The effective utilization of digital communication tools by commercial poultry farmers in Aba metropolise of Abia State

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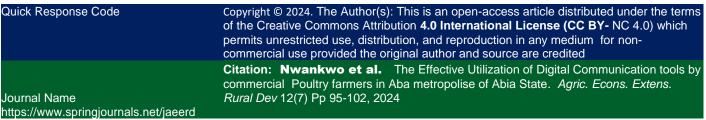[1]Faculty of education, Clifford University, Owerrinta,
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Abstract: *This study focused primarily on the effective use of digital communication tools to access agricultural information among commercial poultry farmers in Abia State, Nigeria. The specific objectives are to describe the socioeconomic characteristics of the poultry farmers and to determine the level of farmers' use of digital communication tools in poultry production. A primary source was used for data collection: a structured questionnaire. Purposive and simple random sampling procedures were employed for data collection. Data collected were analysed using simple and inferential statistics like frequency distribution and means. The study used ANOVA for the hypothesis test. Findings from the study indicated that a mean age of 42, consisting of about 53% of males and 47% of females, 24% were single, while 8% were either widowed or widowers. The respondents' educational level reveals that they were highly literate, with 95% having some form of educational attainment and an average of 7 years of farming experience. On the extent of use of digital communication tools in assessing information, the results show a grand mean of 2.41, which is on a moderate scale on level of use of digital communication in Abia states, the result indicated differences in level of use across the state, but a post-hoc test of poultry farmers in Aba north and Isiala Ngwa North performed better than counterparts in Aba south in the level of use of DICTs.*

Keywords: Utilisation, poultry, effectiveness, digital, communication

INTRODUCTION

Agricultural information is an indispensable ingredient required for the effective transfer of agricultural technologies (Donye, 2018). Access to reliable and timely agricultural information enhances the performance of farmers and other agricultural stakeholders (Ogessa & Sife, 2018). For sustainable agricultural development to take place, there is a need to share current, relevant, and timely information with the farmer's community (Partap and Manju, 2021). Technological and other agricultural information can only be beneficial if properly disseminated to the intended end users. To accomplish this, different channels of information dissemination in agricultural extension services must be used. Sustainable development hinges on people's attitude towards information, their ability to share it, and their proper consumption of it (Sinha, 2018). The dissemination of information is evolving in tandem with technological advancements. Recent innovations in information technology can deliver agricultural information to a large number of people at high speed and with greater accuracy (Goyal, 2011). In the 21st century, social media has dominated communication, and there is no field untouched by social media. ICT utilization was highest among livestock and poultry farmers, followed by mass media exposure and extension agencies (Ifeoma et al., 2023), indicating the importance of ICT tools. The tribal farmers of Rajasthan ranked mobile, TV, and radio in higher positions for getting agricultural information (Jat *et*

al., 2021). The availability of numerous online information resources from computer files, library catalogues, databases, organisations, newsgroups, industrial, and commercial sources, as well as from individuals, makes the internet an indispensable tool for academia and research (Buabeng *et al.,* 2016). Mobile-based delivery ensures timeliness and is of great use to the farmers (Sandhu *et al.,* 2012). Google ranked first for information searching, followed by Facebook and others (Malik et al., 2020). Nain et al., 2019 found social networking effective in creating knowledge. Digital communication is the process of exchanging information, messages, and ideas using digital technologies and platforms. Nwachukwu (2023). Digital communication technology is a tool to better provide agricultural recommendations to farmers through digital applications. The researcher expect extension digitalization to enhance farmers' technical skills, tackle socioeconomic challenges, enhance food traceability, and lessen environmental impact (Balafoutis et al., 2017; Dawkins, 2016; Klerkx, Jakku, and Labarthe, 2022).

