

Impact of ICT-based Initiative (Mobile Phone) On Market Access by Women Farmers in Nigeria,

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Abstract: Information and communication technology (ICT) is a novel and crucial kernel of the Nigerian government agricultural service delivery architecture. The initiative has the principal objective of delivering government subsidised inputs directly to farmers through their GSM telephone sets. There is considerable evidence that women smallholder farmers' access to markets is constrained by asymmetric information which causes moral hazard, raises transaction costs, impedes output performance, squeezes income and exacerbates poverty. ICT-based market interventions is therefore a potentially useful tool for improving women farmers' access to markets for agricultural produce by providing timely, reliable and accurate information about actual market conditions. The basic objective of the study is to assess the degree to which ICT (mobile phones) enhances market access by women farmers. The methodology involves gathering primary data from women farmers in Nigeria which are analysed using descriptive and inferential statistics and a regression model. The results show that the scheme is hampered by poor literacy, poor understanding on use of ICT for agricultural transactions and lack of mobile phones by some farmers. Despite these challenges, the study found high rate of adoption of mobile phones for agricultural purposes by women farmers and increased aptitude of farmers to access market to sell their products.

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1. Introduction

Market access can have dramatic effect on smallholder agriculture in Nigeria by stimulating the generation of marketable surplus and raising farmers' income, spurring higher revenues, savings and investments. Indeed, access to local, regional and international markets can profoundly impact livelihoods and reduce poverty in rural subsistence farming communities (Okello, *et. al.*, 2012). Small and subsistence farmers in particular have difficulty connecting to markets due to poor understanding of market dynamics (Timmer, 1997). This reflects in higher transaction costs and suboptimal livelihood decisions. Given fast-paced changes in consumer demand, growth of new and potentially lucrative markets, market intelligence and access to information is crucial to farmers production decisions/plans and ultimate survival. Thus ICT platforms can be instrumental in reducing transaction costs, increasing consumer prices and improving rural income. Indeed, ICTs can be pivotal to bridging information asymmetries and deficiencies and facilitating access to markets, in the process contributing to poverty reduction and improvements in livelihoods.

With over 84 million hectares of arable land, the Nigerian agricultural sector has huge potential to engender economic diversification, provide jobs, guarantee food security, dampen inflation and earn

foreign exchange. The sector contributes an average of 40 per cent to the GDP in 2011-2012, contributes 47.17 and 45.49 per cent to non- oil GDP in 2011 and 2012 respectively and employs about two thirds of the country's labour force. The Nigerian government recently crafted an Agricultural Transformation Agenda (ATA) focusing on the key agricultural value chains for rice, cassava, sorghum, cocoa and cotton. Overall, the ATA is expected to add 20million MT to domestic food supply by 2015, including rice (2million MT), cassava (17million MT) and sorghum (1million MT); create over 3.5 million jobs in the sector from value chains and provide over USD2 billion of additional income for Nigerian farmers.

The government is also implementing a Growth Enhancement Scheme (GES) designed to replace the enormously corrupt agricultural service delivery system especially in the seeds and fertilizer distribution sector. This has resulted in reaching 1.5 million farmers with subsidized seeds and fertilizers via mobile phones within 120 days of development and deployment of the e-wallet system; increase in percentage of farmers that accessed subsidized seeds and fertilizers from 11 per cent under the old system to 70 per cent under the e-wallet system; growth of the number of seed companies from 11 in May 2011 to 70; scrapping of contracts for supply of fertilizer and seeds and sale of fertilizer and seeds directly to farmers by accredited companies instead of

government and registration of 10 million farmers in a farmers' database out of an estimated 14 million farmers in the country.

Nigeria has a teledensity 86.25 per cent from over 120 million active telephone lines by June 2013, 97.5 per cent of which are mobile phones. Anecdotal evidence shows that mobile phones are also widely used by smallholder farmers in rural communities. Indeed, cell phone penetration in rural households in Nigeria has significantly narrowed the digital gap with urban areas. The radio and, to a lesser extent, the television are also commonly used ICT tools in rural households across Nigeria. By contrast, Internet access is extremely limited.

