Determinants of Communication Channel Used among Rice Value Chain Actors in Nasarawa and Benue States, Nigeria
https://dx.doi.org/10.4314/jae.v27i2.3

Nwobodo Cynthia Ebere
Department of Agricultural Extension,
University of Nigeria, Nsukka, Enugu State, Nigeria
Email: cynthia.nwobodo@unn.edu.ng
Phone no: +2348039462574
Orcid ID: 0000-0002-5664-6498

Agwu Ekwe Agwu
Department of Agricultural Extension,
University of Nigeria, Nsukka
ekwe.agwu@unn.edu.ng
Phone no: +234 803 402 4251
Orcid ID: 0000-0002-6842-0955

Okoronkwo David John
Corresponding author
Department of Agricultural Extension,
University of Nigeria, Nsukka
david.okoronkwo.200317@unn.edu.ng
Phone no: +2348109880764
Orcid ID: 0000-0002-2029-7687

Innih Celestina Dupe
Department of Agricultural Extension,
University of Nigeria, Nsukka
celestinainnih@gmail.com
Phone no: +2347037073530
Orcid ID: 0000-0002-3385-5086

Abstract

The study assessed the determinants of communication channel use among rice value chain actors in Nasarawa and Benue States, Nigeria. A multistage sampling procedure was used to select six hundred (600) respondents. Data were collected using a semi-structured interview schedule and were analyzed using a binary logistic regression model with the forced entry method. Results show that the full Logit Regression model containing all the predictors for determinants of use of face-to-face communication channel ($x^2 = 19.74$), mobile phone ($x^2 = 46.453$), radio ($x^2 = 55.12$), television ($x^2 = 34.41$) and print media ($x^2 = 29.71$) were statistically significant. The key determinants for the use of mobile phones include: sex, age, number of social organizations, and years of experience while sex, age, and number of years spent in school were key determinants in the use of television. Therefore, extension agents should consider the different socio-economic groups in selecting communication channels in reaching out to rice value chain actors as identified. Also, extension agencies should create awareness, and provide training opportunities to enable actors to take advantage of the available channels in rice value chain communication.

Introduction

A value chain describes the complex range of activities implemented by various actors, including primary producers, processors, traders, and service provider, to bring a raw material through to the sale of the final product (Smith, 2017). An agricultural value chain is, therefore, a chain of activities and actors engaged in bringing an agricultural product or service from the initial conception stage through its production and final consumption. Enhanced agricultural value chains can contribute greatly to the reduction of transaction costs, increased income, and poverty reduction. It can contribute to food security in terms of access, availability, and improved quality of food through increases in production volumes, farm diversification, higher income reduced postharvest losses, and in the upgrading of technologies or a more efficient use of natural resources and agricultural inputs (Wiesner, 2020). Communication in agricultural value chains is very critical as it is the vehicle through which products move from the producer to the final consumers; and through which information on consumer demand preferences move from the consumer to the producer of agricultural products. Communication allows for information and knowledge sharing among agricultural value chain actors. It helps in tracking and traceability of products as it travels along value chains (Feed the Future, 2018). Enhanced communication brings about closer business ties among agricultural value chain actors thereby enhancing their participation and income.

Information and communication technologies (ICTs) are increasingly being utilized in agricultural value chains (Feed the Future, 2018). Because of their ability to unite people, separated in space real-time for real-time communications and information exchange, ICTs have become a game changer in agricultural value chains. Both the new ICTs including mobile phones, computers, internet, and the older tools such as radio, television, and video are all communication channels gaining increasing acceptance and utilization by agricultural stakeholders. The difficulty in accessing technical information due to a general reduction in funding for the extension has also necessitated that farmers take advantage of the ICTs in communicating production, marketing and financial information with other actors in agricultural value chains. Access to production and marketing information can be greatly enhanced through the use of ICT tools. ICTs play key roles in improving agriculture value chains in such areas as ICT-enabled marketing and access to market prices and demand, food traceability systems, and strengthening smallholder participation in local and international markets. However, information asymmetry is a major challenge in communication with ICTs in agricultural value chains. This is because a digital divide is an inherent challenge in communications using ICT tools. While some value chain actors may be benefitting from improved value chain communication, ICTs may limit the level of communication of some other actors both among and within groups of actors such as producers, processors, marketers, and consumers.