To some extent, Abia State has made remarkable achievements in agricultural production, which plays an important role in ensuring national food security. Nigeria faces several challenges in providing quality agricultural extension services, including an unfavorable staff-to-farmer extension ratio, a weak connection between research extension and farmers, a restricted budget, low motivation among extension personnel, inadequate aids for information dissemination, inadequate transportation, a lack of networks and logistics, and a broad scope of agricultural policy implementation (Akpan et al., 2016). These challenges suggest that the extension service has consistently failed to effectively reach its intended clientele over the years. Excessive, if not complete, reliance on face-to-face extension strategies for interacting and exchanging agricultural information and expertise with clients has further exaggerated the situation. This study aims to ascertain the level of farmers' use of digital communication tools in poultry production in Abia State.

H0: There is no significant difference in the level of use of digital communication tools in poultry production among farmers in Abia States.

METHODOLOGY

STUDY AREA

The researcher conducted the study in the Aba Agricultural Zone (AAZ) of Abia State, Nigeria. AAZ is made up of seven local government areas, namely: Isialangwa North, Aba North, Aba South, Obingwa, Ukwa East, Ukwa West, and Ugwunagbo. The zone is located between latitudes 50 and 390N and longitudes 20 and 00E, has a total land mass of 810,160ha, and has a population of 1,167,698 persons (Ifeoma and Stella 2024). Aba was chosen due to its rapid population growth. The

predominant soil of the area is sandy loam, while the natural vegetation is the tropical rain forest, characterised by two distinct seasons: the dry season and the wet season. The dry season lasts from November to March, while the wet season lasts from April to October. Aba is a commercial and industrial town. Farmers, however, are the primary owners of the land. The farmers in the area are primarily involved in food crop production, but they are also involved in livestock production, including poultry, and so on. It is important to state that Abia State has three (3) agricultural zones, namely: Aba, Umuahia, and Bende Agricultural Zones. The researcher selected the Aba Agricultural Zone for this study due to its high level of urbanization in Abia State. I used a multistage sampling technique to select 144 respondents from a total of 1450 registered crop farmers for the study. The study began with a purposive selection of four (4) Local Government Areas (LGAs) from the seven LGAs in the zone. The LGAs chosen were AbaNorth, Obingwa, Isialangwa North, and AbaSouth. The selection of these 4 LGAs was due to rapid population growth, farming activities, and other non-farming activities going on in the LGAs selected from the areas for the study. The second stage is a random selection of 12 communities from a list of 43 across the already selected LGAs in the zone.Since the number of communities in the selected LGAs is uneven, I used proportionate sampling to select the 12 communities for the study. Aba North and South have ten (10) and eight (8) communities, respectively, while Obingwa and Isialangwa North have thirteen (13) and twelve (12) autonomous communities, respectively. The study randomly selected three (3) communities from Isiala Ngwa Northand Aba North LGAs, and four (4) and two (2) communities from Obingwa and Aba South LGAs, respectively, for a total of 12 communities. The third and the

The final stage involved the random selection of 180 farmers from the list of farming households obtained from the Aba zonal office of the Abia State Agricultural Development Programme (ADP) for this study. The unequal number of farmers across these communities led to a proportionate selection of only 30% of the sampled farmers from each community in the list. Between 40 and 37 of these farmers were selected.drawn from Obingwa and Isialangwa North LGA's, while 35 and 32 were drawn from Aba South and Aba North, respectively, and used for the study. The researcher selected 180 farmers from a sample frame of 1450 poultry farmers. The researcher collected primary data for the study using a structured and open-ended questionnaire.

The researcher used the Likert scale of Always (4), Often (3), Rarely (2), and Never (1) to assess farmers' usage of digital communication tools in poultry production. The researcher will calculate a midpoint on the Likert scale by summing up 4, 3, 2, and 1. Dividing this total by 4, the researcher will arrive at a mean score of 2.5. The researcher will calculate and pool the scored responses to determine the mean scores for the use of digital

communication tools. The researcher will thus establish the farmers' level of use of digital communication tools into three categories: high, moderate, and low, by dividing the maximum response score (5) into three, resulting in a class interval of 1.66. Next, the researcher successively deduct the class interval (1.66) from the maximum response score (5) to determine the various class ranges for the 3 categories: low = 0–1.66; moderate = 1.67–3.33; and high = 3.34–5.00.

