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## **Determinants of Access and Use of ICT Based Sources of Market Information Amongst Finger Millet Farmers in Teso South, Kenya**

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### **Abstract**

In the traditional field of economics of information, marketing information is an important input to reduce the uncertainties faced by participants in the agricultural markets. In most developing countries, efforts have been directed towards improving farmers' access to ICT based market information with an intention of providing requisite and real time market information to augment farmers' access to input and output markets. This study analyses the quality of market information provided by radio and mobile phones and assesses the determinants of access and use of ICT based sources of market information amongst finger millet farmers in Teso South district. The results show that use of both mobile phone and radios as sources of market information is still low amongst the finger millet farmers (about one in four finger millet farmers uses ICT sources), thus transforming the market information system entirely into an ICT based system may preclude most farmers who are semi illiterate hence reliant on non ICT based sources of market information. Integration of both ICT based sources of market information and non-ICT sources is inevitable to ensure all the farmers are given the opportunity to access and use market information.

**Keywords:** Market information; Information Communication Technology (ICT).

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## **1. Introduction**

In the traditional field of economics of information, marketing information is an important input to reduce uncertainties faced by participants in agricultural markets [1-3]. Reliable, useful and relevant market information can improve agricultural productivity, market positions of farmers and competitiveness of agricultural markets [4-7]. Prior to market liberalization, marketing information was provided publicly to aid the decision-making processes of buyers and sellers of agricultural commodities [4]. However, the political economic context of liberalization and privatization has led to cuts in government spending in dissemination of agricultural marketing information in developing countries [1, 7]. As a result, small holder farmers are forced to rely on unreliable market information provided by traders and brokers who take advantage of existing information asymmetry to pay relatively low prices and widen their profit margins [8]. Value of information in performance of agricultural markets remains fundamental in transitional and developing economies. In most developing countries efforts have been directed towards improving farmers access to information communication technology (ICT) based sources of market information [2, 7, 8]. The ICT based sources of information are thought to play a significant role in integrating agricultural supply chain by ensuring real time information flow consequently increasing certainty and functioning of the entire supply chain system [7, 9]. In Kenya a number of ICT based projects such as DrumNet, Kenya Agricultural Commodity Exchange (KACE), Regional Trade Intelligence Network (RATIN), National livestock market information system (NLMIS) and M-farm have been initiated with an intention of providing requisite and real time market information to augment farmers' access to input and output markets [2].

### ***1.1. Literature Review***

Several studies have identified the sources of market information used by smallholder farmers in developing countries [3]. The results show that farmers use combinations of both formal and informal sources which mainly provide price information but lack information of quality and quantity of produce in the market [1, 3, 6]. Some of the studies established dominant use informal interpersonal sources of information by smallholder farmers [1, 3, 10, 11]. Radio in contrast has been documented as the most extensively used ICT based source of agricultural production and market information due to its ability to reach farmers in their local dialects [6, 11-13]. Use of internet and mobile phones have also been reported in some studies [13, 14] Several studies have investigated the determinants of access and utilization of ICT based market information [2, 6-8, 15]. Level of education, income, level of asset ownership has been found to positively determine access and use of ICT based sources of information in most of the studies [2, 7, 8, 15]. Membership to farmers associations also increases the likelihood of accessing and using ICT sources of information [2, 8]. Age and gender of a farmer however have been documented to have both positive and negative influences conditional on the type of ICT in question [2, 12]. Poole and Lynch [9] and Kiiza and Pederson [8] established that access to other rural services for example microfinance increases access and use of ICT based market information. The impact of access to ICT based market information on welfare of farmers and on agricultural technology adoption, input use and productivity is well documented in the literature [2, 7, 8, 16]. The findings of these studies have shown that access and use of ICT based market information have increased use of farm input consequently increasing farm yields and returns and improving welfare [2, 7, 8]. Despite massive amount literature on ICT based market information, very few