Rice is a high-value chain in the Nigeria's agriculture. Rice is the most rapidly growing food crop in Nigeria (Olasehinde et al., 2022). It is produced and consumed in all the geopolitical zones and by all the socio-economic classes in Nigeria. The demand for rice in the country is rapidly growing. This is a result of a population of 195 million people with an annual growth rate of 2.6%, increasing urbanization, changing consumer preferences, and social welfare/humanitarian feeding, (Obi et al., 2019). Rice has, therefore, been recognized and targeted as a strategic food security crop by successive governments and donor agencies in Nigeria. Improving the Nigeria rice value chain is germane to food security and poverty alleviation for the population. As communication is a source of competitive advantage, it is imperative to determine the factors that undermine the use of communication channels in rice

value chain communications. This could inform policy on which segment of the population is being placed at a disadvantage in ICT-enabled communication in the rice value chain. The study was designed to assess the determinants of communication channels used by rice value chain actors in Nasarawa and Benue State, Nigeria. The specific objectives were to: 1) describe the socio-economic characteristics of the value chain actors, 2) ascertain access to communication channels, and ascertain the determinants of use of communication channels among actors in the rice value chain in the area.

The objective of the study was to ascertain the socio-economic determinants of the use of communication channels by rice value chain actors in two States in North-Central Nigeria.

Methodology

The study was carried out in two states in the North-Central geo-political zone of Nigeria. The zone is the highest rice-producing region, accounting for over 50% of the total rice output of the country (Kamai, Omoigui, Kamara, and Ekeleme, 2020). A purposive sampling technique was used to select two (2) states (Nasarawa and Benue) based mainly on their high involvement in rice production in the zone. A multistage sampling procedure was used in selecting respondents. In the first stage, two (2) agricultural zones were selected from each state. In the second stage, two blocks were selected from each of the two agricultural zones giving a total of eight (8) blocks. In the third stage, the snowball sampling technique was used in selecting eighty (80) input dealers, while the random sampling technique was used in selecting two hundred and forty (240) rice farmers. Also, cluster sampling and snowballing techniques were used in selecting forty (40) rice millers, forty (40) rice parboilers, forty (40) rice paddy dealers, forty (40) milled rice wholesalers and forty (40) milled rice retailers giving a total 80 rice processors and 120 rice traders. Additionally, simple random and snowball sampling techniques were used in selecting a total of eighty (80) local rice consumers in the study area. The sampling frame gave a total sample size of six hundred (600) respondents. To collect data on the socio-economic characteristics, respondents were asked to indicate their sex (male or female), age (years), marital status (single, married, widowed or divorced), household size, monthly household income (Naira), rice value chain experience (years), and the number of social organizations they belonged. Respondents were also asked to indicate the communication channels they had access such as radio, mobile phone, and television among others. Data on channel(s) used in value chain communication was obtained by asking respondents to tick yes (1) or no (0) against each channel to indicate the one they used in linking up with other actors in the rice value chain in the area. Data were analyzed using a binary logistic regression model with the forced entry method. The socio-economic variables were the predictor (independent) variables while use of communication channels was the dependent variable. The regression estimate was in the following form:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + U$$

Where:
Y= Use of each communication channel/tool (Use = 1; Do not used = 0)
$\beta_{1-}\beta_{10=}$ Regression coefficient
X_1 = Sex (Male=1, Female=0)
X_2 = Age (years)
X_3 = Marital status (Married =1 (i.e. living with spouse), Not married (i.e. single or not living with spouse) = 0)
X_4 = Number of years spent in formal education (years)
X_5 = Household size (number of people living under the same roof and eating from the same pot)

X_6 = Monthly household income (naira)