There is no significant difference in the level of use of digital communication tools in poultry production among farmers across the selected areas in Abia State was tested using ANOVA at 95% confidence level (P ≤ 0.05). Similarly, the researcher will use the Duncan Multiple Range Test (DMRT) to distinguish between two or more means, identifying which treatment means are different from the others.

The ANOVA model will test the extent of digital communication tool use among poultry farmers across the States, finding no significant differences. Similarly, he researcher will use the Duncan Multiple Range Test (DMRT) to distinguish between two or more means, identifying which treatment means are different from the others.

$$F\text{-statistic} = \frac{MS_{Between}}{MS_{within}} \quad\text{.............................(1)}$$

But,

$$MS_{Between} = \frac{SS_{Between}}{Df_{Between}} \quad\text{.............................(2)}$$

$$\text{and } MS_{within} = \frac{SS_{Within}}{Df_{Within}} \quad\text{.............................(3)}$$

Where,

$MS_{Between}$ = Mean sum of squares between the group
MS_{Within} = Mean sum of squares within the group
$SS_{Between}$ = Sum of squares between the group
SS_{Within} = Sum of squares within the group
$Df_{Between}$ = Degree of freedom between group given as (k-1);
Df_{Within} = Degree of freedom within group given as (k-1)

Decision: if $F_{cal} > F_{tab}$ at (P ≤ 0.05), we reject the null hypothesis and accept the alternative hypothesis and vice versa.

RESULT AND DISCUSSION

Table 1: Percentage Distribution of Commercial Poultry Farmers Based on their Socioeconomic Characteristics

Variables	Aba North (n=60)	Aba South (n=60)	Isialangwa North (= 60)	(n = 180)
Age				
≤30	9(15.0)	8(13.3)	20(33.3)	37(20.6)
31 - 40	21(35.0)	19(31.7)	17(28.3)	57(31.7)
41 - 50	13(21.7)	22(36.7)	13(21.7)	48(26.7)
≥51	17(28.3)	11(18.3)	10(16.7)	38(21.1)
Mean	**45**	**43**	**38**	**42**
Sex				
Male	32(53.3)	42(70.0)	22(36.7)	96(53.3)
Female	28(46.7)	18(30.0)	38(63.3)	84(46.7)
Marital Status				
Single	23(38.3)	8(13.3)	12(20.0)	43(23.9)
Married	37(61.7)	42(70.0)	46(76.7)	125(69.4)
Widowed	0(0.0)	10(16.7)	2(3.3)	12(6.7)
Highest Level of Education				
Primary	3(5.0)	7(11.7)	2(3.3)	12(6.7)
Secondary	19(31.7)	29(48.3)	32(63.3)	80(44.4)
Adult education	9(15.0)	2(3.3)	3(5.0)	14(7.8)
Tertiary education	29(48.3)	22(36.7)	23(38.3)	74(41.1)
Household Size				
≤3	17(28.3)	10(16.7)	6(10.0)	33(18.3)
4- 6	27(45.0)	13(21.7)	26(43.3)	66(36.7)
≥7	16(26.7)	37(61.6)	28(46.7)	81(45.0)
Mean	**4.6**	**6.2**	**5.4**	**5.4**
Years of Experience				
≤5	39(65.0)	27(45.0)	27(45.0)	93(51.7)
6 – 10	8(13.3)	11(18.3)	14(23.3)	33(18.3)
11 - 15	**6(10.0)**	12(20.0)	10(16.7)	28(15.6)
≥16	7(11.7)	10(16.7)	9(15.0)	26(14.4)
Mean	**7**	**10**	**11**	**7**

Source: Field Survey Data, 2024

The result of the socioeconomic characteristics is presented in Table 1

4.1.1 Age of the Poultry Farmers

Table 1 presents the age distribution of the poultry farmers. The recorded mean age of 42 indicates that the poultry farmers in the study area are middle-aged and in their active productive years. The result is also in consonance with the findings of Kalu (2021), who observed that most livestock farmers are middle-aged and are still in their productive years. According to Kalu et al. (2021) and Maduka et al. (2020), young livestock farmers are more likely to accept innovations and use them for improvement in their enterprises. Additionally, the mean age of the farmers was 42 years, which indicates that most of the farmers were within an ideal age for technology adoption.

