

FARMERS' AWARENESS AND USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGIES IN THE LIVESTOCK INNOVATION CHAIN IN IBADAN CITY, NIGERIA

Williams Ezinwa Nwagwu

Council for the Development of Social Research in Africa

Dakar, Senegal

Department of Information Science

University of South Africa, Pretoria, South Africa

and

African Regional Centre for Information Science

University of Ibadan, Ibadan, Nigeria

willieezi@yahoo.com

ABSTRACT

The use of information and communications technologies (ICTs) in agriculture is a new and growing field that focuses on how agricultural and rural development activities can be enhanced using modern ICTs. Currently in Nigeria, this field has not addressed how livestock farmers use ICTs to conduct their businesses. The objective of the study was to examine the awareness and use of ICTs by livestock farmers in Ibadan, an agrarian community in Nigeria. The study also

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investigated the relationship between ICT awareness and use in the various innovation links as well as how the farmers' demographic characteristics relate to these uses. A questionnaire was used to guide data collection from various types of farmers. From the trade societies of each type of livestock, 340 farmers were selected for the study and usable data was collected from 300 respondents. For all the ICTs listed, more respondents reported awareness of ICTs than use, except for mobile phones where an equal number of respondents reported awareness and use. Marketing was the purpose for which most of the respondents reported using ICTs. Computers were used by large farmers for feed formulation and knowledge management; mobile phones served the purpose of managing animal health, linking customers, managing farms and marketing goods, while Internet/email was scarcely used for farming purposes. The findings of the study raise the question of the need of building electronic livestock farmers network in Ibadan as well as training farmers in the city on how to use ICTs to meet livestock farm needs.

KEYWORDS: information and communication technologies, agriculture, livestock, Ibadan City, Nigeria

1. INTRODUCTION

Agriculture is a major component of Nigeria's economic life, with livestock constituting an integral part of this component. Livestock farming means rearing animals for commercial and other purposes; it contributes immensely to the livelihood of people living in urban and rural communities through increased food production, farm energy, manure, fuel, transportation and nutritional security and incomes (Robinson et al. 2014; Tewe 1997). Livestock accounts for one third of Nigeria's agricultural gross domestic product (GDP). In 2010, livestock production contributed substantially to Nigeria's economy, accounting for about 11 per cent of the total GDP (World Bank 2014). The dominant livestock enterprises engaged in by Nigerian livestock farmers are poultry, piggery, rabbitry, beef, dairy and pasture production and small ruminant fattening operations (International Water Resources Management 2005, 14). Agriculture is an information-intensive business, and information and communication technologies (ICTs) could play crucial roles in facilitating information exchange (Todaro 2000, 87). The role of information in livestock farming could be visualised from the perspective of development, flow and management of information and ideas in the various links in the system of livestock farming, namely, input/procurement, production, marketing, sales and health management issues.

ICTs describe electronic computers and computer software used to convert, store, protect, process, transmit, and retrieve information as well as the seamless

convergence of digital processing and telecommunications (Steyn 2013). Rahman (2007) has clearly illustrated how ICTs could promote social and economic development by facilitating information flow and sharing as well as creating opportunities for all forms of learning.

ICTs help farmers in Nigeria to efficiently access current information and also provide information to buyers and consumers alike through innovative avenues like joining online communities of farmers; advertising in local farmers' markets that host a neighbourhood website; and joining social network sites such as Facebook to build community interest around the farmers' activities (Jones 1997, 178). Using ICTs can also enable farmers to use their savings in a number of ways, with many investing their extra income back into their businesses or paying for their children to go to school (Jama et al. 2004, 182). These advantages notwithstanding, ICT deployment in livestock in Nigerian communities is expected to be confronted with some challenges and disparities according to the level and quality of telecommunication services, ability and demographic characteristics of individuals as well as the scale of enterprises where those individuals are affiliated. Farmers who are highly educated or are engaged in large-scale farming, for instance, would most likely deploy ICTs more than the others.

Farmers could also easily use mobile phones and other ICTs either to inform customers about the availability of products, or discuss and negotiate prices with their customers. Many farmers live far away from their farms, and need to regularly link up with those managing their farms to be kept abreast of the farm conditions. On educational aspects, farmers could learn how to manage farms, formulate feeds, and manage some diseases by browsing the Internet or linking with their veterinary doctors, fellow farmers and others. Also, ICTs will be very useful in animal health management. Like in all health situations, animal health challenges might develop at any time and farmers might need to reach their health care providers to either visit the farms or supply information about what could be done to manage the situation. Farmers would visit the Internet, use email or mobile phones or instant messaging devices to seek information about what to do.

The potential benefits of ICTs for farmers and farm processes call for an understanding of the factors that might influence the use of the technologies by farmers. Several studies exist (Dao 2004, 504), but none on Ibadan city, an agrarian community that is the largest semi-urban community in West Africa. However, interactions with agricultural extension workers and agro-based entrepreneurs as well as literature sources such as Agwu and Uche-Mba (2010, 42) show that the cost of technology, lack of training, trust level in ICTs, lack of ICT proficiency, lack of technological infrastructure and non-awareness and unwillingness to use new technologies could influence ICT use by farmers in many Nigerian communities. Agwu and Uche-Mba's evidence emanates mainly from general observations, with a few studies based on the opinions of farmers who are directly involved with the use

of ICTs. Furthermore, there are no streamlined studies that show how relevant these general factors are to livestock farming in Nigerian communities with their unique agricultural processes and demands.

