An Assessment of Factors Influencing the Use of Information and Communication Technologies in Maize Marketing in North Central Nigeria

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ABSTRACT

The factors influencing the use of Information and Communication Technologies (ICT) and the effect on the efficiency of maize marketing in North-Central Nigeria were analyzed; based on profit margins, factor effects and logit regression model. Results showed that age of marketers, education, regulatory bodies, market channels, marketing cost and ICT significantly affect maize marketing efficiency; and that maize marketing was price efficient but operationally inefficient (ranging from 194.83 to 399.46 percent). Sources of market information were: extension agents (53 percent), radio and television (53 percent), mobile phones (47 percent), video programs (30.5 percent), and internet (25 percent). Furthermore, the costs of mobile phones and air time, electricity, phone support services, internet services, radio and television network services, and literacy of marketers significantly influence the use of ICT. The use of mobile phones should be promoted for disseminating market information and market infrastructure should be improved.

Keywords: ICT, maize, marketing efficiency.

1. INTRODUCTION

Agriculture contributes more than 40% of the annual gross domestic product (GDP), employs about 70% of the labour force, supplies more than 80% of the food needs of Nigerians, and is responsible for more than 70% of non oil exports (FMARD, 2011; Adegboye, 2004). Maize is one of the most important staple food crops being the second most common cereal food crop after rice, widely consumed as a staple food by poor rural and urban households, while more than half of the total annual output is consumed by

livestock (FMARD, 2011). It is produced largely in the Guinea savanna of Nigeria, providing livelihood for many urban poor households, particularly women and children engaged in hawking green fresh maize either in boiled or roasted form. More than 60 percent of the Nigeria's maize output is consumed by the industrial sector for production of flour, animal feeds, biscuits, beverages, malt drink, beer, corn flakes, starch, syrup, and dextrose (ASCE, 2008). The Federal Government policy restricting cereal importation has greatly extended the industrial uses and consequently the overall demand for maize in Nigeria (Ahmed and Rikko, 2005).

The domestic markets for maize in Nigeria are located at Dawanau in Kano, Dandume and Jibia in Katsina, Giwa in Kaduna, Shinkafi and Talata Mafara in Zamfara, Bodija in Ibadan, and Mile 12 in Lagos. The market networks for Nigerian maize extends into international markets such as Niger, Chad, Mali, Benin Republic and some other countries in the West African sub-region (ASCE, 2008). Previous efforts of government to improve maize marketing in Nigeria gave rise to the Nigerian Grains Board in 1977 which was later scrapped in 1986, Arable Crop Marketing and Development Company in 2003 (Ayoola, 2009), and the recent marketing corporations (FMARD, 2011).

However, marketing problems have continued to be the bane of agricultural development and food security in Nigeria, resulting in dwindling farm income and agricultural trade over years. Low market prices, poor infrastructure and limited access to market information are major disincentives to farmers in developing countries as they hinder efficient marketing and undermine farmers' incomes (Katengeza et al., 2011). Moreover, the failure of agricultural markets for smallholder farmers have been linked to lack of access to information and the endemic problem of information asymmetry between farmers and buyers (Munyua, H., 2000; Aina, L.O., 2007).

Consequently, majority of smallholder farmers sell their produce in local low-paying markets or at the farm-gate rather than travel to distant better-paying markets (Aker, 2008). Information and Communication Technology (ICT) is increasingly becoming an important instrument for driving economic growth in developing countries, and Nigeria specifically. The Growth Enhancement Scheme and Agricultural Transformation Agenda of the Federal Government of Nigeria, since 2011, has been employing mobile phones as tools for technology dissemination and input distribution in Nigeria (FMARD, 2012). Not

much has been done to ascertain whether maize markets in the North Central Nigeria have benefitted from this intervention in terms of using ICT to transform the efficiency of maize marketing.

Thus, the germane questions are: how far has the use of ICT been embraced for maize marketing, how has it contributed to market efficiency, and what factors influence the use of specific forms of ICT for maize marketing in the study area? This paper assessed the factors influencing the use of ICT in maize marketing in North Central Nigeria; with specific objectives of evaluating the efficiency of maize marketing, examining the effect of ICT and other socio-economic factors on marketing efficiency, and assessing the factors that influence the use of different forms of ICT (mobile phones, radio and television, video and CD, internet and website applications) for maize marketing.