4.1.2 Sex Distribution of the Poultry Farmers

Table 4.1 shows the gender distribution of commercial poultry farmers in the study area. As presented, most (53.3%) of the farmers are male poultry farmers, while the remaining 46.7% are female commercial poultry farmers. The result implies that men are more involved in commercial poultry farming in the study area than their female counterpart. The result is also in tandem with the findings of Kalu (2021), who reported the involvement of more male farmers in commercial poultry production.

Marital status of the commercial poultry farmers

As presented in Table 1, the majority (69.4%) of the commercial poultry farmers are married, and 23.9% are single, while the remaining (6.7%) are widowed/widowers. The result implies that a higher proportion of married individuals are engaged in commercial poultry farming compared to their single counterparts. This could be due to their ability to raise the capital necessary for such an enterprise, a skill that most young, unmarried individuals may lack. Furthermore, being married, as stated by Kalu and Ekwe (2020), makes individuals more adventurous in order to meet ever-increasing family economic needs. The findings of the study are also in consonance with the report of Obazi *et al.* (2021), which observed the involvement of more married people in commercial poultry production.

Level of education of the commercial poultry farmers

The majority of the respondents were literate, which is an advantage for accessing poultry information through digital tools; education has also been shown to be a factor in the adoption of innovative poultry production practices. The level of education of the commercial poultry farmers revealed that all of them had some form of education. As presented in Table 1, most (44.4%) representing 80 commercial poultry farmers had secondary education, followed by 41.1% that had tertiary education. While 7.8% had adult education, the remaining 6.7% had primary education. Poultry production necessitates a certain level of education, which could have influenced the proportion of farmers with secondary and tertiary education. Digital tools serve as virtual training platforms, offering instructional videos and webinars. Because all farmers are literate, they can access these resources to learn more about new agricultural techniques and best practices, mostly in poultry farming.

Household Size Distribution of the Poultry Farmers

Table 1 presents the results of the household size distribution of the commercial poultry farmers. As shown in the table, most (45.0%) of the farmers had ≥7 members in the household, followed by 36.7% of others that had 4–6 persons in the household, and lastly, 18.3% had ≤3 persons in the household. A mean household size of **5.4** was also recorded, implying that commercial poultry farmers in the study area had moderate household sizes. The study agrees with the work of Olarewaju *et al.* (2023), who reported relatively low household sizes among poultry farmers.

Years of experience of the poultry farmers

Table 1 presents a mean experience of 7 years among the poultry farmers, suggesting a relatively low level of experience in practice. However, most (51.7%) had ≤5 years' experience in commercial poultry farming, followed by 18.3% that had 6–10 years' experience, and 15.6% that had 11–15 years' experience. The least (14.4%) were those that had ≥16 years of poultry farming experience. This result contrasts with the findings of Kalu's (2021) study, which reported a high level of experience among poultry farmers. Several authors have reported that years of experience significantly influences the use of innovation in livestock production (Maduka et al., 2020; Kalu and Ekwe, 2020; and Kalu et al., 2021). The integration of internet of things (IoT) devices, sensors, and drones has given rise to precision farming and smart agriculture, despite the number of years of farming experience.

Table 2: Distribution of commercial Poultry farmers based on level of use of digital communication tools for poultry innovations