According to the International Water Management Institute (IWMI 2007, 18), Ibadan is mainly an agricultural economy and crop production accounts for 72 per cent of the 5 082 farms; livestock agriculture accounts for 26 per cent; while 1.6 per cent of the farms are used for non-traditional agriculture. Like many other ICT users in the city, farmers in Ibadan are expected to encounter some challenges in using ICTs.

The maximal deployment of ICTs has been found on a number of occasions to relate to users' demographic characteristics. Younger and more educated persons use ICTs more than those who are older and less educated (Leung 2005, 12). Farmers' level of awareness about the existence and benefits of ICT use in agriculture could also affect their actual and adequate use of the technologies. It will therefore be expected that the challenges confronting farmers' ICT deployment might vary according to the scale of business, farmers' level of education, and other factors. Technology level in Nigeria has consistently been found to be low (Uwaifo and Uddin 2009, 119). The IWRM (2005, 27) showed further that livestock farming in the city is significantly undertaken.

2. PROBLEM STATEMENT AND OBJECTIVES OF THE STUDY

Many studies have been carried out to address the role of ICTs in agriculture in Nigeria (Chukwunonso, Abubakar and Obidi 2012, 8; Lorliam, Imbur and Lortima 2012, 85; Raji 2008, 28). These studies examined the role of ICTs in agricultural extension, information sharing as well as the skills of the farmers in the utilisation of ICTs. In a recent review of literature on the subject matter, Okeke, Nwalieji and Uzuegbunam (2015, 15) identified the various categories of studies that have been carried on various segments of agriculture in Nigeria. These studies are very insightful, but none of them focussed on the role ICTs play in the livestock agricultural chain, which is a significant contribution made by the current study.

The current study was designed to examine ICT awareness, its general use and its use in the livestock innovation chain by livestock farmers in Ibadan, an agrarian community in Nigeria. The study also examined the relationship between ICT use, awareness, and use in the livestock innovation chain as well as how demographic characteristics of farmers relate to their ICT use in the livestock innovation chain. Finally, the study elicited and analysed specific experiences of ICT use to facilitate information exchange by livestock farmers in the city.

What are the technologies used by livestock farmers in Ibadan to achieve information exchange in the innovation chains? What are the factors influencing use

of ICT by the farmers. What is the level of ICT awareness among livestock farmers? Addressing these questions would yield information that can be useful in addressing how ICT could be further deployed to improve the activities of farmers. In a study in the United States, Mishra and Williams (2006) found that adoption of computers with Internet access is positively influenced by age of farmer, educational level of farmer, and other variables. They also found that large farms were more likely to adopt computers with Internet access.

3. LITERATURE REVIEW

3.1. ICTs and livestock farming

ICT use in agriculture is a new and growing field that focuses on how agricultural and rural development activities can be enhanced by using modern ICTs. The major question addressed is about innovative ways in which ICTs could be used given the rural nature of much of the domain in which agriculture is undertaken. This question arises because of the awareness that advancements in ICT can aid the provision of accurate, timely, relevant information and services to the farmers so that their activities can be more productive and remunerative. Lio and Liu (2006, 23) have strongly linked the use of ICTs with farmers' productivity. ICTs can increase farmers' bargaining power. Good access to information can reduce the bargaining superiority of large operators in favour of small-scale farmers. With ICTs farmers can make choices about crops and livestock; create products for the niche markets; and connect and sell their products directly to consumers.

In South Africa, most local livestock data is fed into the centralised Integrated Registration and Genetic Information System (INTERGIS) managed by the Animal Improvement Institute National Recording and Improvement Schemes. The role of the system is to set up national livestock productivity benchmarks to enable comparison of genetic potential of livestock, and then provide policy makers and farmers with a reliable source of reference (Van der Westhuizen 2003). There is also the Livestock Identification and Trace-back System (LITS) in Botswana which promotes best practices in livestock management (Burger 2003).

3.2. ICTs and livestock farming in Nigeria

In much of Nigeria, particularly in Ibadan, farm sizes are generally small; livestock farms are even smaller. Large-scale farming is therefore not very common. The structure of the agrarian system in Nigeria could be considered as a major impediment for balanced rural development (Rogaly, Harris-White and Bose 1999, 231). The farmers are beset with a vicious cycle of land tenure obstacles, poor funding support and several other structural and factors. As a result of these and other problems,

the farmers' bargaining power in the input market is not very strong; thus, they pay high prices for inputs thereby reducing their net earnings. Farmers also compromise their prices due to lack of bargaining power. The farmers' incomes are reduced due to their low capacity and incentive to increase productivity and investments. Todaro (2000, 12) has suggested that value addition in agriculture requires technological, institutional and price incentive changes designed to raise the productivity of the small farms.