2. METHODOLOGY

2.1. Area of Study

The study was conducted in North Central Nigeria, situated in the southern guinea savannah agro-ecology, and consisting of Plateau, Nasarawa, Benue, Kogi, and Niger states as well as the Federal Capital Territory, Abuja (National Bureau of Statistics, 2005). North Central Nigeria covers a land area of about 251,425 square kilometres (Nigeria Annual Abstract of Statistics, 1996; Nasarawa State Agricultural Development Programme, 2010), with a population of about 20,266,257 inhabitants (National Population Commission, 2009) and very diverse ethnic composition. Specifically, the study population was drawn from the agricultural produce markets and traders in four Local Government Areas (LGAs) namely Obi and Doma in Nasarawa State, and Guma and Okpokwu LGAs in Benue State. Agriculture was the main occupation, while other income generating activities were carpentry, barbing, milling, produce marketing and firewood sales.

2.2. Sampling and Data collection methods

Both primary and secondary data were used for the study. Primary data were obtained from a sample survey of market actors conducted in 2012 in four selected markets in Nassarawa and Benue States of North Central Nigeria. A sample of 240 maize marketers was selected by multi-staged and stratified random sampling, from Obi and Doma LGAs of Nasarawa State,

and Guma and Okpokwu LGAs of Benue State. The study area was purposively selected due to high maize production and numerous concentric rural and urban markets in North Central Nigeria; while the states and LGAs were selected by random sampling. Two hundred marketers were selected from eight markets using stratified random sampling technique. Structured questionnaire was employed to collect information for the study.

2.3. Data analysis method

The data were analyzed using descriptive and inferential statistics. The descriptive statistics; frequency distribution, means and percentages were used to summarize the socio economic characteristics of the marketers. Estimates of marketing margins were obtained by the difference between what the consumer pays and the farm gate prices per unit of food produce (Kohls, 1985). Factor analysis was used to isolate and name the critical factors influencing the use of ICT for maize marketing in North Central Nigeria. The loading under each factor (beta weight) represents a correlation of the variables to the specific form of ICT and has the same interpretation as any correlation coefficient. Attributes with loadings of 0.40 and above (10% overlapping variance) were considered in naming the factors, based on Comrey (1962). The logit regression model was used to estimate the influence of ICT on marketing efficiency (Eboh 1998).

2.4. Analytical Model

Marketing margin MM = RSP – FSP equation 1

Where:

RSP = retailers selling price (in Nigeria currency ₦), and

FSP = farmers selling price (₦)

Marketing efficiency was calculated using the Shepherd-Futre model (Shepherd, 1990), that:

ME = (Net market margin / Marketing cost) x 100% equation 2

Where:

Net market margin = marketing margin – costs of marketing functions performed

The logit model is expressed implicitly as:

$$P_i = \frac{1}{1 + e^{-(\beta_o + \beta_1 x_{i1} + \ldots + \beta_k x_{ik}}}$$ equation 3

Where:

P*i* = the probability that there is efficiency in the market structures and conduct of marketers.

β_o = Constant term

β_k = Coefficient to be estimated

X_k = for K=1…...9, which are independent variables

i = i^{th} observation

Let $Z_i = \beta_o + \sum \beta_k X_{ik}$ equation 4

Then $Pi = \frac{1}{1 + e^{-Z}}$ equation 5

As Zi ranges from –α to + α, P*i* ranges from 0 to 1 and P*i* is non-linearly related to Zi. The Logit of the unknown binomial probabilities i.e. the Logarithms of the odds, are modeled as a linear function of the X_i. In estimable form, the model is expressed as,

$$Logit(P_i) = \ln\left(\frac{p_i}{1 - p_i}\right) = \beta_o + \beta_1 X_{i1} + \ldots + \beta_k X_{ik} + U_i$$ equation 6

The unknown parameters β_i are usually estimated by Maximum likelihood. Thus, the model is explicitly expressed as

$$Z_i = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10}$$ equation 7

Where

Z_i = the efficiency of marketing (1, 0)

β = constant term

X_1= the sex of marketers

X_2= age of marketers

X_3 = years of educational attainment

X_4 = annual income of marketers

X_5 = source of finance for the marketers

X_6 = availability of storage facilities at the markets

X_7 = regulatory bodies or institutions

X_8 = length of the marketing channels

X_9 = cost of marketing functions in the markets.