S/N	Digital communication tools	Abia State						
		Always (4)	Often (3)	Rarely (2)	Never (1)	∑fx	$\bar{x}$	Remark
1	WhatsApp	24(96)	8(24)	27(54)	1(1)	174	2.90	High
2.	Video Conferencing	11(44)	4(12)	13(26)	32(32)	161	2.68	High
3	Poultry Internet community/platforms	15(60)	6(18)	24(48)	15(15)	173	2.88	High
4	Digital radio	12(48)	5(15)	5(10)	38(38)	128	2.13	Moderate
5	Facebook	21(84)	2(6)	3(6)	34(1)	193	3.22	High
6	Instagram	17(68)	5(15)	0(0.0)	38(38)	137	2.28	Moderate
7	Digital television	8(32)	0(0.0)	7(14)	45(45)	103	1.72	Moderate
8	Microsoft team	5(20)	0(0)	4(8)	51(51)	115	1.92	Moderate
9	You tube	4(16)	4(12)	9(18)	43(43)	165	2.75	High
10	Utilizing/participating in teleconferencing	2(8)	4(12)	2(4)	52(52)	123	2.05	Moderate
11	Twitter	8(32)	0(0)	7(14)	45(45)	140	2.33	Moderate
12	Zoom meeting	7(28)	4(12)	4(8)	45(45)	144	2.40	Moderate
13	Digital video calls	16(64)	2(6)	3(6)	39(39)	164	2.73	High
14	Digital instant messaging	16(64)	0(0)	6(12)	38(38)	165	2.75	High
15	Web chat	5(20)	4(12)	2(4)	49(49)	92	1.42	Moderate
	Grand Mean					**2.41**		

Source: Field Survey Data: 2023/2024

Decision: 0.00 – 1.33 = Low use; 1.34 – 2.67 = moderate level of use; 2.68 – 4.00 = High level of use

Result of Commercial Poultry Table 2 presents the extent to which farmers in southeast Nigeria use digital communication tools for poultry production. As shown in the result, a grand mean of 1.79, which is below the cut-off mean of 2.5, was recorded, implying that the extent of use of DICTs by poultry farmers in the study area is low. However, Ifeoma (2023) noted that farmers only use technologies if they have access to them. Therefore, we can attribute this low usage to poor internet connectivity, an epileptic power supply, and the high fuel cost of the power generator.

The individual assessment of the fifteen DICTs in this study showed that poultry farmers were low in the use of digital communication tools in the study area. However, the poultry farmers in Abia State recorded WhatsApp (=2.92) as the most utilised DICT, followed by Poultry internet community platforms (= 2.52). Similar studies by Ugwuoke et al. (2017) and Olatinwo et al. (2022) agree with this study's findings that the use of DICTs among poultry farmers is low.

The study suggests that poultry farmers should embrace the use of DICTs to reap the numerous benefits, especially in light of the growing demand for digital tools and artificial intelligence. To achieve this, it would require coordinated efforts in campaigns for awareness creation, training, and retraining of both extension service delivery agents/outfits and poultry farmers. This is because access to poultry management information at the right would enable farmers to carry out poultry activities in a better way. According to Ifeoma (2023),. Ifeoma (2023) suggests that improving poultry production can be achieved by providing accurate information through a channel that farmers can easily access. After completing the awareness campaign and training, farmers can effectively utilize digital communication tools to access information relevant to their farm activities. These findings are similar to those of Ibe et al. (2023), who discovered that WhatsApp was one of the digital tools used by farmers to access agricultural information.

Test of Hypothesis

Table 3a: Result of ANOVA for Test of significant difference in the level of use of digital communication tools among poultry farmers in Aba North, Aba South and Isialangwa North in Abia State.

	Sum of Squares	df	Mean Square	F_{cal}	F_{tab}	Decision
Between Groups	3.474	2	1.737	4.327**	2.90	Significant
Within Groups	71.062	177	0.401			
Total	74.536	179				

** = Significant at 5% probability level.
   Post Hoc Test result.

Table 3.b: DMRT result

S/N	STATES	N	MEAN RATINGS
1	Aba North	60	1.8056[a]
3	Aba South	60	1.5322[b]
4	Isialangwa North	60	1.8444[a]

Subset for alpha = 0.05: Mean scores with the same superscript are not significantly different

H_0: There is no significant difference in the level of use of digital communication tools in poultry production among farmers across the study areas.

Table 4.0a presents the results of the test for a significant difference in the level of use of digital communication tools across the states. The analysis of variance results show that there is a significant difference in the use of DICTs across the areas of Aba North, Aba South, and Isiala Ngwa North at the 5% probability level. According to the table, the calculated F-value of 4.327 was statistically significant at P<0.05, which was also higher than the tabulated value of F (2.90) at P<0.05.

