

ORIGINAL ARTICLE

Challenges and Coping Strategies of Smallholder Poultry Farmers in South-West, Nigeria

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ABSTRACT

BACKGROUND:

Smallholder poultry activities in Nigeria are enormous, but there are diverse challenges that impair the productivity of farmers.

OBJECTIVE:

This study examined the challenges and coping strategies of the smallholder poultry farmers. Specifically, it identifies different types of poultry activities, as well as the challenges faced and coping strategies deployed by the farmers.

METHODS:

A multistage sampling procedure was used to select 360 farmers in four agricultural zones in South-West, Nigeria. Data were obtained through the administration of questionnaires and focus group discussions (FGDs). Percentage, mean score and multivariate probit model (MVP) were employed to analyze the data.

RESULTS:

Results indicated that rising prices of foundation stocks, feeds and poor road network with mean scores of 2.17, 2.13 and 2.07 respectively were leading challenges to farmers. The identified coping strategies through FGDs included diversification into value addition, direct sales of products using trust factors, investment in alternative power generation, and rural road management through cooperative society. At $p \leq 5\%$; gender, level of education, average capacity/cycle and membership in farmers' cooperatives have a positive significant influence, while age, infrastructure, experience, household size and awareness of poultry experience have a negative significant influence on the climate change coping strategies adopted by farmers.

CONCLUSION:

The study concludes that literacy and years of experience motivate farmers to continue engaging in small-scale poultry business despite their challenges. Also, climate change coping strategies was influenced by socioeconomic factors such as gender, age, educational attainment, household size, and average capacity/cycle which improve farmers' livelihood and contribute to increasing of food security.

KEYWORDS:

Challenges, coping strategies, smallholder poultry farmers, inclusive business

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INTRODUCTION

Smallholder farmers in Nigeria are those that own less than 5 hectares of land for crop cultivation and those that have less than 50 heads of cattle, or those with less than 100 goats or sheep or pigs or 1,000 chickens.¹ Smallholders account for more than 80% of Nigerian farmers and produce 99% of the country's agricultural products, although their productivity is constrained by a variety of issues.¹ The livelihoods of smallholder farmers and agricultural productivity are thus both at risk.² Smallholder productivity is low, which is made worse by a lack of understanding of how enterprises interact.³ Smallholder food farmers are regarded as significant actors in increasing global food security and contributors to the economies of both developed and developing countries. Fan & Rue, 2020 opined that smallholders in developing countries are crucial to the global food security equation. Despite their key roles, they represent the majority of the world's poor and hungry people, making them a vulnerable because they are frequently disregarded by development policy in the pursuit of global food security and nutrition.⁴ Consequently, *Muronda* et al, 2020 suggested that a thorough understanding of the potential of agricultural enterprises, their interconnected dynamics, and strategies for increasing the value of product, earnings, and food security of smallholder farmers are necessary for agriculture to provide substantial benefits.

Globally, the livestock industry is becoming more organized along the value chains that engage at least 1.3 billion people and significantly sustain 600 million poor smallholder farmers in emerging countries.⁵ Livestock production is an essential component of the agricultural economy in developing countries, and it is a driver for social and economic growth, higher income, and improved rural life quality in Nigeria.⁶ Livestock production is an important and fundamental component of Nigeria's agricultural economy, with contributions that expand beyond direct food production but also include the generation of job opportunities, source of income for farmers, development of a country's economy, source of vocation to farmers and other multiple purposes.⁷ Traditional livestock farming in Nigeria is thus, characterized by an ageing farmer population who do not have adequate agricultural inputs or funds to

sustain their farming livelihood.⁸ Poultry farming is an important sub-sector of the livestock industry in Nigeria. Poultry farming in Nigeria, outnumbers all other types of livestock and evolved from a backyard hobby to a commercially oriented industry.⁶ It is thus, conceptualized as the rearing of birds like chickens, ducks, quails, turkeys, and geese for meat and egg production, as well as using their by-products, such as faeces and feathers, in industries as natural resources.⁹ Chicken, guinea fowl, and turkeys have high commercial relevance in the poultry trade in Nigeria. Nigeria's poultry industry comprises around 180 million birds, which addresses about 30% of the chicken egg and meat demand; production amounts to 300 metric tons of meat and 650 metric tons of eggs every year¹⁰. The poultry sector in Nigeria is the most commercialised domestic agriculture sector and has the highest rate of turnover and fast return on investment.