X_{10} = Access to Information and Communication Technologies

U = independent error term.

3. RESULTS AND DISCUSSION

3.1. Socio-economic Characteristics of maize marketers

Table 1 showed that 52 percent of the maize marketers were male while 48 percent were female, contrary to Rikko (2005) which indicated a much greater participation of men (97 percent) than women (21 percent) in Plateau State. The age distribution of the maize marketers indicated that majority were in their productive years, consistent with findings of Ahmed et al (1998) and Rikko (2005) in Northern Nigeria and Plateau State respectively; youths are more inclined to using ICTs. About about 51 percent lacked access to adequate market facilities, and 47 percent lacked adequate access to market information; which might undermine marketing efficiency and volume of trade, and might lead to high marketing cost and consumer price. There was also low literacy among maize marketers with about 45 percent and 35 percent having no formal education and primary education respectively; which may hinder farmers' access to ICT and formal credit for efficient marketing.

Figure 1 showed access to market information through: extension agents (44.17 percent), radio and television (44.17 percent), mobile phones (39.17 percent), video and CD-ROM programs (25.42 percent), and internet/web-based applications such as e-mails (20.83 percent). Munyua, H. (2000) and Aina, L.O. (2007) reported that failure of agricultural markets for smallholder farmers often results from lack of access to information or from the endemic problem of information asymmetry between farmers and buyers. Since 2011, the Growth Enhancement Scheme (GES) and Agricultural Transformation Agenda (ATA) of the Federal Government of Nigeria have been employing mobile phones as tools for technology dissemination and input distribution in Nigeria (FMARD, 2011); the potential gain of integrating this with market information service provision could be worthwhile.

3.2. Efficiency of Maize Marketing

The net marketing margin ranged from N648.25 to N1151.13 per 100 kg of maize, average marketing cost was N297.45 per 100kg of maize, and marketing efficiency varied between 194.83 percent and 399.46 percent, averaging 306.07 percent (Figure 2). These results are consistent with Rikko (2005) who found wide variability in marketing cost in Plateau State, attributed to poor roads, numerous charges by associations, varying distance to markets and extortion at numerous check points. The wide variation in market efficiency might be an indication that the markets were not operationally efficient, while the marketing margin indicate substantial value addition and price efficiency.

3.3. Determinants of Maize Marketing

Table 2 shows results of ten variables regressed against a dichotomous dependent variable, the probability of market efficiency (0, 1). The age of the marketers was significant at 1% level (-1.479); conforming to the *a priori* expectation that the older the age of the marketers, the less the vigour and agility for marketing strategies. The coefficient of educational profile of the respondents was positive (2.064) conforming to the *a priori* expectation that higher education enhances the marketing skills and ability to access market information. Katengeza et al. (2011) reported in the case of Malawi, that literacy of marketers promote access to market information and is positively correlated to their use of mobile phone.

The coefficients for market regulatory bodies and length of market channels were statistically significant at 1% level (1.810 and -3.811 respectively); conforming to the *a priori*

expectation that structured market regulation and short market channel tend to be more efficient, and to Harrison (1985) that longer market channels wear away the market efficiency. Marketing cost had negative coefficient significant at 1% (-3.629); agreeing to the expectation that higher market charges reduce marketing efficiency. ICT as a useful tool for market regulation could help shorten the market channel and reduce marketing cost through effective access of marketers to necessary information.