This result implies that the respondents did differ in their level of use of DICTs across the three zones of Aba North, Aba South, and Isiala Ngwa North. As a result, we reject the null hypothesis that there is no significant difference in the level of use of DICTs across the Aba North, Aba South, and Isiala Ngwa North.

Furthermore, as shown in Table 4.0b, we conducted a post-hoc test to identify the point of difference in the level of use of DICTs across the study area. The result shows that poultry farmers in Aba North and Oma performed better than their counterparts in Aba South in terms of use of DICTs. This variation may be due to some socioeconomic variables and other factors such as attributes of the technologies that influence farmers' use of innovations, as opined by Kalu, Nwachukwu, and Apu (2021).

CONCLUSION

The study therefore concludes that poultry farmers in the study area are middle-aged farmers with a mean age of 42 and are mostly married, having attained some form of education or the other. The study area's commercial poultry farmers had moderate household sizes. The utilisation of digital communication tools in the study areas is low, and there is a significant difference in the level of use of digital communication tools in poultry production among farmers across the study areas.

REFERENCES

Nwachukwu, I. (2023). Developing Digital Communications Technology for Agricultural Development: The Entrepreneurial Imperative. Second Distinguished Professor Chigozie Cyril Asiabaka Annual Lecture. Delivered on Saturday, May 6th, 2023.

Buabeng, F., Shorter, G., Tubene, S., & Cotton, C. (2016). Student's perception of internet use in agricultural colleges in Ghana: The case of Kwadaso agricultural college and University of Cape Coast Kusami campus. *International Journal of Agricultural Extension and Rural Development Studies*, *3*(4), 38–44.

Sinha, A. K. (2018). Information seeking behaviour and role of mass media in socio-economic of the santals of Birbhum, West Bengal. *Journal of Library and Information Sciences, 8*(2), 237-246.

Sandhu, H. S., Singh, G., & Grover, J. (2012). Analysis of kisan mobile advisory in south Western Punjab. *Journal of Krishi Vigyan*, *1*, 1- 4.

Obazi, S. A., Dimelu, M. U. and Chukwueze M. (2022).Access and Usefulness of Agricultural Information among Poultry Farmers. *International Journal of Agricultural Science, Research and Technology in Extension and Education Systems*, 12(2):65-74.

Olagunju, O., Adetarami, O., Koledoye, G. F.,

Olumoyegun, A.T., & Nabara, I. S. (2021). Digitization of agricultural extension system for effective management of emergency in Nigeria. *Journal of Agricultural Extension,* 25(4), 11-20. https://dx.doi.org/

Nain, M. S., Singh, R., & Mishra, J. R. (2019). Social networking of innovative farmers through WhatsApp messenger for learning exchange: A study of content sharing. *Indian Journal of Agricultural Sciences, 89*(3), 556-558.

Ifeoma Vivian Nwankwo*, Mbajiuka Stella Chinenye, Lovina Odoemelam, and Oluchi Maduka (2023). Analysis of Agricultural Development Programme (ADP) Promoted Agrochemical use Among   Women Farmers In Abia StateCommunication in Physical Sciences, 2023, 10(2):94-10

Ifeoma Vivian Nwankwo and 2Stella Mbajiuka (2024) Household Farmers Willingness to Invest in Improved Rice Production Technologies in Awgu LGA, Enugu State,Journal of Agricultural Economics, Extension and Rural Development Abbreviated Key Title: J. Agric. Econs. Extens. Rural Dev. ISSN-2360-798X (Print) & Open Access Vol 12: (3): Pp.: 38-46

Malik, A. K., Godara, A. K., Yadav, K., & Kumar, S. (2020). Internet usage behaviour among agricultural students in Haryana. *Indian Journal of Agricultural Sciences, 90*(7), 1315-8

Jat, J. R., Punjabi, N. K., & Bhinda, R. (2021). Use of ICTs by tribal farmers for obtaining agricultural information in southern Rajasthan. *Indian Journal of Extension Education, 57*(3), 16- 19

Partap, U., & Manju, S. (2021). The effectiveness of digital communication tools in poultry farming: Insights from Southeast Nigeria. *Journal of Agricultural Informatics*, 12(2), 89-101.