The poultry industry is getting more attention in the urban centres of Nigeria as a readily available source of animal protein due to rapid migration from rural to urban areas, middle-class expansion, conflicts in the production, movement, and availability of other protein sources, such as beef,¹¹ change in consumers' taste, and Nigeria's Federal Government ban on the importation of poultry products.¹² The advancement of the poultry sector is identified as the most efficient method to rectify the protein deficiencies gap observed in most developing countries.¹³ Consequently, the smallholder poultry sector, which is perceived as unorganized, has stayed in the narrative of food security changes and alternatives to means of livelihood for the growing youth employment in urban and peri-urban communities in Lagos, Ogun, and other cosmopolitan communities in Nigeria. Smallholder Poultry Farmers face diverse challenges; environmental restrictions, a lack of capacity, and limited access to markets and related services.¹⁴ Climate variabilities are another threat to poultry production, consequently affecting poultry farmers' profit.¹⁵ Farmers are posed with different resilience strategies to cope with their productivity. A farmer's decision to adopt a strategy is influenced by his understanding of and trust in the benefits of the strategy, the size of his operation, the likely danger of not adapting, and his financial ability to absorb the cost of the approach.¹⁶ Despite these

challenges, farmers have developed conscious operations to remain in the food production activities for many years. Smallholder poultry farmers in South-West, Nigeria are no exception; they experience diverse challenges to their products which come from rising prices in their primary inputs such as day-old chicks and feed^{6, 35}, an unorganized marketing system²¹, etc. Their business is, however, plagued with many growth challenges ranging from the low sale of life broiler chicken⁷, product pricing knowledge by the producers¹⁷, price fluctuation due to unstable cost of primary inputs (day-old chick and feed)^{6,35}, poor marketing channels or structure²¹, uncoordinated logistic system to aid distribution^{9,35}, seasonal occurrences of egg glut¹⁷, a technical support system to strengthen diversification along the chain^{6,17}, low knowledge and attitude towards value addition^{6,7}, access to reliable credit and other support systems like poultry experience⁶ and basic social infrastructure that could aid growth^{7, 36}, poor asset growth due to shallow business orientation¹⁷, declining yearly products turnover¹⁷, adaptation strategy to climate variability^{29,36}, etc.

Though there are observed increasing numbers of poultry businesses in the southwest^{17, 35}, these numbers have not provided corresponding growth in the sector. Several development programmes and projects, such as the poultry value chain of the Nigerian Federal Government's Agricultural Transformation Agenda (ATA) 2011 was aimed to make Nigeria an agriculturally industrialized economy³⁷, where poultry sector benefited from loans facility from Nigeria Incentive-Based Risk Sharing Scheme for Agricultural Lending (NIRSAL)^{38, 39} with moratorium period of two years. Also, Global Alliance for Livestock Veterinary Medicines (GALVmed) 2016 project was aimed to develop sustainable smallholder poultry production in rural communities in the South-West, Nigeria for improved livelihood. As well as, African Chicken Genetics Gains Nigeria (ACGG-NG) 2015 implemented by International Livestock Research Institute (ILRI). ACGG-NG was a platform for testing, delivering, and continuously improving tropically-adapted chickens for productivity growth in sub-Saharan Africa. These programmes and projects have been proposed to capitalize on the potentials of rural households and smallholder poultry value chains, yet, the activities of this sector are

observed to be slow in Nigeria compared with dynamic nature of poultry industry globally^{40,41}. Interestingly, there are potential and high-level opportunities in the poultry industry subsector. Hence, interventions in the form of incentives; like capacity development of the knowledge, skill, and attitude of the farmers to cope with the challenges causing inverse productivity have been at the forefront^{6,9,17,29}. Consequently, this study examined the challenges and coping strategies of the smallholder poultry farmers. Specifically, it described the socio-economic attributes of the farmers, identified different types of smallholder poultry value chain activities performed by the farmers, and determined the challenges and coping strategies along with the effect of climate change coping strategies used by the poultry farmers within the sector.

METHODS

Study area

The study was conducted in Lagos and Ogun States, South-West Nigeria. South-West Nigeria comprises a total of six states and is between latitude 4° and 9°N and longitude 30° and 7°E. The population of the South-West is 43 million with a land mass of 78,505 km². Traditional livestock rearing, particularly of small ruminants and poultry, is an important source of livelihood in the region. The South-west is known for having a high concentration of commercial chicken farms and hatcheries¹⁷.