Access to ICT had positive coefficient (2.035) and significant at one percent level (Table 2), implying that market efficiency increased with greater access to market information. The use of ICT has been shown to enhance information flow among users, thereby aiding efficient performance of economic activities through improved access to timely and accurate information (Aker, J. 2008; Katengeza et al., 2011). Kerry (2009) reported that increasing number of developing country smallholder farmers have recently embraced the mobile phone technology in order to enhance their access to agricultural markets. The mobile phone offers smallholder farmers the potential to increase market participation through access to information on available markets and prevailing market prices.

3.4. Constraints to use of ICT in maize marketing (Factor analysis/Principal component analysis)

Four forms of ICT namely: mobile phone, internet/website, radio and television, and video programs were assessed in terms of factors influencing their use for maize marketing (Table 4); using factor analysis factors with coefficients greater than 0.4 were rated significant (Comrey, 1962). Factors that loaded high under use of mobile phones include cost of mobile phones (0.524), cost of air time (0.492), electricity supply (0.404), access to durable mobile phones (0.45), access to mobile phone support services (0.415), and literacy status (0.407). The use of internet/website was influenced by cost of mobile phones (0.438), cost of air time (0.493), access to internet services such as cybercafé and business centers (0.483), access to durable mobile phones (0.403), access to internet/web-based applications (0.488), and access to mobile phone support services (0.401). Factors influencing use of radio and television include access to radio and television network (0.458) and radio/television repair/maintenance services (0.418). The use of video was influenced by access to video programs (0.423) and television/video repair services (0.412). Katengeza et al. (2011) reported in the case of Malawi, that access to market information is promoted by literacy of

marketers, contacts with extension service providers and intensity of using mobile phones; and that use of mobile phone is positively correlated to farmers' literacy.

4. SUMMARY AND CONCLUSION

The study aimed at assessing the factors influencing the use of ICT in maize marketing in North Central Nigeria; specifically evaluated the efficiency of maize marketing and its influence by ICT and other socio-economic factors, as well as the factors that influence the use of different forms of ICT (mobile phones, radio and television, video and CD, internet and website applications) for maize marketing. Data for the study were obtained from a sample of 240 maize marketers, selected from Obi and Doma LGAs of Nasarawa State, and Guma and Okpokwu LGAs of Benue State through stratified random sampling technique. Descriptive statistics, ratios, factor analysis and logit regression model were used to analyze the data.

Results showed wide variation of marketing efficiency from 194.83 percent to 399.46 percent, indicating that maize market was price-efficient but operationally inefficient in the study area. The age of the marketers (-1.479), educational profile (2.064), regulatory bodies (1.810), length of market channels (-3.811), marketing cost (-3.629) and access to ICT (2.035) significantly affect maize marketing. Sources of market information include extension agents (53 percent), radio and television (53 percent), mobile phones (47 percent), video and CD-ROM programs (30.5 percent), and internet/web-based applications such as e-mails (25 percent). Factors that influence use of ICT for marketing include cost of mobile phones, cost of air time, electricity supply (0.404), durability of mobile phones, mobile phone support services, access to internet services such as cybercafé and business centers, access to radio and television network, radio and television repair services and literacy status of marketers.

The study concluded that increased use of ICT could enhance the price and operational efficiency of maize marketing; and that use of mobile phone, internet and other forms of ICT for marketing could be improved if rural infrastructure especially electricity and communication networks are improved. It is recommended that government in collaboration with private sector and mobile network operators, implement policies that

promote use of mobile phones for disseminating market information, while investment in support of market infrastructure should be increased.

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Table 1: Socio-economic Characteristics of Maize Marketers in North-Central Nigeria

Index	Frequency	Percentage (%)
Sex: Male	124	51.67
Female	116	48.33
Age (No. of years): ≤20	10	4.16
21-30	47	19.59
31-40	63	26.25
41-50	60	25.0
51-60	40	16.67
≥61	20	8.33
Educational Profile: No formal	99	41.25
Primary	79	32.92
Secondary	47	19.58
Tertiary	15	6.25
Income (N'000): ≤100	24	10.0
101-200	129	53.75
201-300	85	35.42
≥301	2	0.83
Source of Finance: Self	140	58.33
Community	88	36.67
Bank loan	4	1.67
Others	8	3.33
Storage Facilities: Availability	118	49.17
Non-availability	122	50.83
Regulatory bodies: Availability	99	41.25
Non-availability	141	58.75
Marketing Channel: Producers	29	12.1
Wholesalers	42	17.5
Retailers	68	28.3
Consumers	23	9.58
Assemblers	41	17.1
Processors	37	15.42