Given the poor conditions under which farmers conduct their business, information could be considered one very crucial need of the farmers. At the macro level, the information cycle is imperfect. Farmers lack the relevant information they need to keep abreast of development, leading to high transaction costs, which impede the agricultural marketing process (Dao 2004, 59). Kizilaslan (2006, 51) has argued that proper dissemination of information for agricultural and rural communities is a crucial tool in the fight against poverty and deprivation. Information is known to have the capacity to help the poor make use of opportunities and reduce their vulnerability to market forces. Dissemination of relevant information to communities can facilitate the effective adoption of agricultural inputs, decision making on markets and adoption of scientific methods.

3.3. Constraints and enablers of ICT use by livestock farmers

A major challenge to agricultural development in Nigeria and other African countries has been the low level of agricultural information exchange among the different stakeholders in the agricultural sector as a result of limited access to current and relevant information in the form of primary documents and machine-readable databases (Agwu and Uche-Mba 2010, 9). There is also the lack of ICT proficiency; lack of ICT benefit awareness; too difficult to use; lack of technological infrastructure; cost of technology; trust level in the ICT system; lack of training; system integration; and software availability that limit farmers' ICT use (Taragola and Gelb 2005).

Agwu and Uche-Mba (2010, 9) have further listed some constraints as hindrances to the use of ICTs in agriculture in Nigeria and these include: lack of confidence in operating ICT facilities such as computers and CD ROMs; lack of competence in handling ICT facilities; lack of adequate time for training on ICT facilities; and unavailability of hardware required by modern ICTs. They also mentioned the lack of communication infrastructure; fear that things will go wrong in using ICTs; inappropriate contents of ICT messages that do not meet the needs of clients; poor benefits in using ICTs, and others. Furthermore, they suggested other challenges such as lack of sufficiently trained computer personnel; erratic and fluctuating power supply; poor finance; lack of adequate awareness about ICTs; complexity in using ICTs; lack of Internet access in the rural areas; poor communication network; nature of information provided; high cost of ICT software and hardware; negative attitude

of people to change; and general lack of awareness of the importance of ICTs in agriculture.

There are also enabling factors such as ubiquity, low cost, ease of use and access and availability of mobile phones and other information technologies. Mobile technology is known to be the fastest growing technology in comparison with others, and has also achieved the deepest penetration in human communities. This picture is true about Nigeria where almost everyone has access to the technology. Evidently, ICTs have played significant roles in livestock agriculture, but the studies identified show that the studies have omitted the specific roles of ICTs in the value chain of livestock farming.

4. METHODOLOGY

4.1. Location of the study and research design

The study was carried out in Ibadan in the South-West region of Nigeria. Ibadan was chosen on account of its size; the high number of farmers in the city; and commercial activities that obtain therein (IWMR 2005, 16). A sample survey research design was adopted for the study, involving the systematic collection of information from selected farmers because Ibadan is a very large city and the farmers are spread across the city.

The target population for the study was livestock farmers in Ibadan. General information about the population of livestock farmers in the city was extracted from IWRM (2005, 12) and is shown in Table 1.

Table 1: Population and sampling

Livestock farm	Number of farms	Sample
Goat/sheep	501	124
Poultry	434	114
Cattle	53	17
Piggery	68	21
Aquaculture	200	46
Dog rearing	58	18
Total	1314	340

Source: IWRM (2005)

Based on this information, the researchers identified the farmers' society for each type of livestock. The farmers' societies are an authoritative source, from which

the respondents (farmers) were drawn, and there is some guaranteed access to the registered members of the society. Members of the societies and their farms are spread across the large city.

The proportional to size sampling method was used to decide the number of farmers to be included from each of the livestock categories. The essence of this scheme is to eliminate the effect of differences in the magnitudes of the number of subjects in each category in respect of the number selected as samples. The difficulty of crisscrossing the city in search of these farmers necessitated the choice of a threshold sample of 340 livestock farmers. To execute the proportional to size sampling, the researchers multiplied this number by the ratio of the number of farmers in each livestock category to the total number of the farmers to obtain the sample size for the study (see Table 1).

The leaders of each of the societies were approached, and the mission of the research was explained to them in order to obtain their cooperation. The survey took place in 2013. Due to the long distances to farmers in the rural areas, access was the major factor that decided which farmers were included in the study. Therefore, the farmers included in the study were mainly from within the city axes; incidentally these farms were relatively larger and most likely to be owned and run by more educated farmers compared with those in the rural areas; they also have increased chances of using ICTs. The researchers could not identify any societies for pig farmers and dog rearing, but identified 14 piggery farmers and 10 dog rearers across the metropolis.

The instrument used for data collection was a questionnaire which contained closed and open-ended questions and was administered during July and September 2013. The open-ended questions requested the respondents to share narrations of specific experiences in using mobile phones, computers and Internet/email to exchange agricultural information. The open-ended questions helped obtain first-hand stories from the respondents about their ICT encounters in their business, and also clarify aspects of information collected using the questionnaire. This approach was considered very necessary after preliminary observations indicated some difficulty in carrying out interviews due to the key respondents being absent from the farms due to the tightness of their schedules and other reasons. In addition to the demographic variables, level of ICT awareness was measured by listing ICTs and the respondents were asked to supply their responses on a 3-level scale consisting of aware, neutral and not aware. The same ICTs were listed and the respondents were asked whether or not they had used the technologies. Then the innovations were listed and their responses on the use of these ICTs on the innovations were recorded on a 5-point Likert scale.