studies looked at the quality of market information that farmers access and use [1, 10]. Odendo and De Groote [10] pinpointed reliability and utility as measures of quality of market information used by maize farmers in Western Kenya. Wolf and his colleagues [1] singled out accuracy, timeliness, accessibility and specificity to measure the relative value of farmers attribute to market information. Wolf and his colleagues [1] argues that higher quality of information improves farmers' ability to make good marketing decisions for their produce. The studies by Wolf and his colleagues [1] and Odendo and De Groote [10] both evaluated the value of information from non-ICT based sources of information. This study strives to fill the gap in literature by analyzing the quality of market information provided by radio and mobile phones as reported by finger millet farmers in Teso south district. In addition to the two measures of quality (reliability and utility) used by Odendo and De Groote [10], we used additional quality characteristics namely usefulness, timelines, and accuracy of market information provided by these two forms of ICT. In this study, quality is construed to denote the respondents' appraisal of the market information they receive based on the quality characteristics. Secondly, the study adds to the continuing literature on ICT based sources of market information by assessing the determinants of access and use of ICT based sources of market information amongst finger millet farmers in Teso South district. Files should be in MS Word format only and should be formatted for direct printing.

### **1.2. Data**

The data was obtained through a cross sectional farm household survey of finger millet farmers, a group that deals with both production and marketing in Teso south district in 2012. Finger millet was chosen because of the crop's importance as source food and cash. The crop provides farmers with the greatest opportunity for reliable harvest, food and nutrition in environments where rainfall is erratic and scanty, and soil fertility levels are low [17]. Teso South district and its two administrative divisions (Amukura and Chakol) were purposively sampled for the survey because finger millet is widely grown all the divisions. All the 12 locations were also purposively sampled. At the time of the survey in 2012, Teso South district was relatively new having been created from the greater Teso district hence the 12 villages that existed in the old Teso district were upgraded to locational status to form Teso south district. A list of farm households was therefore available at locational level. Households were randomly sampled from a list of households in each location. 12 households were randomly sampled from each of the 7 locations of Amukura while 11 households were sampled from each of the 5 locations of Chakol division. A questionnaire was administered randomly selected 139 households growing finger millet in the district.

## **2. Empirical framework**

A binary logistic regression model was used. Mobile phones and Radio were identified as the ICT based sources of market information and for each source a logistic regression run to infer the factors that influence its use. The use of a given source of market information is a dichotomous dependent variable. The cumulative distribution function for a logistic random variable is given by Hill and his colleagues [18] as shown in equation 1 below:

Equation 1

$$\Lambda(l) = P[L \leq l] = \frac{1}{1 + e^{-l}}$$

The probability of using a given source of marketing information by a finger millet farmer lies between 0 and 1.

$$\text{Source of market information} = \begin{cases} 1 & \text{If a farmer used a given source of market information} \\ 0 & \text{if the farmer did not use a given source of market information} \end{cases}$$

Probability that the observed value of Y takes the value of 1 given by equation 2 below:

Equation 2

$$P_j = \frac{1}{1 - e^{-\beta_0 + \beta_i X_i}} = \frac{\exp(\beta_0 + \beta_i X_i)}{1 + \exp(\beta_0 + \beta_i X_i)}$$

The probability that the observed value of Y=0 is given by equation 3 below:

Equation 3

$$1 - P_j = \frac{1}{1 + \exp(\beta_0 + \beta_i X_i)}$$

Logistic regression model is thus given by equation 4 below:

Equation 4

$$P_{\text{Source of Market information}_j} = E(\text{Source of market information}_j) = \Lambda(\beta_0 + \beta_1 X_i)$$

Where

P<sub>j</sub>=Probability of using a given source j

B<sub>0</sub> = Maximum likelihood estimate of the constant term

β<sub>i</sub> =Maximum likelihood estimates of the parameters

X<sub>i</sub>=Explanatory variables (gender, age, farming experience in years, number of crops grown, size of land in acres, number of children, quantity of crops sold, perception of reliability of the source and level of education).