X_7 = Rice value chain experience (years)

$X_{8=}$ = Number of social organizations belonged (the actual number of social organization each respondent belonged to)

U = Error term

α = Intercept

Results and Discussion

Access to Communication Channels

Table 1 shows that the majority (93.1%) of the input dealers had access to a mobile phone;, 90.3% had access to radio;, 73.6% had access to television;, and 51.4% had access to print media. This finding shows that input dealers in the area had considerable access to major ICT tools. The implication of this is that input dealers could take advantage of this access to communication tools to improve their access to value chain information which could mean improvement in their competitive advantage in the chain. Similarly, entries in Table 5 reveal that the majority (96.6%) of the rice farmers had access to a mobile phone, 89.0% had access to radio, 82.2% had access to television, 75.8% had access to a video machine, 60.6 and 60.6% had access to print media. Also, the majority (87.9%) of parboilers had access to a mobile phone, 74.8% had access to radio, and 72.7% had access to television. This finding means that ICT tools could be adopted by parboilers towards ensuring better access to value chain information. The majority (97.5) of the rice millers had access to a mobile phone, 97.5 had access to radio, and 92.5% had access to television. The implication of this finding is that wide access to ICT tools could trigger a competitive advantage resulting from better information access by the millers.

The majority (99.2%) of the rice traders had access to a mobile phone, 89.2% had access to radio, and 88.3% had access to television. This finding implies that access to a variety of communication tools could provide traders with a wide range of value chain information which could also improve their competitive advantage. Table 5 shows that the majority (92.5%) of the rice consumers had access to a mobile phone, 77.5% had access to radio, and 62.5% had access to television. This finding shows that rice consumers in the area had access to a wide range of communication channels which could imply better access to value chain information by the consumers.

These results show that value chain actors in the area had wide access to a variety of ICT tools. Because of the widespread access to these ICT tools, value chain actors are in a good position to make value chain linkages with those tools. However, more of the respondents had access to mobile phones and radio compared to other tools. Atoma and Onoh (2018) found that mobile phones and radio are the most used ICT tool among agricultural value chain actors. More access to the mobile phone may mean better and faster access to information among actors. Through mobile phones, voice messages, pictures, videos, and other infographics can be shared among actors in real time thereby enhancing the competitiveness of the rice value chain.

Table 1: Access to communication channels

Communication channels	Input dealers	Farmers	Parb oilers	Millers	Traders	Consumers
Mobile phone	93.1	96.6	87.9	97.5	99.2	92.5
Radio	90.3	89.0	74.8	97.5	89.2	77.5
Television	73.6	82.2	72.7	92.5	88.3	62.5
Video machine	47.2	75.8	39.4	42.5	40.8	36.2

Internet	36.1	57.2	12.1	5.0	13.3	25.0
Computer	13.9	51.7	6.1	2.5	10.8	11.2
Print media	51.4	60.6	36.4	25.0	49.2	46.2

Determinants of the Use of the Face-to-Face Communication Channel

Table 2 shows that the full model containing all the predictors was statistically significant (x^2= 19.74; p=0.011). The model was able to explain between 4.20% (Cox &Snell R squared) and 24.0% (Nagelkerke R squared) of the variance in the use of face-to-face communication in making rice value chain communication. However, no single factor had a statistical significant influence on the variation in the use of face-to-face communication among value chain actors. This means that each of the factors so tested did not on their own affect the use of the face-to-face channel by value chain actors in the area. The implication of this result is that one-on-one contact between rice value chain actors was not enhanced or hindered by a given socio-economic attribute but could be affected by ~~an~~ interplay of their attributes. A study by Alkhajar and Luthfia (2021) found that face-to-face was the best way to approach local people for comprehensive information. As much as the ubiquity of ICT tools is enhancing communication, face-to-face contact is very important in building trust among value chain actors.