Although the study consisted mainly of farmers who were literate in English, the researchers first asked the prospective respondents whether they were capable of

completing the questionnaire in English unassisted. The copies of the questionnaire were distributed to the farmers who were literate in English, and the researchers returned at agreed times to pick up the completed tools. For those respondents who were not literate in English, the questionnaires were administered by the researcher reading out each question, interpreting what had been read in Yoruba language, and helping the respondents to tick the appropriate response. The researchers also translated into English the narrations of those respondents who could not write. Data collection was spread over six weeks since the respondents were business persons, and needed sufficient time to complete the survey questionnaire.

Apart from the data collected using this instrument, repeated visits to the farms granted the researchers a first-hand interaction opportunity to make some observations, and also assess the ICT environment of the farmers. The results of the observations were used to counterbalance the results of the survey. Furthermore, the literature provided some useful information about agriculture in the city, although the sources did not examine issues related to ICTs. Altogether, 321 of the 340 copies of the questionnaire were completed and returned; 21 were not usable and were discarded. Given the spread of the farmers in the very large city of Ibadan, and the several visits the researcher had to make to reach the respondents, the response rate of 78 per cent (321) was considered adequate for the survey. Although the sampling scheme adopted a probabilistic technique to decide the number of respondents, the specific subjects were not selected using any probabilistic approach. Hence, the data set was not considered fit for any inferential analysis.

A relationship was sought between pairs of awareness, ICT use in the livestock innovation chain, ICT use in marketing, production, health and procurement using Spearman's rank correlation. This approach enabled the researchers to measure the strength of association between pairs of variables. Chi square analysis was further used to measure the association between the demographic variables and the innovations; significant dimensions were further examined using cross-tabulation. On a scale of 1 = lowest to 5 = highest, the respondents were asked to rate the relevance of ICTs in their farming businesses. Since the responses were ordinal, mean scores were used to measure the power of the intersection between innovation activity and the livestock type. The expectation was that mean scores less than 2.5 could be considered low while higher values could indicate a higher likelihood that farmers would utilise ICTs to meet the innovation activity. The researchers synthesised the narrations in the open-ended questions by interpreting the responses to identify the key subjects to strengthen the discussion.

Validation of the questionnaire was executed by giving the draft questionnaire to senior lecturers in the Department of Agricultural Extension of the University of Ibadan as well as by colleagues of the author at the Africa Regional Centre for Information Science of the same university. A major observation was that the

study did not adopt any theoretical model, an observation the researchers justified because the variables in the study vary largely from those in the theories used to study technology use. Creswell (2009, 32) has suggested that adequately reviewing the literature and teasing out variables from the review should be sufficient to guide a study when the variables of interest in the study are not sufficiently integrated in existing theories. The questionnaire was anonymous and administered to the respondents after their consent was obtained.

5. RESULTS

5.1. Respondents' socio-demographic characteristics

Table 2 presents the frequency distributions of the respondents' socio-demographic characteristics. Of the 234 poultry farmers, males accounted for 70.2 per cent, while 29.8 per cent were females. Married respondents accounted for 71.4 per cent; 23.8 per cent were single; 2.4 per cent were separated; 1.2 per cent were divorced; and 1.2 per cent were widowed. The mean age of the respondents was 40.28 years with a standard deviation of 11.93. Also, 67.9 per cent of the respondents were Christians while 32.1 per cent were Muslims.

Table 2: Respondents' socio-demographic characteristics

Variable	Measurement	Frequency	Percentage
Gender	Male	210	70.2
	Female	90	29.8
Marital status	Married	214	71.4
	Single	71	23.8
	Separated	7	2.4
	Divorced	4	1.2
	Widowed	4	1.2
Age (years)	19–24	11	3.6
	25–39	55	18
	31–34	34	10.8
	35–39	34	10.8
	40–44	44	14.4
	45–49	37	16.8
	>50	75	24

Experience (years)	1–5	143	46.7
	6–10	89	29.7
	10–15	39	13.2
	>15	29	9.6
Farm size (plots)	1–6	235	78.6
	7–12	32	10.7
	13–18	11	3.6
	>18	22	7.2
Highest level of education	Primary	15	4.8
	Secondary	32	11
	Polytechnic/College of Education	111	37
	University	142	47.2
Formal qualification/training	Yes	96	32.1
	No	204	67.9

The mean number of years' experience in farming was 8.13 with the largest number of farmers having 1–5 years' experience (46.7%) and the lowest number (9.6%) having been in the business for 15 years and more. With 78.6 per cent of the respondents having their farms on 1–6 plots of land (equivalent to an acre) the farm sizes could be regarded as relatively small; 10.7 per cent of the farms were 7–12 plots; followed by 3.6 per cent having three acres of land; while 7.2 per cent owned more than three acres. The highest percentage of respondents had a university education (47.6%); followed by those with a polytechnic qualification (23.8%); while 13.1 per cent had attended the colleges of education; 10.7 per cent had attended secondary school; and 4.8 per cent had a primary school qualification. Most of the respondents (67.9%) had no formal qualifications in agriculture.