Sampling techniques

Lagos and Ogun states were purposefully selected out of the six states in the region due to the prevalence of smallholder poultry farming enterprises, a succession of poultry value chain markets operations by Smallholder Poultry Farmers (SPFs) and millions of different class of consumers of poultry products (chicken and eggs). Also, there is substantial trans-border poultry value chain business activities between the two states and their neighbouring country, the Republic of Benin. A multistage sampling procedure was used to choose smallholder poultry farmers for this study. Farmers were selected randomly from the identified poultry farm clusters and poultry farm households within the communities in the study area. Stage one was a purposive selection of two agricultural zones from each state, Lagos (Imota and Ojo

Agricultural zones) and Ogun (Ijebu and Ikenne Agricultural zones). Stage two involved the purposive selection of two blocks (Local Government Areas) from each zone, while three (3) communities (cells) were purposively selected from each block in the third stage. The fourth stage involves a random selection of 15 smallholder poultry farmers from each cell to make a total of 360 samples. Convenience sampling was used to choose a seven-man team as Focus Group Discussion participants from the Imota (Ikrodo) zone of Lagos State. An expert in Poultry Nutrition from Lagos State University of Science and Technology (LASUSTECH), Ikrodo, served as the team's facilitator. Other team members included an Extension/Sales Representative from Ayobami Foodies & Agriservice, a distributor of poultry products, representative of the poultry groups at Erikorodo Poultry Estate and Odogunyan Fish Farm Estate, two major input suppliers (suppliers of feeds and other equipment within the poultry clusters), and the researcher. Some of the issues raised for discussion included; other business, either non-farm or farm that the farmers engaged in, and how farmers have been coping with the dynamics of the industry and with the challenges confronting productivity. The team discussed and exchanged information on various coping strategies, including climate change mitigation farmers have employed throughout the years to deal with challenges in the poultry industry.

Method of analysis

Data were analysed with the use of frequency, percentages, mean and multivariate probit models. Socioeconomic characteristics, types of smallholder poultry value chain business activities and the challenges with the coping strategies deployed were measured with the descriptive statistics, while the multivariate probit model was used to analyse the relationship between climate change coping strategies and socioeconomic factors influencing adaptation decisions. The ability of the MVP framework to simulate the concurrent or sequential decisions poultry farmers make in regards to using climate change coping strategies is a key advantage, and this aspect drove the choice of the MVP for this study. Climate change coping strategies is represented in the equations below.

$$Y_i = 1 \text{ if } \beta_i X' + \varepsilon_i > 0 \quad (1)$$

$$Y_i = 0 \text{ if } \beta_i X' + \varepsilon_i \leq 0, i = 1, 2, \dots, 12 \quad (2)$$

The choice of the MVP framework for this study was influenced by the capacity to replicate the concurrent or sequential decisions farmers make regarding the use of climate adaptation techniques. Farmers frequently choose complementary or substitutive approaches to manage climate risk, and the multivariate probit model makes it simpler to assess these concurrent adaptation options. Water ventilation, traditional practices, the use of medicine, and the use of vitamins have all been identified in this study as dependent variables for climate change coping strategies used by farmers. The use of cooling pads or water sprinklers for the birds to improve internal thermoregulation were operationalized as water ventilation strategy. While planting of plantain and banana as perimeter trees, use of bamboo as drinker and integration of fish farm into poultry farming were operationalized as traditional practices. Also, farmers often utilize vitamins to protect birds from heat stroke, medicines to stop the spread of diseases brought on by severe heat. Farmers are aware of the traditional adaptation tactics as effective practices with affordable effects that can increase output on their farms and assist them in adapting to a warmer environment. A farmer was deemed an adopter if they chose to use this option or combination of two or more strategies. However, the dichotomous dependent variable was used to measure whether or not a poultry farmer used climate change coping strategies, which are nominal variables. To make the dependent variables binary, which can only have one of two values (0 or 1), each farmer that uses the practice is coded as either one or zero.