### 3. Results and Discussion

Use of the two ICT sources of market information was found to be very low amongst the finger millet farmers in Teso south district. 28.8% of the finger millet farmers interviewed accessed and use market information from radio while 25.2% accessed and used market information from mobile phones. The finding of just slightly over a quarter level of use of radio and mobile phones contradict the findings of Oyesola and Obabire [13] and Fawole

[12] that showed that ranked mobile phones and radios as the most popular sources of information accessed and used by farmers in Nigeria. The low level of use of radio may be attributed to lack of congruence between the time the market information is broadcasted and the time farmers listen to radio while the low level of use of mobile phone is linked to high levels of illiteracy and costs associated with accessing market information from the source. The farmers were asked to indicate rate their perceptions in a scale of 1 (poor) to 5 (very good) regarding the quality characteristics (usefulness, accuracy, timeliness and accessibility) of the market information they received from mobile phone and radio. The usefulness of market information accessed from radio was collectively scored at 3.1. The respondents who accessed information from mobile phones through a short message service gave it a score of 2.7. Market information disseminated through radios achieved a score 2.5 in terms of accuracy, while the information disseminated through mobile phones attained a score of 2.4. This is however unexpected finding because the mobile phone short message service relies on real time information collected from various markets. In terms of timeliness, the farmers perceived market information disseminated through information collected by Kenya Agricultural commodity Exchange (KACE) making it timely. This is because KACE collects, updates, analyses and provides reliable and timely marketing information and intelligence on a wide range of crop commodities for instance finger millet, targeting actors in commodity value chains, with attention to smallholder farmers and small-scale agribusinesses [19, 20]. KACE also have the capability to keep up to date with daily wholesale and retail buying prices for finger millet in selected main markets in the country, as well as commodity offers to sell and bids to buy which enhances their timeliness. Market information disseminated through the radio may exhibit a time lapse inherent when information is received and transmitted later depending on the stations programme schedule. To value the accessibility of market information from mobile phones and radio, the respondents were indicating the number of times they encountered information from the sources in a scale of 1(Never) to 5 (Daily). The respondents frequently met information from the radio was less timely and scored it at 2.2 compared with that distributed through mobile phones which was weighed at 2.6. The mobile phone short message service application used to access market information relies on real time radio giving it a score of 3.3. Information from the mobile phones was however less accessible compared to radio and achieved a total score of 1.9. This is because radio is popularly owned by most households in the rural areas and the only step involved in accessing market information is simply tuning in to the local station at the right time. However, ownership of mobile phones on the other hand is limited and most of households who already owned mobile phone handsets are still ignorant of how to use the device to access market information. Secondly accessibility of market information via mobile phone involves a series of steps which makes it infeasible for ICT illiterate farmers to use.

The findings in table 1 shows that male headed households were more likely to access and use market information from both mobile phones and radio compared to female headed households. Sex not only represent differences in market orientation between male and female [21] but also determines access and control to certain assets such as radios and mobile phones. These findings are consistent with that of Adetumbi and his colleagues [22] and Kiiza and Pederson [8] which showed that male headed households are more likely to access ICT based sources of market information like radios and mobile phone in comparison to their female counterparts.

**Table 1:** Binary logistic regression results on factors influencing the use mobile phones and radio as sources of market information

Variables	Mobile phones			Radio		
	$\beta$	P-Value	Marginal effects	$\beta$	P-Value	Marginal effects
N=139	Prob>Chi <sup>2</sup> (12) = 0.00 Log likelihood=-617.29 Pseudo R squared=0.40			Prob>Chi <sup>2</sup> (12) = 0.01 Log likelihood Ratio=75.97 Pseudo R squared=0.09		
Sex						
Female (reference group)						
Male	0.479***	0.000	0.016***	1.127*	0.063	0.187*
Age						
30 years & below (reference group)						
31-50 years	1.324***	0.000	0.046***	0.557	0.286	0.071
Over 50 years	-0.871***	0.000	-0.012***	0.265	0.708	0.036
Farming experience in years	-0.395***	0.000	-0.012***	0.609*	0.086	0.095*
Number of crops grown	0.305	0.514	0.010	1.776*	0.078	0.013*
Size of land in acres	1.611***	0.001	0.086***	2.651**	0.018	0.107**
Number of children	-0.061	0.606	-0.002	0.949	0.879	0.038
Quantity of finger millet sold	0.814*	0.080	0.030*	1.643***	0.000	0.270***
Perception of reliability of the source						
No (reference group)						
Yes	0.216**	0.023	0.070**	2.457*	0.055	0.011*
Level of Education						
Primary School (reference group)						
Secondary school	0.488*	0.098	0.020*	1.452**	0.035	0.055**
Tertiary education	0.670***	0.000	0.023***	1.832**	0.039	0.061**
Constant	-5.600***	0.000	-0.012***	1.116**	0.044	0.043**