5.2. ICT awareness and use

The level of ICT awareness among the livestock farmers was examined by asking respondents to tick as applicable to them their level of awareness about the different categories of ICTs listed in the questionnaire. Figure 1 shows a very high percentage of the respondents (95.2%) reporting awareness of mobile phones while some of the respondents (57.1%) were aware of computers. Further, 85.7 per cent of the

respondents were aware of using radio as an information source; while 4.8 per cent were not; and 9.5 per cent were neutral. A large number (84.5 %) were aware of television; 4.8 per cent were not; and 10.7 per cent were neutral. Awareness of print media was reported by 59.5 per cent who agreed also to being aware of print media, while only 45.2 per cent were aware of the Internet. A relatively low number of respondents (45.2%) reported being aware of the Internet. The lowest level of awareness (28.6%) was reported for wireless technologies, while none of the farmers reported being aware of websites.

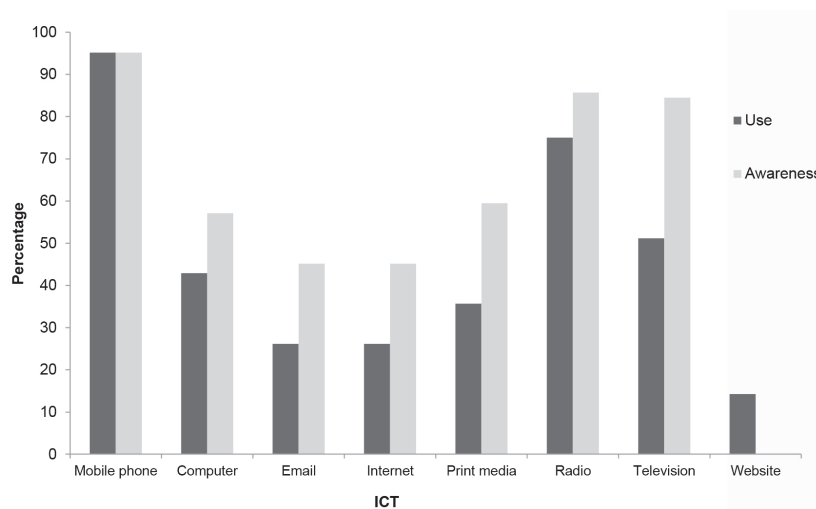


Figure 1: Awareness vs. use of ICTs

Figure 1 presents an analysis of which of the ICTs reported the farmers used. The largest number of respondents (95.2%) reported using mobile phones; followed by radio (75.0%); television (51.2%); computers (42.9%); and print media (35.7%). ICTs with the lowest use were the Internet (26.2%); email (26.2%); farming software (16.7%); website (14.3%); wireless (8.3%); and PDA (3.6%).

5.3. ICT use in the livestock innovation chain

The mean values of responses on ICT use in the livestock innovation chain were taken, as shown in Table 2, where marketing (Mean = 4.78, SD = 1.11) had the highest mean value of ICT use. Marketing related activities, namely sales (Mean = 4.65, SD = 2.88) and procurement (Mean = 4.44, SD = 2.91), also had high mean use values.

Table 3: Means of ICT use in the livestock innovation chain

Innovation links	Mean	SD
Marketing	4.78	1.11
Production	2.66	1.90
Health	3.49	2.01
Procurement	4.44	2.91
Sales	4.65	2.88

Table 2 also conveys that production (Mean = 2.66, SD = 1.90) and health (Mean = 3.49, SD = 2.01) had the lowest mean use values.

5.4. Relationship between ICT use, awareness, and use in the livestock innovation chain

The correlation matrix in Table 3 shows how pairs of ICT use, awareness, and use in the livestock innovation chain were correlated. The highest correlation ($r = 0.86$) was between ICT use and awareness about ICT use in livestock farming as well as between awareness and marketing.

Table 4: Correlation between ICT awareness and use in the livestock innovation chain

	Awareness	ICT use	Marketing	Production	Health	Proc.	Sales
Awareness	1						
ICT use	0.83	1					
Marketing	0.81	0.73	1				
Production	0.16	0.23	0.02	1			
Health	0.13	0.32	0.29	0.03	1		
Procurement	0.66	0.43	0.43	0.09	0.02	1	
Sales	0.63	0.74	0.84	0.02	0.11	0.71	1

The results also suggest that sales had a high correlation with awareness, ICT use, ICT use in the livestock innovation chain, marketing and procurement, but production, health, issues and procurement had a very low correlation with all other variables.

5.5. Demographic characteristics of farmers vs. ICT use in the livestock innovation chain

Table 4 shows a Chi-square analysis addressing the relationship between ICT use in the livestock innovation chain and the respondents' demographic characteristics.

Table 5: Chi-square analysis of ICT use in the livestock innovation chain by demographic characteristics

Demographics	Marketing	Production	Health	Procurement	Sales
	<i>Chi-square values</i>				
Gender	19.180	4.176**	12.001	2.113	7.230
Marital status	5.998	14.751	2.991	12.347	17.309
Age	1.111	4.601	0.909	12.000	16.313
HEQ	1.198	11.001	13.092**	20.290	7.159
Experience	15.108**	14.01	14.290	12.897	19.300**
Formal qualification	4.188	9.966	18.022**	0.007	8.006
Farm size	0.100	12.121**	129.020**	6.891	13.290

** = Significant at 5% level

Gender and HEQ were significantly associated with health and procurement, respectively. Experience was significantly associated with marketing and sales, while formal qualification and farm size were significant in terms of their relationship with marketing and health issues. The significant results were cross-examined to uncover the underlying explanations.