Source; field survey, 2012

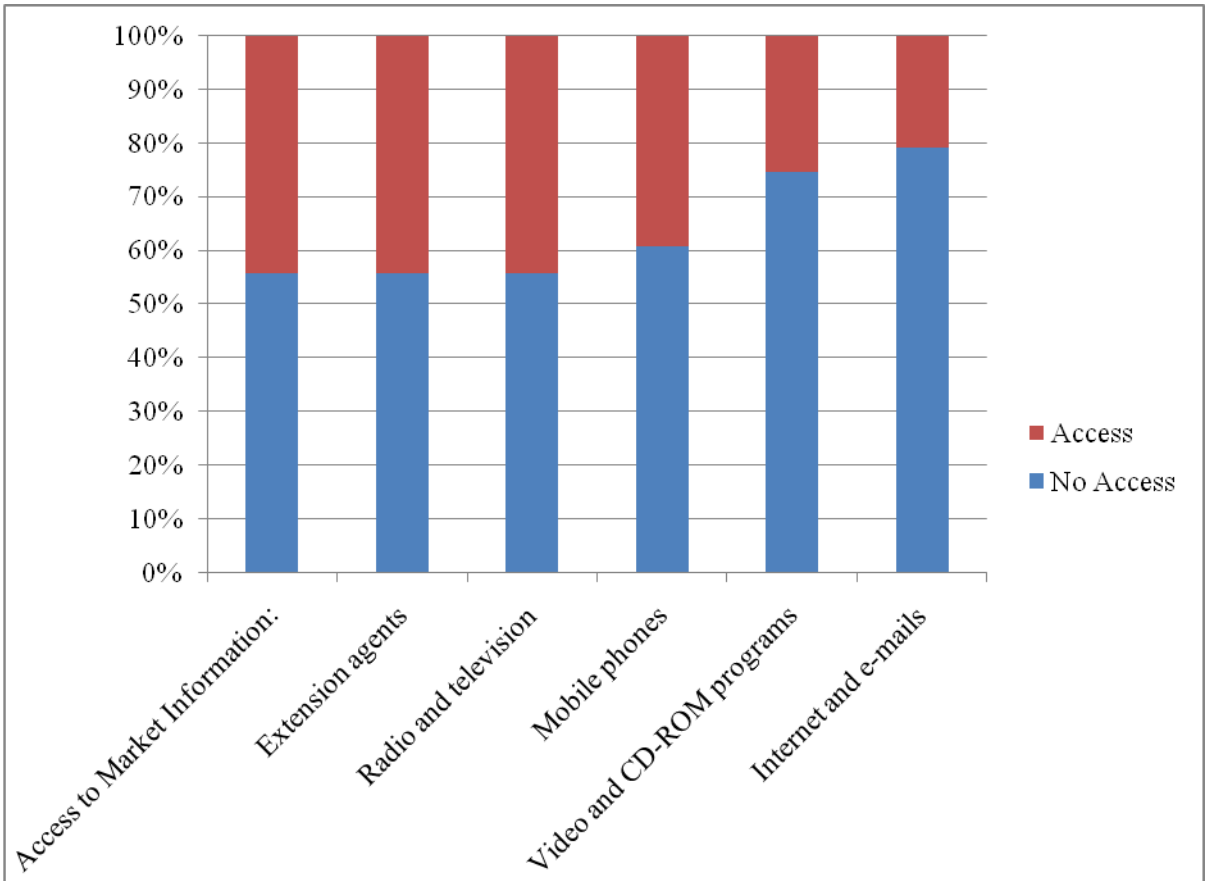
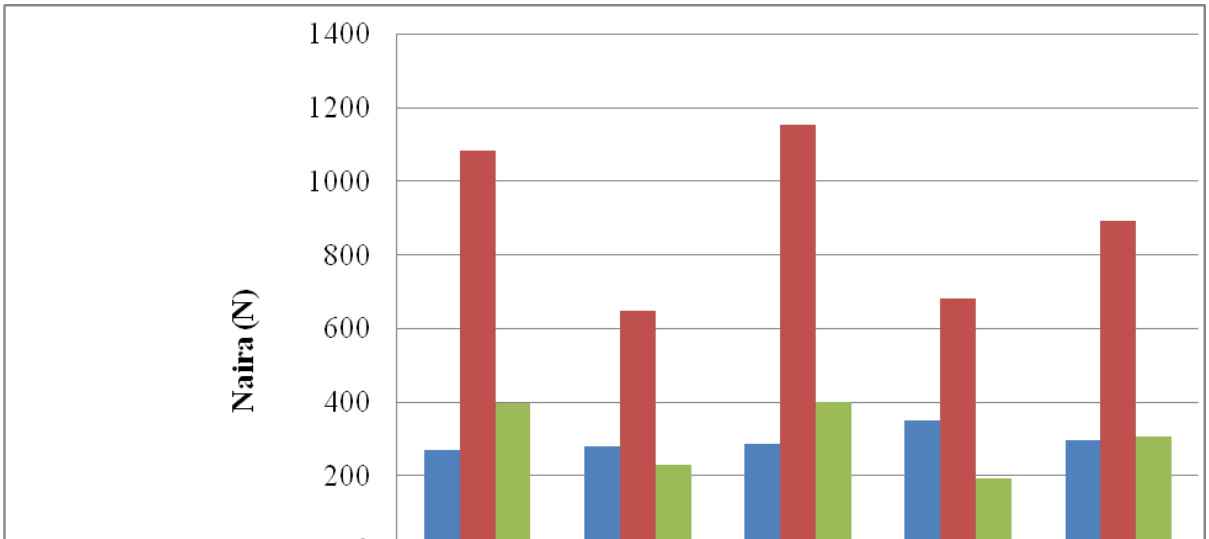