Table 2: Socio-economic determinants of the use of face-to-face communication channel

	Estimate	Standard Error	Wald	Exp. (B)
Sex	-17.88	3328.43	0.00[NS]	0.00
Age	-0.02	0.04	0.18 [NS]	0.98
Marital status	1.08	0.93	1.35 [NS]	2.95
Household size	-0.51	0.06	0.73 [NS]	0.95
Number of years spent in school	0.15	0.09	3.05 [NS]	1.17
Number of social organization belonged to	0.86	0.55	2.43 [NS]	2.38
Monthly household income	0.00	0.00	0.93 [NS]	1.00
Years of rice value chain experience	0.04	0.05	0.84 [NS]	1.04
Constant	18.43	3328.43	0.00 [NS]	1.009E8

x^2 = 19.74; p=0.011; R^2=4.20 (Cox &Snell R squared) and 24.0 (Nagelkerke R squared)

Determinants of the Use of Mobile Phone

Table 3 shows that the full model containing all the predictors was statistically significant (x^2= 46.453; p=0.000). The model was able to explain between 9.7% (Cox & Snell R squared) and 14.7% (Nagelkerke R squared) of the variance in the use of a mobile phone in obtaining rice value chain information. The factors that had a significant influence on the use of the mobile phone were: sex, age, number of social organizations belonged to, and years of rice value chain experience. Results show that by being male (versus female), the log odd of using mobile phone to obtain rice value chain information increased by 2.11. This means that male value chain actors were 2.11 times more likely to use a mobile phone in accessing rice value chain information than their female counterparts; in other words, male value chain actors used mobile phones in obtaining rice value chain information much more than their female counterparts. This finding may be connected to the gender differential in access to a mobile phone which is common in most African countries where men, as heads of households, own and use mobile phones more than women and children. The finding corroborates that of Quandt, Salerno, Baird, Mccabe, Xu et al. (2021) who found that gender influenced use of mobile phones, in which men used the mobile phone more than women.

On the other hand, for a unit increase in age, the log odds of using a mobile phone in accessing rice value chain information increased by 1.03. This means that for a unit increase in age, actors were 1.03 times more likely to use phones in obtaining rice information; in other words, the more the age of rice value chain actors, the more they were likely to use mobile phones in accessing rice value chain information. Results show that for a unit increase in the number of social organization belonged to, the log odds of using mobile phones in obtaining information increased by 1.63. This means that for a unit increase in the number of social organizations belonged to, actors were 1.63 times more likely to use the mobile phone in obtaining rice information. In other words, belonging to more social organizations increased the possibility of the use of mobile phones by actors. This trend may be linked to peer influence and socialization. This contradicts the findings of Folitse, Manteaw, Dzandu, Obeng-Koranteng et al. (2018) who found that membership in a group has no influence on the use of a mobile phone to source agricultural information.

However, results show that for a unit increase in the number of years of experience in rice value chain activities, the log odds of using a mobile phone decreased by 0.96. This means that for a unit increase in the number of years of experience in rice value chain activity, actors were 0.96 times less likely to use a mobile phone in obtaining rice value chain information; in other words, the more the number of years actors spent in value chain activity, the less the likelihood of using mobile phone in obtaining rice value chain information. More experienced people are usually more resistant to change. The more experienced actors could be more traditional and would stick to the old way of using face-to-face contact in communicating with other actors. Ayisi et al. (2022) found that older members of farm groups do not support organizational change as much as younger members.

It is interesting to note that the number of years spent in school did not have a statistically significant influence on the use of mobile phones among value chain actors. This shows that mobile phones can form a good medium for information communication both for the literate and illiterate actors. This is in contrast to the findings of Folitse et al. (2018) that literacy levels had a significant influence on mobile phone use in communicating agricultural information.