Note: The asterisks [\* , \*\* , and \*\*\*] represent statistical significance at 10%, 5% and 1% levels respectively.

Age of the respondents influenced the use of mobile phones as sources of market information hence consistent with the findings of Adetumbi and his colleagues [22] and Sekabira and his colleagues [23] which showed age minimal use of ICT based sources of information among elderly farmers. Use of mobile phone in accessing market information is still relatively new hence older farmers are less likely to use it as source of market information. The probability of using mobile phones to access market information by farmers aged 30-50 years increases by 4.6% while that farmers aged above 50 years decreases by 1.2% as shown in table 1 above. Farming experience significantly reduces the probability of using mobile phone as a source of market information by 1.2% but raises the probability of using radios by about 9.5%. Results in table 1 above shows that number of crops grown positively influenced the use of radio. This may be attributed to the fact that radios not only give diverse information of various crops but are also easily accessible to most farmers [12]. Size of land owned enhances the use of both radio and mobile phone as sources of market information as shown on table 1. These results concurs with findings in previous studies which also indicated that that land size positively influence the access of ICT based sources of market information [7, 23-25]. The larger the farm size, the more the output and consequently relatively high farm incomes that enable farmers to access and pay for market information from various sources. Findings in table 1 show that the quantity of finger millet sold positively influences the probability of using mobile phones and radios as sources of market information. The more produce a farmer has for sale the more like the farmers is to seek market information from multiple sources, and

increased farm income from sales of produce permit farmers to access and pay for market information from the different sources [23]. Perception of reliability of the source of market information positively influence the likelihood of using radio and mobile phones agents as shown on table 1 above. Positive perception of reliability of a source of market information gives farmers more drive and bravery to explore and use different sources that they perceive to be reliable [23]. Level of education have positive effect on the likelihood of accessing and using of mobile phones and radio to acquire market information as shown on table 1 above. This finding corroborates with those of Fawole [12] and Ali and Kumar [7]. Level of education arguably represent human capital thus likely to improve farmers' understanding of market dynamics [21]. It is therefore posited that farmers with high level of education are better placed to read, understand and implement procedures for appropriate access and use of market information from mobile phones and radio [23].

#### **4. Conclusion**

In the past few years, there have been efforts to provide ICT based market information services, however it is worth noting that farmers use of the sources of market information is still very low, thus transforming the market information system into an ICT based system may preclude most farmers who are semi illiterate hence reliant on non ICT based sources of market information. Integration of both ICT based sources of market information and non-ICT sources is inevitable to ensure all the farmers are given the opportunity to access and use market information. Despite mobile phone scoring a higher value in terms of timelines, it is evident that most respondents attributed relative high value to market information from radio in terms of usefulness, accuracy and accessibility compare to market information from mobile phones. Few farmers use mobile phones due to ignorance on its ability of give real time market information. It is therefore necessary to create awareness amongst farmers on the alternative sources of marketing information to enhance their access and use of marketing information. Use of ICT based information sources could be made known to farmers through advertisement and advocacy campaigns in order to increase the number of farmers who find their services useful as a source of agricultural marketing information. Training on the use of modern information communication technology (ICT) such as mobile phone short message service (SMS), interactive voice response (IVR) service, live radio auction service and online computer services could be explored by K.A.C.E to build farmers capacity to use the ICT based channels of information.

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#### **Statement of competing interests**

The authors have no competing interests.

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