.439	1	142.439	490.033	.000 <sup>b</sup>
	Residual	132.468	399	.332		
	Total	294.907	400			

a. Dependent Variable: Accessing agricultural information

b. Predictors: (Constant), Factors influencing mobile phone-enabled services

As shown in Table 12, the high F-statistic (490.033) and the small p-value (0.000) indicates that the model is statistically significant. This means that factors influencing the use of mobile phone-enabled services are a strong predictor of accessing agricultural information in Bungoma County. Table 13 shows the regression coefficients that can be used for model fitting.



**Table 13**  
*Coefficients of Factors Influencing Mobile Phone-Enabled Services*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.289	.036		12.621	.000
	Factors influencing mobile phone use	.763	.010	.640	17.748	.000

a. Dependent Variable: Accessing agricultural Information

From Table 13, a unit increase in factors influencing mobile phone use causes an increase of 0.640 in accessing agricultural information. The results gave the study a simple linear regression equation of:

$$\text{Accessing agricultural information} = 1.289 + 0.640 \text{ Factors influencing mobile phone use} + \epsilon$$

The equation indicates that for every individual unit increase in factors influencing mobile phone-enabled services, there would be a resulting 64.0% % increase in accessing agricultural information.

## V. CONCLUSIONS & RECOMMENDATIONS

From the findings, it was observed that 71.1% indicated that it was costly to use mobile phone communication to access agricultural information. Another 57% of the farmers felt that socio-economic characteristics (age, education, and income) were factors determining the use of mobile phone-enabled services for accessing agricultural information. Cost is factor number one that poses a barrier to the usage of mobile phone-enabled services for accessing agricultural information. Women had less access to mobile phone-enabled services than men, and the level of education and literacy increased the usage of mobile phone-enabled services; reducing transportation costs. About 75.8% of the smallholder farmers did not use mobile phones to communicate agricultural information needed for their farming activities for various reasons, including having no one to communicate with, the complexity of mobile phone technology, not being able to pay for the cost of both the purchase and use of mobile phones, and network problems. Further evidence showed that the factors affecting the use of mobile phone-enabled services have a significant impact on accessing agricultural information. The fact that socio-demographic factors significantly affect the use of mobile phone-enabled services in accessing agricultural information It is recommended that mobile phone service providers such as Safaricom, Airtel, and Orange need to understand the user’s characteristics, their needs, dynamics, and challenges, as well as potential changes in the future. To cater for those smallholder farmers who cannot afford credit and mobile data or subscribe to available platforms, the county government should provide financial support for the establishment of information centers at sub location agricultural extension offices in Bungoma County, Kenya. These centers will provide free Wi-Fi for farmers, and farmers can visit these centers with their mobile phones to access agricultural information.

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