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Research Application Summary

The role of mobile phones in unlocking production for sustainable development among medium scale farmers in Kenya

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Abstract

Integration of mobile phones offers incredible opportunities to share agricultural information. Being one of the ICT tools currently used in extension science, evaluating its contribution on agricultural production remains crucial. This study particularly focused on the medium scale farmers who work in formal sector and mostly stay in urban areas hence lack direct contact with rural extension officers. The study was conducted in Uasin-Gishu, Nyeri and Embu Counties, where mobile phone application initiatives have been piloted. A sample of 220 farmers was selected through systematic random sampling. Afterwards, a survey was conducted to evaluate access of extension, ownership of mobile phones, communication pathways preferred and implementation of disseminated information among the participants. Primary data were collected using semi-structured questions. Descriptive statistics were used to analyze data. The results showed that all the farmers owned mobile phones. Out of this, 97% of the farmers from Uasin-Gishu, 100% from Nyeri and 84% from Embu were able to use their phones to access information. Short Message Services (SMS) was the most preferred means of sharing information. Further, 43% of the respondents implemented information on how to diversify farming, 26.2% of the farmers implemented information on post-harvesting techniques, 42% and 30% of the farmers implemented information on sales timing and consumer trends respectively. Hence, to reach a large audience of farmers, phone based applications such as esoko should be built on free social networks like Facebook and information shared in SMS format.

Key words: Agricultural extension, dissemination, information, Kenya, medium scale farmers, mobile phones

Résumé

L'intégration des téléphones portables offre des opportunités incroyables pour partager des informations agricoles. Étant l'un des outils TIC actuellement utilisés dans la science de la vulgarisation, l'évaluation de sa contribution à la production agricole reste cruciale. Cette étude s'est particulièrement concentrée sur les agriculteurs de taille moyenne qui travaillent dans le secteur formel et restent pour la plupart dans les zones urbaines, par conséquent, n'ont pas de contact direct avec les agents de vulgarisation rurale. L'étude a été menée dans les comtés d'Uasin-Gishu, Nyeri et Embu, où des initiatives d'application de téléphonie mobile ont été testées. Un échantillon de 220 agriculteurs a été sélectionné par échantillonnage aléatoire systématique. Par la suite, une enquête a été menée pour évaluer l'accès à l'extension/vulgarisation, la possession de téléphones portables, les voies de communication préférées et la mise en œuvre des informations diffusées parmi les participants. Les données primaires ont été recueillies à l'aide de questions semi-structurées. Des statistiques descriptives ont été utilisées pour analyser les données. Les résultats ont montré que tous les agriculteurs possédaient des téléphones portables. De ce nombre,

97 % des agriculteurs d'Uasin-Gishu, 100 % de Nyeri et 84 % d'Embu ont pu utiliser leur téléphone pour accéder aux informations. Les services de messages courts (SMS) étaient le moyen préféré de partage d'informations. En outre, 43 % des répondants ont mis en œuvre des informations sur la manière de diversifier l'agriculture, 26,2 % des agriculteurs ont mis en œuvre des informations sur les techniques post-récolte, 42 % et 30 % des agriculteurs ont mis en œuvre des informations sur le calendrier des ventes et les tendances de consommation respectivement. Par conséquent, pour atteindre un large public d'agriculteurs, les applications basées sur le téléphone telles que esoko devraient être construites sur des réseaux sociaux gratuits comme Facebook et des informations partagées au format SMS.

Mots clés : Vulgarisation agricole, diffusion, information, Kenya, agriculteurs de taille moyenne, téléphones portables

Introduction

Farming is becoming a more time-critical and information-intense business. As income generating sector, agriculture remains a major source of export earnings, creates employment and wealth (GoK, 2008). Majority (80%) of those who engage in agriculture are small scale farmers (FAO, 2005) while the rest are medium and large scale farms but cover substantial (54%) of the area farmed (Kamau, 2013). Specifically, medium scale farmers alone constitute 14% of total number farmers in Kenya (EFG, 2014). This is quite a number of farmers; however, little agricultural efforts have been directed to them despite controlling more land than large-scale foreign investors (Jayne *et al.*, 2014). As a result, they have manifested poor farming methods, low yields and poor marketing.