RESULTS

Socioeconomic Characteristics of Smallholder Poultry Farmers

Table 1 shows that 69% of the farmers were male, and 58% with mean score of the age group; $\bar{x}=1.47$, indicating that the average age of farmers is less than 40 years. A significant portion (57% and 61%) of the farmers were Christian and married respectively, and smallholder poultry farmers, on average; $\bar{x}= 2.33$, have completed 11 years of schooling with majority (75%) have had over 10 years of poultry farming experiences. However, FGD session reported that these farmers have had both up and down poultry business experiences. The results

also show that about 57% of the farmers have between 101 and 500 average capacities of poultry per cycle. This was also reflective of the mean score ($\bar{x}=2.67$), and supported by the FGD session, indicating that most of the farmers rear more than 500 poultry per cycle, producing chicken meat (47%) as a specific product from poultry animal.

Table 1: Socioeconomic characteristics of smallholder poultry farmers

Socioeconomic features	Percentage (n=360)	Mean score (SD)
Gender		
Female	31	
Male	69	1.69 (0.462)
Age group (years)		
19-38	58	
39-58	37	
>= 59	05	1.47 (0.592)
Religion		
Christianity	57	
Islam	39	
Traditionalist	04	1.47 (0.577)
Marital status		
Married	61	
Single	37	
Widowed	02	1.41 (0.538)
Household size		
<= 5	74	
>=6	26	1.26 (0.441)
Years spent schooling		
1-5	23	
6-11	36	
12-16	14	
>= 17	27	2.33 (1.218)
Years of poultry experience		
1-10	75	
11 & >15	25	1.88 (0.971)
Average capacity/cycle		
20-100	16	
101-500	57	
Above 500	27	2.67 (1.042)
Specific product from poultry		
Both live birds & eggs	46	
Chicken meat	47	
Eggs	07	2.02 (1.054)

Note: SD = Standard Deviation

Types of smallholder poultry value chain activities by the farmers

An investigation into the daily operations of smallholder poultry farmers was carried out in order to have a deeper understanding of the livelihoods of the respondents. The earlier conversation with the FGD participants served as the impetus for this investigation. Consequently, Table 2's results show that 44% of farmers are solely into poultry enterprise producing poultry, either as layer farmers (49), broiler farmers (90), or both (19). In addition, 17% of the farmers sold chicken inputs, with 7% and 10% dealing in feed and equipment, respectively. Also, 26% and 13% of farmers were actively involved in the processing and selling of poultry products (live birds, processed chicken, eggs and by-products). On the other hand, 70% of the farmers were regularly involved in monthly business operations, and 61% of the farmers kept poultry specifically for both live birds and eggs. The primary motivation for operating a poultry business was income generation, as revealed by 73% of the respondents.

Table 2: Value-chain activities of smallholder poultry farmers

Variables	Percentage (n=360)
Value chain activities	
Poultry production	44
Input dealers	17
Processing of poultry products	13
Marketing of poultry products	26
Purpose of poultry business	
Family consumption	18
Income generation	73
Gifts	09
Specific products poultry are raised for	
Live bird	20
Egg	08
Both live bird and egg	61
Chicken meat	11
Frequency of business operations	
Monthly	70
Quarterly	18
Seasonal	08
Per cycle	07

Challenges and coping strategies of smallholder poultry farmers

Based on evidence from the literature and the FGD sessions, the farmers were presented with the statements in Table 3. These statements were rated as 1 "not a constraint," 2 "minor constraint," and 3 "major constraint." The results revealed that, with a sliding mean value of 2.17 to 1.69, respondents evaluated all of these statements as minor constraints. This implies that rising prices of foundation stocks (day-old chicks and post-brooder chicks), inputs and feeds, a poor road network and rising transportation costs, and a weak support system from poultry experience are minor challenges limiting the productivity of smallholder

poultry farmers in the study area. Additionally, low consumer pricing of poultry products, seasonal fluctuations in prices of major inputs such as feed ingredients, insufficient funding facilities and agencies, and poor public infrastructural facilities such as public electricity and pipe-borne water were perceived as minor challenges hindering smallholder poultry farmers' outputs. In addition to the relatively high cost of investment in smallholder poultry farming, farmers reported inadequate information about the technicality of value addition, a scarcity of skilled labour to support business sustainability, and incidences of climate change as minor challenges to their livelihoods in the study area.