Table 3: Socio-economic determinants of use of mobile phone communication channel

	Estimate	Standard Error	Wald	Exp. (B)
Sex	0.75	0.25	8.83	2.11*
Age	0.03	0.01	4.40	1.03*
Marital status	-0.16	0.36	0.20	0.85
Household size	0.00	0.02	0.01	1.00
Number of years spent in school	0.05	0.03	3.19	1.05
Number of social organization belonged to	0.49	0.16	9.44	1.63*
Monthly household income	0.00	0.00	3.62	1.00
Years of rice value chain experience	-0.04	0.01	8.94	0.96*
Constant	-0.88	0.64	1.91	0.42

x^2 = 46.453; p=0.000; R^2=9.7(Cox &Snell R squared) and 14.7 (Nagelkerke R squared)

Determinants of Use of Radio

Table 4 shows all the predictor variables were statistically significant ($x^2 = 55.12$). The model was able to explain between 11.4% (Cox &Snell R squared) and 16.9% (Nagelkerke R squared) of the variance in the use of radio in obtaining rice information. The factors that had a significant influence on use of radio at 5% probability level were: sex, age, and number of years spent in school. Results show that by being male (versus being female), the log odds of using radio increased by 3.14. This means that male value chain actors were 3.14 times more likely to use a radio in making rice value chain communication than female actors; in other words, being a male increased the use of radio by rice value chain actors. The implication is that value chain intervention programmes that use radio programme may be excluding women if a prior arrangement was not made to include them. The finding is in line with that of Yahaya, Yahaya and Sa'adu (2019) who found that sex was a significant factor influencing farmers' attitudes to different information sources.

On the other hand, for a unit increase in age, the log odds of using the radio increased by 1.05. This means that for a unit increase in age, actors were 1.05 times more likely to collect rice value chain information with radio; in other words, the more the age of rice value chain actors, the more they were likely to use a radio in obtaining rice value chain information. A study by Yahaya et al. (2019) on factors influencing the radio adoption decision of rice farmers in the dissemination of agricultural information in Zamfara state showed that a positive relationship existed between the age of farmers and the use of radio. This means that radio can form a good channel for information dissemination for older rice value chain actors. Also, the result shows that for a unit increase in the number of years spent in school, the log odds of using radio increased by 1.13. This means that for a unit increase in the number of years spent in school, actors were 1.13 times more likely to use a radio in obtaining rice value chain information. In other words, the more the number of years spent in school, the more the likelihood of using radio in obtaining rice value chain information by the actors.

Table 4: Socio-economic determinants of use of radio

	Estimate (B)	Standard Error	Wald	Exp. (B)
Sex	1.15	0.32	12.59	3.14*
Age	0.05	0.01	10.80	1.05*
Marital status	0.27	0.38	.48	1.30
Household size	0.03	0.02	1.09	1.03
Number of years spent in school	0.12	0.03	14.99	1.13*
Number of social organization belonged to	0.02	0.14	0.03	1.02
Monthly household income	0.00	0.00	1.86	1.00
Years of rice value chain experience	0.00	0.01	0.00	1.00
Constant	-5.70	0.76	56.20	0.003

$x^2 = 55.12$; p=0.000; R^2=11.4(Cox &Snell R squared) and 16.9 (Nagelkerke R squared)

Determinants of the Use of Television
Data in Table 5 show that the full model containing all the predictor variables was statistically significant ($x^2 = 34.41$). The model was able to explain between 7.3% (Cox &Snell R squared) and 12.3% (Nagelkerke R squared) of the variance in the use of television in obtaining rice value chain information. The factors that had significant influence on the use of television were: sex, age, household size and the number of years spent in school. Results show that by being male (versus being female), the log odds of using television increased by 2.59. This means that male value chain actors were over 2 times more likely to use television in obtaining rice value chain information than their female counterparts. On the other hand, for a unit increase in age, the log odds of using television increased by 1.03. This means that

for a unit increase in age, actors were 1.03 times more likely to use television in obtaining rice value chain information. In other words, the more the age of rice value chain actors, the more they were likely to use television in obtaining rice value chain information. Katunyo (2019) found that age significantly influence intensity of ICT use in agricultural value chains.