To avert the above situation, access to relevant information on agricultural development efforts becomes important. Notable development efforts include regional integration and bilateral agreements like the East Africa Community which offer huge markets (Ogambi, 2005). In addition, breeding programmes have been initiated at research stations to produce improved varieties of crops and livestock. According to Ongachi *et al.* (2017), timely information on these emerging agricultural interventions helps farmers to make sound decisions on adoption process. A situation that may enhance increased agricultural productivity with multiple effects on economy.

In Kenya like other developing Countries, there are a few extension officers to visit all of the farmers who constantly need services (Bentley *et al.,* 2015). As witnessed from Farmer Field Schools, an active method of tradition extension which uses such officers (Ongachi *et al.,* 2017), large number of farmers cannot be reached. This situation could be more disturbing especially to the medium scale farmers who tend to stay away from their rural farms; as their primary jobs are in the non-farm sector, with majority of them being government officials and businessmen (Jayne *et al.,* 2014). Furthermore, poor linkages and coordination has been noted in farmer's participation particularly in traditional agricultural extension in the current devolved government system (Karembu, 2011). All these scenarios depict low access to extension services provided through tradition means.

As argued by Giridharadas (2009) that being in a network is like living in a village where people are greatly compelled to share information. In light to this, the incredible development and use of mobile phones remain a promising technology for such networking. In agricultural field, a

number of mobile phone application initiatives have been piloted and integrated in bid to facilitate information dissemination. Past studies by Overa *et al.* (2006), have revealed that mobile phones can speed up; and enable farmers to focus and extract useful and up-to-date information from social and business networks. In addition, they can allow farmers to strike better price deals within their existing trading relationships, and to make better choices about where to sell their produce (Katengeza *et al.,* 2011). Furthermore, phones are considered as precious devices which are beneficial to farmer mostly in remote areas (Muto and Yamano 2009) and remain a realistic option means of communication due its wide availability, affordability, simplicity and flexibility (Vennesa, 2006).

With numerous developments in mobile phone sub-sector such as high penetration of mobile phone which stands at 90% (CA, 2017), mobile phone initiatives such as Airtel Kilimo, M-Farm, iCow and applications such as WhatsApp present a remarkable way to enhance networking amongst farmers and relevant stakeholders. However, lack of adequate and reliable electricity, poor communication infrastructure may create barriers toward effective use of such phones especially in rural settings. Based on the above background, the current study sought to understand existing mobile phone based communication pathways and level of uptake of various agricultural interventions disseminated via mobile phones among medium scale farmers in Kenya.

Materials and Methods

Site Description. The study was carried out in Uasin-Gishu, Nyeri, and Embu Counties of Kenya where various mobile phone applications such as Arifu, Esoko have been piloted in order to potentially speak to medium scale farmers. Uasin-Gishu County is located in the former Rift Valley Province and extends between longitudes 340 50' and 340 57' East and latitude of 00 3' South to 00 1' North. This County enjoys two rainy seasons with an annual rainfall ranging between 900 to 1200mm. Nyeri County is located in the former Central Province of Kenya. It receives an average rainfall between 500mm and 1500mm during the short and long rains periods; enjoys range temperature between 12°C in the cold months (June and July) and 27°C in the hot months making it conducive for its diverse agricultural activity. Finally, Embu County which is located at the foothill of Mount Kenya and receives substantial rainfall with average annual precipitation of 1206 mm with temperatures range between 9°C - 28°C.

The main occupation of the majority people in these Counties is farming. Farmers hold different land sizes with some being medium sized. Soils found in these areas are mainly good for maize, wheat, horticultural crops and livestock. This study focused on medium scale farmers who closely work with Equity Group Foundation.

Sample selection and data collection. Specific locations were identified based on the baseline surveys conducted by Equity Group Foundation (EGF), agriculture pillar. The locations were chosen with the hope of finding larger number of mobile phone users in order to achieve the projects' objective. Primary data were purposively gathered among the selected farmers in three Counties. To realize the study objectives, a multistage sampling procedure was employed to divide the Counties into smaller admintrative units, villages. Further, systematic random sampling procedure was employed to select the respondents from the existing list of farmers as kept in the project records at Equity Group Foundation. From the lists, a total of 220 farmers were randomly drawn using a simplified formula for proportion by Yamane (1967) as shown in Table 1.