Table 3: Challenges smallholder poultry farmers face in the sector

Challenges of SPFs	Mean score	Standard deviation
Rising prices of foundation stocks and inputs	2.17	0.613
Rising prices of feeds	2.13	0.697
Poor road network and increased transport cost	2.07	0.618
The weak support system from extension services	2.00	0.674
Low price of produce and seasonal fluctuation of prices	1.95	0.620
Inadequate funding facilities and agencies	1.94	0.690
Poor public infrastructure	1.85	0.718
Relatively high cost of investing in SPF	1.84	0.648
Inadequate information about the technicality of value addition	1.73	0.635
Limited availability of skilled labour	1.72	0.651
Climate change incidences	1.69	0.577

Focus group discussions further revealed that farmers' participation in sales of inputs, like foundation stocks (day-old chicks and post-brooder), feeds, medications, and participation in cooperative activities, are some of the ways they cope with the burden of poultry farming business dynamics. Additionally, broiler farmers move further to process their live birds using available equipment within their farm to slaughter, dress, and package processed chicken for sales within their network, as well as participating in community development services to cope with the challenge of poor infrastructure within the sector. Most time, farmers leverage on their social and religious networks to market their farm produce and also to get reliable manpower to support their skilled labour need. They also relied and benefited from extension services through information and testaments of poultry experiences from agro-input dealers, either through

buying from agro shops or and direct sales by sales representative.

Effect of climate change on coping strategies

The results in Table 4, show all of the pair-wise coefficients, which were correlated positively and indicated the complementarity among the climate change coping strategies. Water ventilation, traditional practices, use of medicines and vitamins are the climate change coping strategies used by the farmers. The findings demonstrate that the joint likelihood of using the coping strategies was 36%, as compared to not using coping strategies; 14%. The linear predictions of the results indicate that the likelihood of farmers adopting water ventilation, traditional practices, medicines and vitamins as coping strategies were 64%, 63%, 70% and 62%, respectively.

Table 4: Complementary relationship of climate change coping strategies

	Water ventilation	Traditional practices	Medicines	Vitamin
Water ventilation			0.226 (0.083)	0.468 (0.069)
Traditional practices		0.409 (0.209)		
Medicines			0.527 (0.061)	0.682 (0.026)
Vitamins				0.582 (0.035)
Likelihood ratio test (Chi ²)	Chi2 (10) = 357.034			
P-value	0.001			
Joint probability (success)	0.356 (36%)			
Joint probability (failure)	0.135 (14%)			
Water ventilation	0.64 (64%)			
Traditional practices	0.63 (63%)			
Medicines	0.70 (70%)			
vitamins	0.62 (62%)			

Table 5 shows the socioeconomic factors influencing climate change coping strategies among the smallholder poultry farmers. At $p \leq 5\%$, education of SPF's positively significantly influenced the adoption of water ventilation (34%), and traditional practices (30%), while it had a strong positive influence on the use of medicines (76%) as climate change coping strategies. On the other hand, household size of farmers had a mild negative influence on the use of water ventilation (40%) and medicines (40%), whereas, it had positive influence on the adoption of traditional practices (52%) as climate change coping strategies. Age of the farmers have weak negative significant on the use of medicine (2%) and vitamins (2%) but it had weak positive significant on the use of water ventilation (3%) as

climate change coping strategies. Also, the marital status of farmers showed mild negative significant on adoption of traditional practices (16%) and positive influence on the use of medicine (25%) as climate change coping strategies. Smallholder poultry farmers' average capacity/cycle, also had a positive significant on the use of medications (31%) and vitamins (46%) as climate change coping strategies. As well, smallholder poultry farmers' experience and religion affiliation had little positive influence on the use of vitamins only as climate change coping strategies. Whereas specific products from poultry farming of farmers had negative significant on the use of water ventilation (21%) and positive significant on the use of vitamins (42%) as climate change coping strategies.

Table 5. Factors influencing climate change coping strategies

Variables	Water ventilation	Traditional practices	Medicines	Vitamins
	MVP (S.E)	MVP (S.E)	MVP (S.E)	MVP (S.E)
Gender	0.427 (0.174)	0.045 (0.159)	0.104 (0.145)	-0.112 (0.168)
Age	0.027 (0.010)	0.003 (0.011)	-0.016 (0.009)	-0.021 (0.010)
Marital status	0.104 (0.090)	-0.157 (0.080)	0.250 (0.089)	0.063 (0.101)
Religion	0.029 (0.090)	-0.079 (0.091)	-0.049 (0.087)	0.281 (0.103)
Education	0.340 (0.115)	0.302 (0.119)	0.758 (0.108)	0.122 (0.133)
Household size	-0.403 (0.192)	0.519 (0.194)	-0.404 (0.191)	-0.173 (0.233)
Specific product	-0.206 (0.099)	0.148 (0.099)	0.088 (0.087)	0.424 (0.120)
Average capacity	-0.180 (0.196)	-0.099 (0.195)	0.312 (0.186)	0.457 (0.207)
Experience	-0.115 (0.117)	0.182 (0.127)	0.045 (0.107)	0.458 (0.146)
Infrastructure	-0.264 (0.118)	-0.095 (0.112)	-0.141 (0.102)	-0.161 (0.120)
Awareness	-0.183 (0.206)	0.083 (0.206)	-0.428 (0.190)	-0.140 (0.225)
Constant	0.900 (0.752)	0.849 (0.720)	-0.615 (0.090)	-0.465 (0.723)
Likelihood Chi-square	288.565			