As many as 67.21 per cent of those who reported using ICTs for production purposes, were males. Further, 65.32 per cent of those who reported using ICTs for health related purposes also reported having a polytechnic/university education. Those who had been farming since 15 years ago (35.17%) and those who started farming five years ago (32.65%) used ICTs for marketing the most. Furthermore, 56.72 per cent of the farmers who used ICTs to meet health needs of their livestock also reported having formal training in livestock farming, while 62 per cent and 59.55 per cent of respondents with farm sizes larger than 13 plots also reported using ICTs for production and health matters, respectively.

5.6. Relevance of ICTs to livestock farming

Table 5 shows that poultry farming had the highest mean score (4.34) with marketing in comparison with other livestock farming activities, while cattle had the lowest (2.01).

Table 6: Mean scores of relevance of ICT in the livestock innovation chain

Livestock farming	Marketing	Production	Animal health	Procurement	Sales
Goat /sheep	2.78	2.13	3.16	2.17	2.09
Poultry	4.34	2.33	4.16	3.22	4.39
Cattle	2.01	2.14	2.24	2.15	2.02
Piggery	2.19	2.23	2.45	2.12	2.34
Aquaculture	3.26	2.41	3.22	2.33	4.19
Dog rearing	2.33	2.52	3.16	3.01	3.22

With relevance of ICTs in production having a mean score less than 2.5 for all livestock, it could be concluded that the farmers do not consider the use of ICTs for this innovation very highly. The farmers reported a higher relevance of ICTs for poultry health (4.16) than they did for other livestock; but they also reported that ICTs are highly relevant for aquaculture (3.22), dog rearing (3.16) and goat rearing (3.16). With a mean score less than 2.5, the relevance of ICTs to piggery and cattle was somewhat low. Except for poultry (3.22) and dog rearing (3.01) where the relevance of ICTs was high, the relevance of ICTs in innovations in the other livestock was generally below the median level. For sales, the relevance of ICTs in poultry (4.39), aquaculture (4.19) and dog rearing (3.22) was very high; but low for the other livestock (<2.5).

6. DISCUSSION OF FINDINGS

The focus of the study was to address the question of whether livestock farmers in Ibadan metropolis use ICTs, and for what purposes. Data was collected from 300 livestock farmers. A survey by the IWRM (2005) showed that poultry and goat/sheep rearing constitute the major livestock farming undertaken by livestock farmers in Ibadan, with cattle farming constitutes the lowest. Generally, goat/sheep and poultry are obviously the easiest livestock to raise; they could be raised in relative large scale in the 'backyard' with less expertise. Moreover, the expertise support required to manage the animals appears to be most available.

Based on interactions with the respondents during data collection, there was some enthusiasm to learn how ICTs could be used to promote their business much

more than the readiness to participate in the survey. The respondents who actually took the time to complete the narrative aspect of the questionnaire did so because the researchers first explained to them why they needed to participate in the study. Except for a few relatively large farms, many of the farms were small (see Table 2). It was the case that the large farms had more staff, better office space and a more coordinated work environment than the small farms which were either located inside or very close to living houses. The large farms were powered by generators, when necessary. The researchers actually saw computers in just a few of the seven farms they visited, although all the individuals encountered during the visits had mobile phones. Usually installing ICT facilities would require a safe environment and empowered personnel, among others.

More than 95 per cent of the farmers had knowledge of the use of mobile telephones, and about eight out of ten knew about radio and television. This pattern of response is recurrent in many studies both urban and rural, and institutional studies (Nwagwu 2007, 25). Mobile phones are the technologies of the present day society, with their portability, cheapness, ease of use and accessibility coupled with their multitasking capabilities making them the most useful ICT today. Even the less-educated can use them, at least to receive calls. Radios have unique qualities, and as mentioned in the study, might even refer to the radios embedded in mobile telephones. Radios are portable and can operate on batteries. Radio signals are also generously available just as many community radios stations are beginning to be created. The reviews of Chapman, Blench and Kranjac-Berisavljevic (2003, 23) support this finding. Unlike mobile telephones, radios are just a one-way communication system which only enables the user to receive information. They also lack the multimedia facilities that make mobile phones the most penetrating technology of all time. None of the respondents reported any awareness about websites, and very few reported awareness about farming software and email. In a sense, websites and farming software are by far more advanced ICTs compared with mobile phones. A similar observation has been made by El Hassan (2013) in his study in Sudan.

How does one understand the relationship between pairs of awareness, use of ICTs, use of ICTs in the livestock innovation chain and the innovations? Awareness about ICTs may trigger off use of the technology generally, but the tendency for use in marketing is very high. Awareness of ICTs does not seem to relate strongly with the health variable – ICT use in animal health may require a high level of enlightenment as well as high skill level including using higher and more sophisticated technologies. This contrasts with awareness of ICTs and use of ICTs in human health. InfoDev. Org's (2015) review of how ICTs are linking people for the purpose of meeting health needs shows that the higher the level of people's awareness about the potential roles of ICTs in health, the more likely they are to be used for meeting health needs.