The result shows that for a unit increase in household size, the log odds of using television is increased by 1.05. This means that for a unit increase in household size, actors were 1.05 times more likely to use television in obtaining rice value chain information. In other words, the more the household size, the more likely actors were to collect rice value chain information with television. On the other hand, the result shows that for a unit increase in the number of years spent in school, the log odds of using television increased by 1.12. This means that for a unit increase in the number of years spent in school, actors were 1.12 times more likely to obtain rice value chain information with television. In other words, the more the number of years spent in school, the more the likelihood of using television in collecting rice value chain information.

Table 5: Socio-economic determinants of use of television

	Estimate (B)	Standard Error	Wald	Exp. (B)
Sex	0.95	0.37	6.59	2.59*
Age	0.03	0.02	4.41	1.03*
Marital status	0.90	0.50	3.27	2.46
Household size	0.05	0.03	3.84	1.05*
Number of years spent in school	0.11	0.04	10.34	1.12*
Number of social organization belonged to	0.11	0.15	0.49	1.11
Monthly household income	0.00	0.00	0.25	1.00
Years of rice value chain experience	-0.02	0.02	1.50	0.98
Constant	-5.98	0.88	46.59	0.00

$x^2 = 34.41$; p=0.000; R^2=7.3(Cox &Snell R squared) and 12.3 (Nagelkerke R squared)

Determinants of use of print media ??

Findings in Table 6 show that the full model containing all the predictor variables was statistically significant ($x^2 = 29.71$). The model was able to explain between 6.3(Cox &Snell R squared) and 13.6 (Nagelkerke R squared) of the variance in the use of print media in obtaining rice value chain information. The factors that had a significant influence on the use of print media were: sex, household size and the number of years spent in school. Results show that by being male (versus female), the log odds of using print media to obtain rice value chain information increased by 3.32. This means that male value chain actors were 3.32 times more likely to use print media in obtaining rice value chain information than their female counterparts. In other words, being a male increased the use of print media by rice value chain actors.

On the other hand, for a unit increase in household size, the log odds of using print media in obtaining rice value chain information increased by 1.11. This means that a unit increase in household size increased the use of print media by 1.11 times. In other words, the more the household size, the more the likelihood of using print media in obtaining rice value chain information. The result however corroborates the findings of Bolarin, Komolafe and Kolade (2022) that household size had a significant relationship with the use of mass media information sources. On the other hand, the result shows that for a unit increase in the number of years spent in school, the log odds of using print media increased by 1.12. This means that

for a unit increase in number of years spent in school, actors were 1.12 times more likely to use print media in obtaining rice value chain information; in other words, the more the number of years spent in school, the more the likelihood of using print media in obtaining rice value chain information by the actors. Bolarin et al. (2022) found that the level of education was significantly related to the use of mass media in accessing agricultural information.

Table 6: Socio-economic determinants of use of print media

	Estimate (B)	Standard Error	Wald	Exp. (B)
Sex	1.20	0.52	5.35	3.32*
Age	0.03	0.02	1.57	1.03
Marital status	0.76	0.62	1.49	2.13
Household size	0.10	0.03	13.27	1.11*
Number of years spent in school	0.11	0.04	6.15	1.12*
Number of social organization belonged to	0.08	0.19	0.16	1.08
Monthly household income	0.00	0.00	0.23	1.00
Years of rice value chain experience	-0.03	0.02	1.73	0.98
Constant	-6.756	1.115	36.688	.001

x^2 = 29.71; p=0.000; R^2=6.3(Cox &Snell R squared) and 13.6 (Nagelkerke R squared)

Conclusions and Recommendations

The face-to-face contact between rice value chain actors is not influenced by a given socio-economic attribute; however, the interplay of those attributes could affect the use of one-on-one communication channels among actors. The sex, age and years of experience of actors, together with the amount of social organization membership, strongly influence their decision to use mobile phones in obtaining rice value chain information. Radio and television are widely used in obtaining rice value chain information, and they are both influenced by sex, age, and the number of years spent in school. In addition, household size further affects actors' decision to use or not use the television rice value chain linkage system. Socio-economic attributes such as sex, household size and the number of years spent in school are factors that affect the use of print media in obtaining rice value chain information. Therefore, development intervention programmes should prioritize these factors that undermine equitable distribution and access to rice value chain communication channels as this could improve the impact of such programmes. **References**

Alkhajar, E.N.S. and Luthfia, A.R. (2021). Communicating Climate Change policy to people in rural area. IOP Conference Series. *Earth and Environmental Science, 824*, 1-4. doi: 10.1088/1755-1315/824/1/012114.