DISCUSSION

Socioeconomic characteristics of Smallholder Poultry Farmers

The results on gender ($\bar{x}=1.69$, $SD=0.462$) and age ($\bar{x}=1.47$, $SD=0.592$) in the study indicated that male participated more in smallholder poultry farming compared with their female counterpart. These results align with the findings of ¹⁸⁻²⁰, who reported that the majority of farmers in Nigeria were male and the majority (58%) were within the age group of 19–38 years. This implies that the farmers are agile and economically fit to participate in smallholder poultry business activities. These results are consistent with the findings of ^{13, 21} who suggested that the respondents fell within the economically active age range. Socioeconomic description of the respondents further showed that majority were married. Marriage is potentially serving as a psychological stabiliser and coping mechanism for farmers to remain in the sector. This implies that married farmers would benefit from collaborative discussions, brainstorming, and advice from their spouses, which in turn would have an impact on their poultry farming outcomes. Also, more than 70% of the respondents were literate, having formal education up to graduate level. This implies that they have the ability to read and communicate in writing ²⁰. Literacy may have motivated them to remain in the poultry business despite its technicality and challenges, albeit at a smallholder level. This finding aligns with the observations of ^{18, 21} suggesting that literate farmers tend to be positively associated with innovation in chicken production and possess a better understanding of new production methods, among other factors. It is imperative therefore to strengthening smallholder poultry farming businesses through advocacy and awareness campaigns to specifically focus on farmers' education.

The studies of ⁷, who posited that a total of 81% of the respondents had between 1 and 10 years of experience in broiler production, and ¹⁸ indicated that over half of the sampled farms have been in poultry production in the last 10 years align with the result of this study that showed over 70% of the farmers consistently doing poultry farming business for about 10 years. This category of farmers had have different experiences which are both good and bad over the years and hence,

remains steadfast in their day-to-day operations. They have deployed different systems and technologies as advised from their colleagues, inputs suppliers and extension agents as exposed by FGD session. These advises have had significant impact on them as they are coping even with the current high inflation and exchange rate. Farmers have over the years of experience improve their awareness through 'adult education'. This influence access to extension services and participation in structured cooperative groups and other support linkages that exposed farmers to the use of trending information and innovation that improve productivity. Consequently, public extension service agencies at the different levels need to be charged to step up their role of linkage, information, advocacy, and advisory services to the farmers.

Types of smallholder poultry value chain activities by the farmers

The involvement of about 56% of the smallholder poultry farmers in input supply (17%), processing (13%) of poultry and marketing (26%) activities are means of diversification strategies into value chain activities within the sector as coping strategies. These farmers aside in their primary activity of rearing poultry either as layer farmers (49), broiler farmers (90), or both (19) engaged in supplementary poultry business activities to maintain and sustain their livelihood in poultry industry. The focus group discussion session, however, found that one of the primary issues for Nigeria's poultry sector is the high cost of feed and other inputs caused by high inflation, exchange rates, insecurity, and climate change. Hence, diversification into other value chain activities as a business provided a relief during the down time of poultry production due to rising cost in feeds and incidences of climate change. The participation of farmers in poultry value chain activities have a connection with the evidence of innovations for inclusive transformation for the future of small farms in Low and Middle-income countries (LMICs) as mentioned by ²² that commercial smallholder farmers run their farms as businesses, downstream from the farm to gain access to urban competitive market through e-commerce linkages and upstream from the farm to access input market through institutions that provide outsourcing services. However, ²² provided supplementary evidence where smallholder farmers' transit into rural non-farm employment (RNFE) while

maintaining small space for home food consumption and semi-commercialized food or non-food products like sales of chicken meat and eggs as food and chicken manure as non-food products. The view of ²³, which argues that the activities of various groups, specifically the Boko Haram group and Fulani herders, have caused invasion and sacking of farming communities, supports the report of FGD on the impact of insecurity on high cost of feeds and other poultry inputs. This has made it practically impossible for farmers to continue engaging in agricultural production optimally, which has direct impact on productivity of primary product and triggers market disruptions with attendant shocks to food prices.