The objective of this study is to assess the adoption of ICT tools (specifically mobile phones) by women farmers in Nigeria and appraise their impact on market access for their products.

2. Literature Review

There is a developing literature on the impact of ICT on market access for agriculture products. Specifically, recent efforts to improve market access by smallholder farmers have been directed at ICT-based innovations including the mobile phones which have recorded rapid penetration in Africa and considerable ownership by rural households (Okello *et al.*, 2012). The range of impact of ICT tools in agriculture is extensive. It can facilitate the diffusion of information to rural communities, enable farmers to carry out background checks on market prices and accelerate agricultural development by facilitating knowledge management (Lashgarara, *et al.*, 2011). Similarly, by registering his location and products, e-commerce allows farmers to sell their products online while inside their farms (Samuel 2010). ICT-based services - information, advice, inputs, finance, and other resources - can incentivise farmers to participate in commercial value chains to solve market failures in insurance, finance, input, and information markets (Barrett *et al.* 2010). The agribusiness concept is anchored on the ICT model to provide access to information at reasonable cost to farmers. In this connection, the development, documentation and dissemination of information and appropriate methods of data collection, collation, storage and application on the farm are critical.

The adoption and utilisation of ICT tools by farmers depends on a number of factors. According to Hamedanlo (2009), age, knowledge, attitude to infrastructures, nature of services, motivation, training, agents' skills, insight on the government objectives, job, educational level, advertisement, familiarity to English language, and controlling and supervising the ICT centers have significant relationship with ICT adoption and utilization.

enumerated barriers and challenges to developing rural ICT facilities to include lack of content and for rural society, human resource capacity, coordination weakness, strategic coordination, poor infrastructures, risk of investment, poor rural infrastructure.

Mobile phones have huge diffusion rate and has facilitated access to information by farmers to help them increase their bargaining power and control over external events (Myhr and Nordstrom, 2008). For instance in Tanzania, the arrival of mobile phones, under the five project of the Agri-Marketing Systems Development Programme (AMSDP), has virtually transformed agricultural business through the way producers' access vital market information (Momero, 2007).

In Uganda, a study by Muto, Megumi, Yamano and Takashi (2009), showed that information flows improved among banana farmers following expansion in mobile phone coverage leading to greater market participation and surge in their profits by 10 percent. In Peru, a study of 1,000 rural households found that public telephone use is positively correlated with incomes. Specifically, telephone use engendered 13 and 32 per cent rise in per capita farm and non-farm income respectively (Chong, Galdo, and Torero 2005). In the Philippines, Labonne and Chase (2009) reported improvements in consumption of 11–17 per cent for commercial farmers from the use of impact of mobile phones as well as enhanced relationships with trading partners. Similar results was reported for Shaffril *et al.* 2009 for Malaysia, where use of mobile phones by 134 younger agriculture-based entrepreneurs resulted in expansion in their information network and faster speed of accessing information which impacted positively on their business profits especially after two years.

Aker (2011) found that the use of mobile phones has positive effects on both traders and consumer welfare in Niger by increasing traders' profits by 29 per cent and reducing average consumer grain prices by 3.5 per cent. Moreover, Aker also reported that the use of mobile phones enabled traders to reach more markets and established wider contacts.

Finally, the use of mobile phones by a small sample of farmers in Morocco inspired market orientation and diversification from low-value crops into higher-value enterprises with corresponding increase in income by 21 per cent (Ilahiane 2007). Simultaneously, it encouraged them to engage directly with wholesalers, switch markets in response to better prices and penetrate larger and more distant markets.