The very high correlation between ICT use in sales and marketing (0.84) could be explained by the fact these farmers often wish to use these products at the right time.

The low correlation between health, production and procurement may mean that the farmers require some enlightenment to the effect that they could achieve more than marketing using ICTs. In respect of production, it could be observed that only a few farms, mainly the very large ones or those that have expertise in production, may need to use the technology for the purpose. Generally, except in relation to marketing and related activities such as sales and procurement, the relationship between awareness of and use of ICTs with other purposes such as production appears very low.

Besides personal use of these ICTs, the researchers did not observe any cooperative activities that could lead to improved use of the technologies for the purpose of livestock farming. Besides mass texts, which all the associations use either to invite or remind the farmers of meetings, no information systems for disseminating information among the farmers or for accomplishing other tasks such as lifelong learning were identified. The major consequence of this observation is that linkages exist among the farmers, albeit only at individual level. Those who have been farming for more than 15 years have greater command of the market and also have control of the business generally, and this might translate to their advantage in marketing using ICTs. For those who came into the business only in the last five years, their success in using ICTs for marketing their products might not be unassociated with increasing revolution in ICTs.

7. ANALYSIS OF THE OPEN-ENDED QUESTIONS

The responses to the open-ended questions added interest to the study findings; they are categorised and discussed below.

7.1. Mobile phones

7.1.1. Managing animal health

The first set of narratives came from 16 farmers who have used mobile phones to achieve management of animal health challenges through connecting with their vet consultants and other knowledgeable persons. Generally, veterinary doctors appeared open-minded in prescribing drugs for their clients using mobile technology, probably endorsing the reality of mobile animal health. Their responses were very apt:

Four of my pigs gave birth at the same time and one of them was very weak, I had to put her children with another pig for fostering. The foster mother was not producing enough milk so I used my phone to call the veterinary doctor and he told me to give her oestrogen and she started lactating well afterwards.

There was a day that my birds were sick and I didn't know which drug to give them. I called my vet doctor and she told me the drug to give them. Fortunately I had the drug in the farm,

but if I had not called the doctor, I wouldn't have known that I can use the drug to cure that particular disease.

I used mobile phone one day when I was faced with bird diseases and didn't know what to use and my doctor made prescription for me.

Like the foregoing testimonies, another farmer narrated how he used the technology to connect with his vet who instructed him on what to do to prevent his rabbits from having still births. Yet another respondent narrated that he used the phone to link up with his vet who was far away on a journey, but the vet linked him with another vet who rescued the farmer from having serious health crisis of the animals. A synthesis of these testimonies shows that mobile technologies are the leading ICT application in animal health management, and applications transcend almost all aspects of animal health needs: drug prescription, drug administration, maternal challenges and disease management, and so on. The study did not inquire whether the communication was by text messages or calls, and this is because the whole study focused on ICT use generally. No mention was made of other technologies.

7.1.2. Linking with customers

Linking with customers is another benefit of the technology which many farmers were happy to narrate:

The use of mobile phone helps me to communicate with customers effectively. They call me for supply and solution to problems they face when rearing their birds and I also respond immediately. It has helped my family business greatly.

Mobile phone has strongly been a great and useful instrument in communicating with my customers and other farmers, information is easily gotten whenever a seminar about a new product is about to be introduced to the poultry farmers.

This testimony relates to how ICTs could be used to enable more experienced farmers and farmers with large farms to provide advice to younger farmers. Apart from short-cutting the vet's bill, this use of ICTs could strengthen the relationship among the farmers, and promote horizontal learning. Learning from peers and colleagues has great advantages.

7.1.3. Remote managing of farms

Some of the farmers who probably have other businesses or are engaged in other activities that keep them away from their farms, mobile phones have helped them maintain contact with their workers thus promoting efficient farm management. According to one respondent: 'I contacted my workers on the farm to know the state of things so that in case there was any problem, I could think of how to solve it even before getting to the farm.'

7.1.4. Marketing

Many of the respondents narrated how mobile phones have helped them to market their products through contacting their customers when their goods are ready. This testimony is an example:

I was with no money and I have pigs that I could sell on the farm, I used my mobile phone to call a customer and he came and purchased the pigs and I had money to spend.

Mobile phone has helped me in the area of marketing, information collection/gathering from farming organisations and customers.

Mobile phone has strongly been a great and useful instrument in communicating with my customers and other farmers, information is easily gotten such as whenever a seminar about a new product is about to be introduced to the poultry farmers.

This finding relates to the object of a project by the Information Development Network in Nigeria in which rural women were enlightened on how mobile connection could assist them to link with their clients in the cities. By this approach, the rural women testified that they were able to sell their wares in their own time and negotiate prices ahead of time. Even buyers who visit rural communities from the cities are able to minimise wasteful trips which are often undertaken with the belief that the goods are available in the rural areas.

7.1.5. General uses

Some farmers merely expressed knowledge of how mobile phones help their businesses and not necessarily how they have used them; their opinions were also very indicative of the important roles of mobile phones in agribusiness. They said that mobile phones help them to market their goods, manage their farms, monitor the performance and activities of farm workers: 'It helps me to monitor prices of farm inputs and products in the market.'