The result of income generation as purpose of poultry business was primary motivation for smallholder poultry farmers. This implies that smallholder poultry farming in Nigeria is a source of income and a means of obtaining a certain amount of economic independence. These findings align with ⁶ study that poultry is raised primarily for dietary and economic reasons in all regions of the nation. The Tanzanian study aligns with these findings, as indicated by ²⁴, that chicken keepers rely on production for income to advance livelihood and protein to increase food security. Focus group discussions affirmed and agreed with the submission of ²⁵ that the income from sales of live birds, eggs, chicken meats and sometimes manure contributed to household expenditures of school fees for children, medical bills, social investment and inputs for reinvestments. The monthly participation of smallholder poultry farmers in value chain activities is evidence of the adoption of technological and institutional innovations of on-farm activities. Evidently, the adoption and use of exotic chicken breeds²⁶ has sparked an industrial revolution in the poultry sector globally, especially in developing communities of the study area. This trending innovation has contributed to the continuous interest of farmers to specifically produce both live bird and eggs as poultry products frequently.

However, policy direction should be provided to empower input dealers who are providing supplementary roles of extension services along the sales of inputs to farmers. On the other hand, it is important to enhance the efforts of the farmers who are

engaging in supplementary value chain activities like processing of chicken, sales of inputs, and marketing by setting up smallholder poultry value chain innovation platforms that will bring together all interested actors, including academia, support organisations, product creation stakeholders, inputs dealers, market researchers, etc., for inclusive business and practical solutions for sustainable income and food security.

Challenges and coping strategies with effect of climate change

The challenges of rising prices of inputs, feeds and foundation stocks, could be attributed the level of dependence on importation in Nigeria. Hence, the exchange rate has had a detrimental effect on input costs. Average prices of feed ingredients has risen by over 168% in the last three years.²⁷ In addition, the cultivation of maize and soybeans; the two main feed ingredients for poultry feeds is being hampered by the insecurity in the country's northern region. The production of high-quality feeds and other inputs, such as vaccines and medications, for an efficient poultry health system is also being adversely affected by the lack of public electricity and poor road network. FGD session confirmed that community service is a coping strategy used by smallholder poultry farmers to deal with inadequate infrastructure, especially provision of alternative electricity to cope with the sector. Aside from technical and managerial issues that impair the productivity of smallholder poultry farmers, climate change incidences have also contributed negatively to the output of poultry farmers.

However, socioeconomic characteristics of farmers influenced the adoption of climate change coping strategies, as revealed by the study. Years of education had a positive and significant impact on coping with climate changes through water ventilation, traditional practices, and use of medicines. The outcome on years of education aligns with the research of ^{29, 33} that there is a positive correlation between years of education and techniques for coping with climate change. The study's findings also show that a poultry farmer's farming experience significantly influenced his or her decision to use water ventilation to mitigate the effects of climate change. Experienced farmers were 53% times more likely to use water ventilation than farmers with less experience. The result on farmers' experience

conform to the findings of³⁴, which showed that climate change adaptation measures were influenced by years of experience by farmers in Nigeria. Years of poultry farming experience is influence positively with exposure to extension services through input dealers as affirmed by FGD. These influences are consistent with earlier research^{28, 33} that discovered that access to knowledge through agricultural extension enhances the possibility that climate change management methods will be adopted. Education motivates respondents' membership in association, which is consistent with the research of³³, who discovered that participation in farmer organizations greatly boosted the uptake of improved varieties in Nigeria. These results imply that farmers who have received more education were aware of the advantages of using water ventilation, following traditional practices and taking medication to mitigate the impact of climate change on poultry productivity. The farmers are more likely to utilize management adaptation measures when their years of education are increased by one year. They are better at managing farm enterprises than those with less education.