3. Materials And Methods

3.1 Study Area

The study was carried out in Oyo state in the South Western part of Nigeria. Oyo State is an inland state in south-western Nigeria, with its capital at Ibadan. It is bounded in the north by Kwara State, in the east by Osun State, in the south by Ogun State and in the west partly by Ogun State and partly by the Republic of Benin. Oyo State covers approximately an area of 28,454 square kilometers and is ranked 14th by size. The landscape consists of old hard rocks and dome shaped hills, which rise gently from about 500 meters in the southern part and reaching a height of about 1,219 metre above sea level in the northern part. Some principal rivers such as Ogun river, Oba, Oyan, Otin, Ofiki, Sasa, Oni, Erinle and Osun river take their sources from this highland.

The Climate is equatorial, notably with dry and wet seasons with relatively high humidity. The dry season lasts from November to March while the wet season starts from April and ends in October. Average daily temperature ranges between 25 °C (77.0 °F) and 35 °C (95.0 °F), almost throughout the year. Agriculture is the main occupation of the people of Oyo State. The climate in the state favours the cultivation of crops like maize, yam, cassava, millet, rice, plantains, cocoa, palm produce, cashew etc. There are a number of government farm settlements in Ipapo, Ilora, Eruwa, Ogbomosho, Iresaadu, Ijaiye, Akufo and Lalupon. There is abundance of clay, kaolin and aquamarine. There are also vast cattle ranches at Saki, Fasola and Ibadan, a dairy farm at Monatan in Ibadan and the state-wide Oyo State Agricultural Development Programme with headquarters at Saki.

3.2 Sources of Data

Data employed for this study was gathered from primary sources. Structured questionnaires and in-depth interviews were used to obtain data on household and respondents' characteristics.

3.3 Sampling Procedure

The sampling procedure adopted for this study is the multi-stage sampling technique. In the first stage, two local governments where maize was widely produced were selected. In the second stage, two villages from each of this local governments based on the intensity of maize production was selected. The third stage was random selection of 60 farmers from each village. Overall, 120 questionnaires were administered but only 110 was valid for analysis. The second level of stratification involves separation into those who own and use mobile phones for agricultural transactions and those who do not. From the 120 farmers, 70 claim to possess mobile phones which are deployed for agricultural transactions while 50 farmers do not.

3.4 Determinants of Mobile Phone use in agriculture

The use of ICT tools by farmers is measured in this study using a dichotomous (binary) choice variable of "Yes" or "No" type indicating the *use* or *none use* of ICT tools by a farmer, respectively. This study uses the binary Logit regression model to identify the determinants of use of ICT tools (specifically, mobile phones).

Following Maddala (2001) and Okello, *et. al.* (2012), the probability, p , that a household uses an ICT tool (and/or a mobile phone) for agricultural purposes is given by:

$$P = e^z / 1 + e^y \quad (1)$$

Central to the use of logistic regression is the Logit transformation of p given by Y

$$y = \ln (p/1 - p) \quad (2)$$

where Y is a latent variable that takes the value of 1 if the farmer uses an ICT tool (or a mobile phone) and 0 otherwise. Y is a vector of farmer-specific characteristics, farm-specific variables and capital endowments. Thus, the empirical model of drivers of use of ICT tools or mobile phones estimated is given by:

use of mobile phone = f(log of age, occupation, fare to output market (fare), distance to electricity (disteletric), number of crop enterprises (numcropenter), household size (hhsiz), market assess (Mktaccess), log of assets, area cultivated, literacy, log of farming experience (exper), own phone, group membership (grpmember)) + e (3)

4. Results And Discussions

4.1 Socioeconomic characteristics of farmers

The age distribution of the farmers reveals that the farmers' age between 30 and 70 years (Table 1). The mean age is 51 years with a standard deviation of 9.4, which suggests an ageing population. About 52.7 per cent of the farmers are aged 50 years and above. An ageing population will likely affect productivity in a negative way and reduce volume of sales or market participation. The educational status of respondents showed that majority of them (58.2 per cent) has primary education, with a standard deviation of 4.7. This means they spent an average of 5 years in school which correspond to junior secondary school education in Nigeria. A higher level of education is desirable to minimise costs of search and screening information and transaction cost in both factor and product market (Matungul *et. al.*, 2001). Most respondents (69.09 per cent) have household size of between 1 and 10. The mean household size is 9.8 with a standard deviation of 4.1. In theory, the larger the household, the lower would be the level of commercialization. According to Laper *et. al.*, (2003), the propensity to participate in the market economy declines with number of

household members. The respondents have an average of 20.4 years of farming experience with standard deviation of 7.9. Most of the farmers have been in the occupation for more than 10 years. In general, the expectation is for farmers with higher farming experience to have higher commercialization index, and thus better participation in the markets.