Some expressed good knowledge about how mobile phones could be used to contact stakeholders such as feed mill for the supply of feed, contact customers and manage time:

I can use it when I have a problem getting some stuff and I want to get in touch with friends that have ideas about issues.

It could help me communicate, to receive information on necessary advice on the poultry feeds and marketing research.

The use of mobile phone saves time, reduces my expenditure and increases my performance and productivity.

Matotay and Furuholt (2010, 128) have also demonstrated empirically how mobile technology has aided the operations of livestock farmers in Tanzania.

Some farmers reported knowledge of the possibility that mobile phones could help to reduce cost of going to meet customers, who they rather would call by mobile phones. According to one of the farmers: 'Mobile phone is one of the cheapest and quickest means of communication' and '[it] makes connecting people easy for me in my poultry business.' Very few farmers mentioned any negative aspects of the use of the technology and their observations were either in relation to 'poor connections and high cost of phone bills' or in the opinion of one respondent: 'The only problem at times is network failure.'

7.2. Computers

7.2.1. Feed formulation

Probably suggesting that computers appeared to be hi-tec to agribusiness people in comparison with mobile phones, one of the farmers said that he used computers for:

Feed formulation and also knowing the financial position of the farm; I use computers for the computation of feed formulas; I use computers in feed compounding and to compute for optimization; It gives us the actual composition of the feed i.e. energy composition, protein fibre and fat.

This farmer was reporting from one of the largest farms in the study.

7.2.2. Knowledge management

Some of the respondents also reported that they used computers for research purposes:

The use of computer improves my technical know-how, reduces stress and fatigue and gives me proper documentation.

Use in researching of information on effect and solution to poultry disease.

Apart from those who reported using computers for research, others used them for records, documentation and preparing of documents as demonstrated by the following apt responses:

It has made sales documentation and purchases easier.

It helps in keeping proper record of day to day activities, income and expenditure of the farm for improved production.

The use has aided operation and decision making process.

Another respondent indicated clearly that he used the computer for publicity purposes: 'I have only used it to produce my handbills.'

7.2.3. Internet/Email

Further, some of the respondents reported their use of the Internet when asked questions about computers. This might suggest that the farmers probably purchased computers because they wanted to have Internet access or they used computers only for Internet related purposes:

I easily download new ways of solving some poultry problems whenever I do not wish to discuss with my vet doctor or a farmer friend.

I get information from the website on different questions, for example feed formula, diseases and control.

I visit some websites to gather information, for example, it was from a site that I got the right mix required for poultry feeds.

Only a very few respondents reported using email, and their responses at best showed that the farmers have some knowledge about email and that they probably used it elsewhere and not necessarily on their farms. Based on the names of the farms that reported having used the technology, it could also be inferred that they were the owners of somewhat large farms, or persons who are relatively very highly educated:

I get to share my experience with others on any problem which has been encountered in the course of farm work.

I was able to assess some foreign partners in terms of advice and also relevant information on the farm operations are exchanged via email.

It has provided a means of reaching out to customers who are far away without much travel expenses.

The use of email gets me global connection and improves my knowledge in things happening on the globe.

These few experiences showed that the farmers' personal experiences of computers probably came from either industrial, highly educated or technology conscious farmers.

Others reported using email to improve communication with suppliers and buyers of their farm products; advise co-farmers; acquire more knowledge; update their personal knowledge in poultry keeping; and help in circulating information among colleagues. Many of the respondents were either not conversant with email, did not use email or did not use email for farming purposes.

8. CONCLUSION

A very large number of the respondents (95%) reported awareness about using mobile phones to share agricultural information. In comparison with other activities in the value chain of livestock farming, marketing is the major activity for which the farmers use ICTs (Mean = 4.72) while production is the least (Mean = 2.66). The

study established a high level of correlation between awareness, ICT use, ICT use in the livestock innovation chain, marketing and procurement, but very low values between production, health issues and procurement. The Chi square result did not show any significant relationship between any of the demographic variables and procurement ($r = 4.34$); the highest relevance of ICT for marketing was reported by poultry farmers whereas the least was reported between cattle rearing and marketing.

9. RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER STUDIES

Given the dominance of mobile phones among the ICTs of which farmers are aware, and their role and high level of use in farmers' businesses, farmers' associations should encourage their members to invest in mobile technologies for the purposes of boosting their businesses. The low use of ICTs for the purpose of livestock production would require intervention regarding increasing farmers' level of awareness and use of ICTs for the purpose. The reported interaction between veterinarians and livestock farmers through mobile technologies could form the basis for strengthening farmers' skills in managing their livestock. The current research focused only on the Ibadan metropolis. A broader picture about the situation of ICTs in the value chain of livestock farming in Nigeria could be generated by a study covering a wider area.

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ABOUT THE AUTHOR

WILLIAMS EZINWA NWAGWU (PhD) is currently on sabbatical as the Head of Documentation and Information Centre of CODESRIA, and is overseeing the Library, Information Technologies, Communication and Membership Services. He holds a PhD in Information Science with specialty in Informetrics, Science/Scholarly Communication. He also teaches on and researches other aspects of the information science field.