Figure 1: Access to Market Information Through ICTs



	Obi	Doma	Guma	Okpokwu	Average
Market cost (N/100kg)	270.9	280.75	288.17	350	297.455
Net margin (N/100kg)	1081.1	648.25	1151.13	681.7	890.545
Market efficiency (N/100kg)	399.08	230.9	399.46	194.83	306.0675

Figure 2: Variability in Marketing Cost, Net Margin and Market Efficiency

Table 2: Regression Parameters for Determinants of Maize Market Efficiency in North Central Nigeria

Index	Beta	Coefficient	t-statistics
Sex	β_1	0.056	0.839
Age	β_2	-0.099	-1.479*
Educational Profile	β_3	0.137	2.064*
Income	β_4	0.026	0.395
Source of Finance	β_5	-0.201	-1.412
Storage facilities	β_6	0.050	0.727
Regulatory Bodies	β_7	0.145	1.810*
Length of Market Channels	β_8	-0.245	-3.811*
Marketing Cost	β_9	-0.244	-3.629*
Information and Communication Technologies	β_{10}	0.132	2.035*

Source: Field survey, 2012

*Significance at 1% level

Table 3: Analysis of Factors influencing the use of ICT in maize marketing in North Central Nigeria

Factor	Forms of ICT*			
	1	2	3	4
Cost of mobile phones	-0.524	-0.438	0.010	0.039
Cost of air time	-0.492	-0.493	0.039	0.098
Electricity supply	0.404	0.207	0.305	0.104
Access to internet services (cybercafé, business centers)	0.234	0.483	0.144	0.167
Access to mobile phones	0.450	0.403	0.118	0.012
Access to internet/web-based applications	0.203	0.488	0.023	0.041
Access to mobile phone support services	0.415	0.401	0.118	0.012
Access to radio and television network	0.042	0.030	0.458	-0.421
Radio/television mechanic services	0.014	0.051	0.418	0.412
Access to video programs	0.023	0.088	0.223	0.423
Literacy status	0.407	0.418	0.050	0.028

*Forms of ICT: 1= mobile phone, 2= internet/website, 3 = radio and television, 4 = video programs