Atoma, C.N. and Onoh, P.A. (2018). Information and communication technology roles in agricultural value chain promotion among peri-urban women farmers in Imo Stat, Nigeria. *Library Philosophy and Practice (e-journal)*, 2061. Retrieved from http://digitalcommons.unl.edu/libphilprac/2061.

Ayisi, D. N., Kozári, J., and Krisztina, T. (2022). Do smallholder farmers belong to the same adopter category? An assessment of smallholder farmers innovation adopter categories in Ghana. *Heliyon, 8*(8), e10421. https://doi.org/10.1016/j.heliyon.2022.e10421

Bolarin, O., Komolafe, S.E. and Kolade, S.A. (2022). Preference for mass media usage among farmers in Egbedore local government area of Osun State, Nigeria. SVU-International *Journal of Agricultural Sciences, 4*(2): 204-209.

Feed the Future (2018). Information and Communications Technology (ICT) Solutions for Inclusive Agricultural Value Chains. Policy Brief.20180718.

Folitse, B.Y., Manteaw, S.A., Dzandu, L.P., Obeng-Koranteng, G. and Bekoe, S. (2019). The determinants of mobile-phone usage among small-scale poultry farmers in Ghana. Information Development, 35, 564 - 574. doi: https://doi.org/10.1177/0266666918772005

Kamai, N. Omoigui, L.O. Kamara, A.Y. and Ekeleme. F. (2020). *Guide to Rice Production in Northern Nigeria*. International Institute of Tropical Agriculture, Ibadan, Nigeria. 27 pp.

Katunyo, P.N. (2019). Determinants of information communication technologies usage in agricultural value chains by rural yourth in Busia County, Kenya. A Thesis submitted in partial fulfilment of the requirements for the award of the degree of master of Science in Agricultural and Applied Economics, Department of Agricultural Economics, University of Nairobi.

Obi, G., Adama, M., Odukale, T., Emezie-Ezigbo, I., Funsho, A. and Onaiwu, E. (2019). Rice Industry Review. Retrieved from: https://assets.kpmg/content/dam/kpmg/ng/pdf/audit /rice -industry-review.pdf.

Olasehinde, T.S., Qiao, F. and Mao, S. (2022). Performance of Nigerian rice farms from 2010-2019: A stochastic metafrontier approach. *Agriculture, 12,* pp. 1000. https://doi.org/ 10.3390/agriculture12071000.

Quandt, A., Salerno, J., Neff, J.C., Baird, T.D., Herrick, J.E., McCabe, J.T., Xu, E., & Hartter, J. (2020). Mobile phone use is associated with higher smallholder agricultural productivity in Tanzania, East Africa. *PLoS ONE, 6*: 43-54. doi: 10.19268/JGAFS.612021.4.

Smith D. (2017). Principles and concepts of value chain analysis. Retrieved from: https://research.aciar.gov.au/cassavavaluechains/wp-content/uploads/2017/12/2.-principles -and-concepts-of-value-chain-analysis.pdf

Wiesner, A.J.W. (2020). Agricultural Value Chains and its contribution to Sustainable Development Goals: The Case of High Value Chains on Hills and Mountain Areas (HVAP) in Nepal. A Masters Dissertation submitted to the Development Practice, Universidad De Los Andes, Bogota, Colombia.

Yahaya, M., Yahaya, K. and Sa'adu, U. (2019). Factors Influencing Radio Adoption Decision of Rice Farmers In The Dissemination of Agricultural Information In Zamfara State. *International Journal of Agricultural Extension and Rural Development Studies 6,* (4): 14-21.