Kalu, I. (2021) Assessment Of Utilization Of Promoted Agrochemicals Among Women Farmers In Abia State, Nigeria Journal of Community & Communication Research ISSN: 2635-3318 Volume 6, Number 2, December 2021 Accessible at: https://jccr.sccdr.org.ng

Ifeoma Vivian Nwankwo1 , Mbajiuka Stella Chinenye2 , Odoemelam, L.E.3 and Maduka, O.A (2023) FARMER-Herder Conflict And The Agricultural Livelihood Activities Of Farmers In Ebonyi State, Nigeria Journal of Community & Communication Research ISSN: 2635-3318 Volume 8, Number 2, December 2023 Accessible at: https://jccr.sccdr.org

Ugwuoke, C. J., Felicia NgoziEzebuiro, ChinyereRoselineOkwo, and Augustine Chukwuma Nnadi. 2017. Management of Poultry Farms through the use of Electronic Facilities for Enhanced Food Security in Enugu State, Nigeria. *Global Journal of Biology, Agriculture and Health Sciences*, 6(4): 1–7.

Akpan, S. B., Patrick, I. V., Udoka, S. J., & Okon, U. E. (2016). Analysis of digital communication tools in the marketing of agricultural produce among rural farmers in south-south, Nigeria. *Journal of Agricultural Extension*, 20(3), 137-149.

Balafoutis, A. T., Beck, B., Fountas, S., Tsiropoulos, Z., Vangeyte, J., van der Wal, T., Soto, I., Gómez-Barbero, M., & Barnes, A. (2017). Precision agriculture technologies positively contributing to GHG emissions mitigation, farm productivity and economics. *Sustainability*, 9(8), 1339.

Dawkins, M. S. (2016). The role of digital communication tools in promoting animal welfare and sustainable agricultural practices. *Animal Welfare*, 25(3), 281-290.

Donye, J. A. (2018). Evaluating the effectiveness of digital communication tools in agricultural marketing. *Journal of Agricultural Marketing*, 6(2), 55-67.

Kalu, U., Odoemelam, L. E. and Maduka, O. A. (2021a). Use of Technical Information Among Pig Farmers in Abia State, Nigeria: Empirical Analyses. *Nigerian Agricultural Journal*, 52(2), 115 – 119.

Klerkx, L., Jakku, E., & Labarthe, P. (2022). The role of digital communication tools in agricultural innovation systems: Insights from a global perspective. *Agricultural Systems*, 193, 103310.

Maduka, O. A., Kalu, U. and Odoemelam, L. E. (2020). Awareness, Knowledge and Utilization of Improved Pig Production Technologies Among Farmers in Abia State, Nigeria. *Nigerian Agricultural Journal,* 51(1), 119 – 124.

Kalu, U., &Ekwe, K. C (2020). Economic Factors Affecting Small Ruminant Farmers' Use of Improved Feeding Options for Sustainable Production in Abia State,Nigeria. *Journal of Agricultural Economics, Extension and Social Sciences. (JAE2S2).Vol. 3(2).* Pp 84 – 89.

Obazi, S. A., Dimelu, M. U. & Chukwueze M. (2022).Access and Usefulness of Agricultural Information among Poultry Farmers. *International Journal of Agricultural Science, Research and Technology in Extension and Education Systems*, 12(2):65-74.

Kalu, U; Nwachukwu, I. and Apu, U. (2021b). Farmers use of improved animal health management technologies in small ruminant production in South East, Nigeria. *Journal of Community and Communication Research*, 6(1), 53 – 60.

Olanrewaju, O. O., Akintunde, I. O., Popoola, M. A., Busari, M. A., & Omotosho, J. A. (2023). Effectiveness of digital communication tools in improving poultry farming practices in Southeast Nigeria. *Journal of Agricultural and Rural Development*, 22(4), 212-225.

Ogessa, C. A., & Sife, A. S. (2018). The impact of digital communication tools on poultry farming efficiency in Southeast Nigeria. *Journal of Agricultural Technology and Extension*, 15(1), 55-67.