Average capacity/cycle is related to educational status and farmers' experience. Educational status and experience motivate smallholder poultry farmers to hold higher flock capacity per cycle.⁴² It provides them the platform to interact with colleagues who are educated and aware of the benefits of rearing larger flock using the same level of resources like manpower and other inputs; medication, feeds, etc. The results on average capacity/cycles were consistent with earlier research in Nigeria that demonstrates the beneficial relationship between accessing credit to increase capacity and implementing climate change adaptation strategies.^{33, 34} consequently, educational status, farmers' experience and average capacity/cycle have significant impact on the use of medications, vitamins and water ventilation as climate change coping strategies.

Farmers with larger households have likelihood of employing traditional methods to mitigate the incidences of climate change. On the other hand, the utilization of medicines and water ventilation as coping strategies were negatively impacted by household size. For example, planting plantains as shade plants around a poultry fence is a practical alternative that large

households can deploy to mitigate the incidences of climate change. Smallholder poultry farmers with average capacity/cycle are more likely to utilize medicines and vitamins as coping mechanisms to increase their livelihood by 31%. The use of traditional methods as climate change coping strategy need the farmer to put in more work, which the household members can do. Hence the higher agreement by the respondents to larger household. The result on household size and climate change coping strategies align with²⁹ finding that adopting climate change adaptation techniques was negatively correlated with household size. The negative relationship imply that a household size increase will reduce the likelihood of employing medicines and water ventilation as coping strategies.

The study further discovered that the age of the farmer positively and significantly impacted the use of water ventilation as coping strategy. While, age negatively and significantly impacted the utilization of medications and vitamins as climate change coping strategies.⁴³ The category of farmers with middle age bracket; less or equal to 40 years could adopt the use of medicine and vitamins as climate change coping strategies compared to the category of older farmers. This is because the middle age farmers are agile and could be motivated with peer groups and exposure to climate change information through social media.⁴⁴ hence, the outcome on age was consistent with³¹ research, highlighting a negative correlation between ageing as well as adaptation to climate change. The result on age also, show clear picture in terms of the interaction between ageing and climate change coping strategies.³³ It suggest that the household head's readiness to employ medication and vitamins as climate change coping strategy declines as age does.

Married head of household responded to traditional practices and the use of medicine as adaptive methods to the negative effects of climate change. The finding on marital status and climate change coping strategies was consistent with research from Ethiopia²⁸ and Southern Uganda³² that found strong associations between marital status and household decision-making. Married households were shown to have a 16% times lower adoption of traditional practices and a 25% times higher adoption of medicine than their unmarried

counterparts. The gender of the poultry farmer significantly influenced water ventilation as a measure for coping with the effects of climate change. Male poultry farmers were 43% times more likely to adopt water ventilation as a climate change coping strategy, as compared to their female counterparts. The outcome on gender is consistent with a study carried out in Ghana, Uganda, and Nigeria, which discovered that male household heads were more likely than female household heads to embrace climate-related practices.^{28, 29} This may be because cultural norms hinder loan access, pushing females to the edge over their male counterparts,³⁰ making them less inclined to make the investment requirements for such adaptation strategies.

CONCLUSION

The study concludes that income generation was the main reason farmers within the sector, who are literate and have had about ten years of smallholder poultry farming business, continued to engage in the regular (monthly) poultry business, despite the challenges faced. Smallholder farmers' persistence in the poultry industry was thought to be feasible and minimally constrained by rising prices of inputs, foundation stock and feeds, limited access to technical support, skilled labour, and timely information about the technicalities of the poultry value chain, as well as climate change coping strategies. Education and years of experience in poultry business activities were observed as major drivers to farmers' adoption of climate change coping strategies like the use of medicine, vaccines, and water ventilation. Education and years of experience in poultry business activities as well expose farmers to extension services and participation in farmers' organisations to improve their productivity. However, the adoption of complementary climate change coping strategies was influenced by socioeconomic factors such as gender, age, educational attainment, household size, and average capacity/cycle and thereby provided allowance for these farmers to improve their livelihood and contribute to the increasing of food security.

The existing poultry cooperative societies should therefore be strengthened with an educational program on the challenges and coping strategies identified in

this study through a participatory approach by both direct and indirect actors along the smallholder poultry value chain. These actors need to understand the livelihood opportunities and interrelationships for potential in the smallholder poultry business.

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CONFLICT OF INTEREST

On behalf of the authors of this research work (manuscript), I certify and declare no conflict of interest in this manuscript. All the processes of research work was conducted including ethical standard professionally. The manuscript has been produced in its original state.

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