Table 1. Sample size determination

County	Total No. Farmers as collated by EFG	Number of Sampled farmers
Uasin-Gishu	239	120
Nyeri	115	55
Embu	85	45
Total		220

Afterwards, a household survey was carried out to assess the impact of mobile phone on the project participants. Data were collected using semi-structured questions administered through face to face interviews to enable clarification and probing of the respondent for accurate answers. Before the administration of the questionnaire, the locals with necessary education and farming experience were trained as enumerators on the objective and questionnaire contents.

The questionnaire captured questions on ownership of mobile phones, mobile phone initiatives piloted, training on use of mobile phone to access information, preferred mode of communication, uptake of information disseminated among others. However, 23 respondents from Uasin-Gishu County did not complete interviews; data were therefore obtained from 97 farmers who successfully completed interviews. All the respondents in other Counties completed their interviews. The collected data were then subjected to descriptive statistics.

Results and Discusion

Ownership of Mobile phones and Access of information by the respondents. The ownership of mobile phones is an important indicator of availability, accessibility and affordability of the phones among the respondents. This study results revealed that all of the respondents (100%) owned mobile phones (Table 2). Out of this, 64.7%, 68.2% and 56.7% of farmers from Nyeri, Uasin Gishu and Embu respectively had 'ordinary' phones while the rest had smart phones. Possession of mobile phone is an important and first step towards which farmers can be exposed to agricultural messages. Past studies by Wawire, (2013) also revealed that physical availability of the medium exposes agricultural programs to farmers. A smart phone has additional applications that may be important in accessing information coded in different formats.

Further, the study revealed that majority of the respondents had a relatively high level of access to extension services through mobile telephony at 97%, 100% and 84% from Uasin Gishu, Nyeri and Embu Counties respectively (Table 2). This was due to the fact that Equity Group Foundation and other extension service providers had developed a strong network with the farmers and information sharing was just at the touch of the button. Nevertheless, it implies that when mobile phones are appropriately used, large audience of farmers can be reached. A scenario that has been widely supported by Asenso and Mekonnen (2012); and Ongachi *et al.* (2017), that ICT tools improve and enhance faster diffusion of information on agricultural technologies.

However, the rate at which farmers were being notified and receiving important updates from service developers was low (Table 2). This implies that majority of the farmers were not able to receive timely information. Access to timely information and possession of knowledge is the first step toward promoting adoption process. This is due to the fact that knowledge influences acceptance of new ideas hence uptake of technologies developed over time to improve production. In addition, about 29.3% and 7.7% of the farmers from Uasin Gishu and Embu Counties respectively received trainings on the use of mobile phones to access agricultural messages (Figure 1). In contrary, all the farmers from Nyeri County had received trainings on mobile phone application. However, they reported only being trained on Arifu and Esoko platforms. Equity Group Foundation and Bayer's company were key and leading training partners.

Table 2. Level of mobile phone ownership and access to Extension services (n=220)

Variables		Counties		
		Uasin Gishu (%)	Nyeri (%)	Embu (%)
Ownership of phone	Yes	100	100	100
Type of phone	Ordinary	87.9	78.2	65.3
	Smart phone	12.1	21.8	34.7
Access to Extension	If Yes	97	100	84
Frequency of access to extension services	Weekly	22.1	2	10.2
	Monthly	31.2	94.1	33.4
	Quarterly	37.9	3.9	42.3
	Twice a year	3.5	0	2.6
	Yearly	5.3	0	11.5