Table 2 presents summary statistics of variables used in estimating the logistic regression model of decision to use mobile phones for agricultural transactions. The results show that the mean of the decision to use the mobile phone for agricultural transaction purposes is 0.5104. The t values suggest that there are significant differences in the variables used for the estimation.

4.2 Use of Mobile phones for agricultural transactions

The results of the logit regression model to assess the determinants of use of mobile phones for agricultural transactions are presented in Table 3. Evidently, age and primary occupation of the respondent significantly influence the decision to use mobile phones by women farmers. A unit increase in the natural log of age decreases the likelihood of a farmer using mobile phones by 0.3256, holding other factors constant. This confirms intuitive expectation that the use of mobile phones for agricultural transactions is more prevalent among younger farmers. Similarly, the likelihood of using mobile phones is higher by 0.276 among farmers that are engaged in farming as a primary occupation compared to those who are not. This is probably because the former are likely to be more anxious to find buyers for their produce to raise income for their daily existence and would therefore seek market information using multiple platforms including mobile phones. Importantly, nearness to output market, distance to electricity source and the number

of crop enterprises grown by the farmer also exert significant influence on the decision to use mobile phones for agricultural transactions. Specifically, a unit increase in the cost of transport to output market increases likelihood of using ICT tools by 0.0022 suggesting that the use of mobile phone is helpful in reducing transaction costs by eliminating repeated visits to markets and the associated transport cost.

Table 1: Selected Socioeconomic Characteristics of Respondents

Age	Frequency	percentage
30-39	13	11.82
40-49	38	34.55
50-59	41	37.27
60-69	17	15.45
70-79	1	0.91
Total	110	100.00
Educational Status		
None	13	11.82
primary	64	58.18
secondary	16	14.55
tertiary	17	15.45
Total	110	100
House hold Size		
1- 10	76	69.09
11 - 20	31	28.18
21 - 30	3	2.73
Total	110	100.00
Years of Farming Experience		
1 to 10	10	9.09
11 to 20	45	40.91
21 to 30	42	38.18
31-40	13	11.82
>40	0	0.00
Total	110	100.00

Source: Field Survey, 2013

Table 2: Summary Statistics of Relevant Variables

<i>Dependent variables</i>	<i>Mean</i>	<i>standard deviation</i>	<i>t-stat</i>	<i>p- value</i>
<i>usemphone</i>	0.5104	0.52395		
<i>lnage</i>	4.0942	0.3339	1.30356	1.0153
<i>hhsiz</i>	6.3206	2.2701	4.65528	
<i>occupation</i>	0.9834	0.32235	-0.19584	1.1011
<i>Fare</i>	54.8053	38.67675	-5.59062	
<i>distelectric</i>	2.97	3.8409	1.32498	0.2522
<i>numcropper</i>	3.201	1.5918	-1.3719	0.2327
<i>literacy</i>	0.9339	0.37485	-4.9317	
<i>ownphone</i>	0.6985	0.50505	-6.17712	
<i>lnexper</i>	2.8743	0.86625	-0.78234	0.5759
<i>lnassets</i>	11.6281	1.491	-3.45474	
<i>area</i>	6.8959	7.35525	-1.23726	0.2925
<i>Mktaccess</i>	8.6372	4.41945	-5.35602	
<i>grpmember</i>	0.6787	0.5103	-2.46228	0.0208

As would be expected, literacy positively influences the decision to use mobile phones for agricultural purposes. The ability to read and write increases the likelihood of using mobile phones by 0.1749. The negative coefficient on physical assets, indicating that asset endowment reduces the

likelihood of using mobile phones, is counter-intuitive. It probably suggests that this category of farmers do not feel pressured to scout for customers since they are relatively well-off, or that they have secured already agreement with dedicated customers to evacuate their produce.