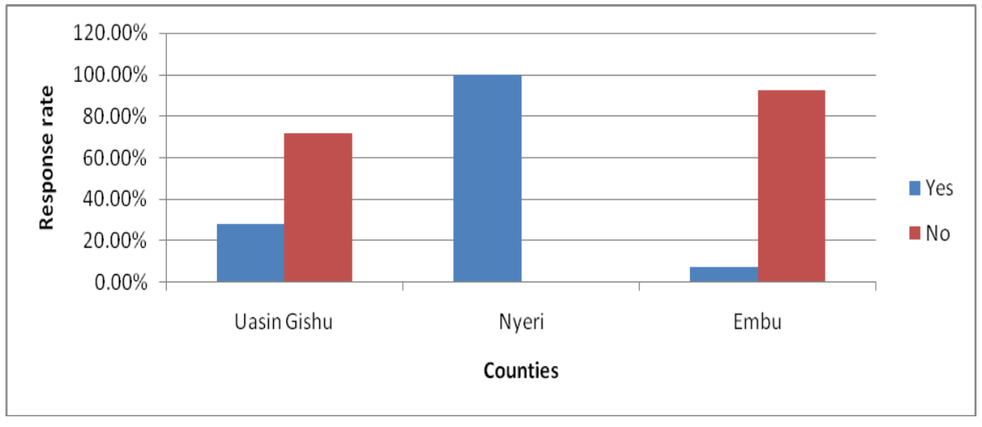

Figure 1. Percentage of farmers who received training via Mobile phones

On sources of information, majority of the farmers got agricultural information from Arifu and Esoko platforms (Table 3). This could be due to the fact that most of the respondents were mainly trained on such platforms. It may also imply that majority of the farmers preferred *Arifu* and *Esoko* as platforms for sharing information. Other platforms included Plantwise.

In addition, the study found information needs for medium scale farmers to be varied ranging from marketing to land preparation. This could be due to diversification of farming as most of them grow a number of crops; both cereal and horticultural crops and rear livestock. However, this contradicts their small scale counterparts who seem to demand for similar agricultural information (Spurk *et al.,* 2013; Bernard *et al.,* 2014). Nevertheless, it implies that for increased productivity, access to appropriate information at the right stage of farming is paramount. Previous study by Nyaga (2012) also asserted that farmers receive varied information from diverse sources depending on their farm activities.

The preferred communication based pathway in disseminating agricultural messages via mobile phones

Short Message Services (SMS) was the most preferred means of exchanging agricultural messages via mobile phones (Table 4). This was attributed to the fact that SMS could be easily retrieved and information stored for future reference. In addition, most of the farmers were engaged in either off-farm or farm duties during the day and could only use their leisure time in the evening hours to read such messages. Similarly, Ango *et al.* (2013) reported that farmers always pay attention and grasp more information when delivered at their convenient time. The time at which agricultural messages are presented is therefore a key determinant factor in technology uptake for increased agricultural productivity.

Table 3. Extension services acquired by farmers via mobile phones (n=220)

	Source of information/Platform								
Type of infor	UasinGishu County (%)			Nyeri County (%)			Embu County (%)		
	Arifu	Esoko	Plantwise	Arifu	Esoko	Plantwise	Arifu	Esoko	Plantwise
Mrk inf.	84.3	12.6	0	98	0	0	0	23.1	0
Product Pln	10.6	22.1	1.1	90.2	3.9	0	0	23.1	0
Agronomic	10.5	15.5	1.1	7.8	80.4	0	0	12.8	0
Weather inf	7.6	26.3	1.1	98	0	0	0	5.1	0
Sales timing	5.3	15.8	3.3	92.2	0	0	0	23.1	2.6
Credit fac.	6.3	16.8	2.1	56.9	0	0	0	5.1	0
Crop Ins.	6.3	11.6	1.1	57	0	0	0	23.1	2.6
Harvesting tec	6.3	2.1	1.1	-	-	-	-	-	-

Table 4. Means of spreading Information using Mobile phones (n=220)

	Uasin Gishu		Nyeri		Embu	
Means	Used	Preferred	Used	Preferred	Used	Preferred
Internet e.g. email	2.1	5.8	0	2.0	0	10.3
Text message(SMS)	60.1	57.5	100	92.9	23.1	55.3
Voice call	22.3	36.7	0	5.9	19.6	38.6

Further, the study found that close to a half of the respondents strongly agreed that SMS was affordable, user friendly and which one could refer from time to time (Table 5). This could be due to the fact that SMS is a store-and-forward service; meaning receiver's mobile phone does not have to be active in order for messages to be sent. The message can be stored for several days until the receiver's mobile phone is turned on, a point at which the message is delivered thus access to information is guaranteed. Further, the high use of SMS could be a consequence of high literacy rates among the respondents. Although this research did not look at education levels of the farmers, however, past studies by Jayne *et al*. (2014) revealed that medium scale farmers exhibit specific characteristics, as they are educated and act as role models within their society. The result therefore suggests the need to embrace and intensify SMS based communication in bid to reach large number of farmers.

Utilization of Information from Mobile Phones and Impact on the Respondents' farm. Table 6 presents different types of agricultural information that the respondents had adopted and implemented. At the time of this research, about 25% of the farmers had utilized information acquired through mobile phone. This implies that innovations disseminated through mobile phones have high chances of adoption. According to Nyaga (2012), using ICT tools such as mobile phone to link the farmers to other stakeholders usually facilitate faster dissemination of information thus higher chances of adoption.

Table 5. Reasons given by the farmers who preferred using Short Massages Services (SMS)

	Uasin Gishu County (%)	Nyeri County (%)	Embu County (%)
Time saving	94.3	83.6	85.4
Affordable	80	68.7	75.2
User friendly	87.4	56.9	76.9
Easily available	79.6	69.1	81.8

Table 6. Various agricultural information put into use by the farmers interviewed

Information put into use	Percentage (%) of farmers (n=220)
Diversification of farming	43
Post-harvest handling techniques	26.2
Sources of credit facilities	37
Sales timing	42
Crop insurance	25
Good agronomic practices	58
Product planning	46
Marketing trends	31.5
Current consumer trends	30

Source: Field data (2017)

Consequently, majority of the farmers who implemented such agricultural information realized greater improvements within their farms (Figure 2). This shows that information on agricultural innovations is key in unlocking production and commercialization. It further signifies the importance of mobile phones in enhancing information delivery and empowering the farmers. Information that relate to agronomic practices such as intercropping, crop rotation, mixed cropping help in improving soil fertility. Crop rotation also reduces the build-up of pest and diseases which could attack crops.

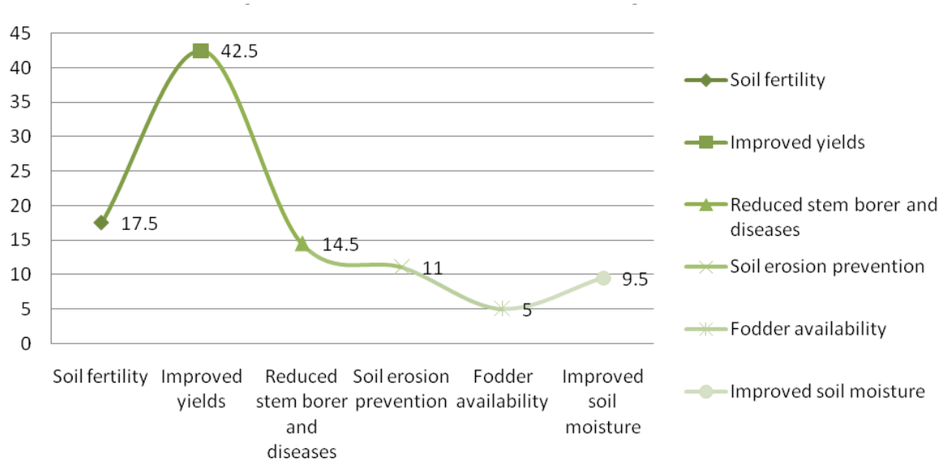

Figure 2. Aspects of the farm that improved

Conclusion and Recommendation

The use of mobile phones remains an important means of reaching the 'missing'-medium scale farmers with relevant agricultural information. The results from this study point a great need to strengthen its application to ensure provision of timely information. Further, the study has shown the importance of farmer training on various mobile phone platforms deployed to spread information. Training creates awareness which is a key determinant of adoption. To effectively reach large number of farmers, there is need by developers to build these platforms on free social networks like Facebook.

Moreover, the study revealed that a greater proportion of the farmers preferred SMS as a means to share and exchange information via mobile phones. In this regard, there is need to engage farmers as the first and key stakeholders in the design of messages in order to instil and enhance their confidence. The study concludes that providing medium scale farmers with appropriate information, at the right time using the right format and the right channel on new agricultural intervention is crucial for development of the farming community.

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