Table 3: Logit Regression of Factors Determining Use of Mobile Phones for Agricultural Transactions

	Logit regression		Marginal effects	
	coefficient	p-value	Coefficient	p-value
Lnage	-1.3112	0.0583	-0.3256	0.0594
occupation	1.2287	0.022	0.2761	0.0055
hhsiz	-0.0792	0.3531	-0.0198	0.3542
disteletric	0.088	0.0319	0.0209	0.0319
Fare	0.0088	0.0231	0.0022	0.0231
numcropenter	-0.2123	0.044	-0.0528	0.044
literacy	0.7304	0.1067	0.1749	0.0858
Lnexper	0.4598	0.0968	0.1133	0.0957
area	0.0011	1.0263	0	1.0263
ownphone	0.2629	0.4411	0.0649	0.4378
Mktaccess	0.077	0.0352	0.0187	0.0352
Lnassets	-0.2101	0.0495	-0.0517	0.0495
grpmember	0.4598	0.1529	0.1133	0.1485

Log Likelihood = 167

Number of Observations = 97

The women farmers' perception of area where use of mobile phones has been most effective is presented in Table 4. Clearly, market information is dominant as indicated by 22.73 per cent of respondents. Weather information and information on

early warning and management of diseases are next as indicated by 18.2 per cent of respondents. According to 13.6 per cent of the respondents, mobile phones have been most effective in providing information on soil testing and soil sampling.

Table 4: Women Farmers Perception of Area where Use of Mobile Phones has been most effective

Variable	Frequency	% of Respondents
Input prices and availability	5	4.55
Latest (best) packages of practices	10	9.09
Post-harvest technology	5	4.55
Early warning and management of diseases and pests	20	18.18
Farm business and management information	10	9.09
Soil testing and soil sampling information	15	13.64
Marketing information	25	22.73
Weather Information	20	18.18
Total	110	100.00

Source: Field Survey, 2013

The women farmers' perception of the dominant constraints to ICT adoption and utilization include poor understanding on use of ICT tool (mobile

phone), lack of mobile phones for agricultural transactions and inadequate electricity Supply (Table 5).

Table 5: Constraints to ICT Adoption and Utilization by Women Farmers

Variable	Frequency	% of Respondents
Age	6	5.45
Poor Knowledge of ICT application	8	7.27
Negative Attitude to infrastructures	2	1.82
Poor Service Provision	1	0.91
Lack of Motivation	1	0.91
Lack of mobile phones	23	20.91
Poor Extension Agents' skills	2	1.82
Lack of insight on the government objectives	5	4.55
Low Economic Status	2	1.82
Low Educational Level	11	10.00
High cost of ICT equipment	1	0.91
Inadequate electricity Supply	10	9.09
Distant Location of ICT facility	6	5.45
Poor understanding on use of ICT tool (mobile phone) for agricultural transactions	32	29.09
Total	110	100.00

Source: Field Survey, 2013

5. Conclusions and Recommendations

This study assesses the determinants of utilization of mobile phones for agricultural transactions by women smallholder farmers in Nigeria. It finds considerable use of mobile phones by these farmers which is influenced by factors such as age, primary occupation of the farmer, the cost of transport to the output market, nearness to electricity for charging phone batteries, the number of crop enterprises, farming experience, literacy levels, crop income and asset value. The results also confirm that farmers use mobile phones to access market information. To minimize the problem of exclusion of many women farmers who are not literate, there is need to organize training and/or capacity training programmes on the use of mobile phones to facilitate access to markets for their products at various intervention points in rural smallholder communities. Moreover, targeted, localized, and local-language ICT content relevant to women farmers and accessible to non-literates should be designed. Finally, monitoring and evaluation schemes for measuring impact of adoption of ICT-based solutions on market access of agricultural products should be put in place.

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