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Economics of smallholder chicken egg production among KAFACI project farmers in Southwest Nigeria

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Abstract

Deficiency in managerial capabilities, shortage of investible capital and high feed cost are major constraints limiting the growth and profitability of smallholder chicken production in Southwest Nigeria. Consequently, empowerment programmes was initiated to train and empower farmers in chicken egg production. Sustainability of the effort depends on the ability of the farmers to generate enough returns for reinvestment into the enterprise. This study evaluates the profitability of chicken egg production under the Korea-Africa Food and Agriculture Cooperation Initiative (KAFACI) project. Weekly data were collected during 2017 and 2018 production cycle on input quantity and cost, and quantity and prices of eggs produced. Analysis was by farm budget analysis. The results showed a decline in mortality rate in farms from 42.74% in 2017 to 7.76% in 2018. Similarly, average egg production per farm increased from 3,977 eggs in 2017 to 18,254 eggs in 2018. Average total income per farm also increased from N225,599.58 in 2017 to N638,758.25 in 2018, whereas gross margin increased from a net loss of N157,097.73 in 2017 to a net benefit of N281,025.93. Loss of revenue in 2017 was attributed to high mortality among laying birds. Cost of feed accounted for 59.34% of the average variable cost of producing table eggs. The study therefore recommended capacity building for farmers on farm-level formulation of cost-effective feeding, as well as improving access of farmers to quality feed at subsidized cost, as an interim measure.

Keywords: Chicken egg production, smallholder farmer, profitability, KAFACI project.

Introduction

The livestock sub-sector of the Nigerian agriculture industry is of enormous food security and economic potential by virtue of the wide diversities of domesticated species. This arises from its traditional role of supplying quality protein of animal origin to the households but also generates enormous employment, income and contributes significantly to the GDP. The Agriculture sector contributes 22.97% of the agriculture GDP (NBS, 2018) out of which the livestock sub sector accounts for 1.17%. The poultry segment of the Nigerian livestock industry is endowed with a wide range of species of proven commercial importance including chicken, turkey and geese, among others. The chicken industry is diverse in commercial rearing of different breeds of chicken for divergent purposes of meat, egg and dual purpose. Egg and meat chicken production have been the major pivot for the decades of growth experienced in the chicken enterprise. Egg production thrives well because of its demand by household throughout the year unlike the broiler chicken enterprise whose demand is seasonal and more attached to the festive periods. One other prominent feature of the industry is the increase in the number of small and medium scale poultry farms dominated by chicken rearing. These farms accounts for 90% of total poultry production and comprises of backyard poultry farms, neighborhood farms in urban and peri-urban communities particularly in

the southern part of the country. They are characterized by shortage of capital cum low level of investment and its attendant low level of adoption of productivity enhancing technologies and production practices. Other constraints include high feed cost, high mortality and poor access to market among others (Apantaku, 2006; Akanni, 2007; Olaniyi *et al*., 2008; Adeyemo and Onikoyi, 2012; Adesehinwa *et al.*, 2016; Saka *et al.,* 2017). Most of these challenges are traceable to deficiencies of farmers as regards appropriate management and entrepreneurial skills, dwindling capacities to access or procure required inputs or adopt recommended routine hygiene or bio-safety measures. Consequently, productivity is hindered and potential returns are less achieved, thereby resulting in loss of opportunity for expansion and growth due to the farmers' inability to meet the conditions for sustainable growth in the industry. Alabi *et al.* (2006) has listed the conditions for sustainable growth in the poultry sector as including the ability to purchase efficient inputs, improved breeds, feeds, vaccines, drugs, equipment, skilled manpower and strict compliance to disease control. The disincentive production environment which is at variance to these conditions underscores the need for intervention towards appreciable investment and technical backstopping for enhanced productivity especially among the smallholder farmers. The Institute of Agricultural Research and Training (IAR&T) with funding support from the Korea-Africa Food and Agriculture Cooperation Initiative (KAFACI) trained 30 farmers selected from the six states of Southwest Nigeria. The farmers were trained on improved management techniques in chicken egg production to bridge the skill gap and empowered with certified stock of layer birds, feeds and drugs to bridge the capital incentive gap. The farmers were also provided with technical backstopping provided by the Livestock Subject Matter Specialist of the Agricultural Development Programme (extension agencies of the States' Ministries of Agriculture) to bridge the extension linkage gap as a way of evaluating the influence of access to input, technical information on the managerial capabilities and performance of chicken egg producers. This study therefore evaluates the performance of the farmers with the aim of determining the productivity of the farmers in chicken egg production, profitability of the farmers in chicken egg production and the immediate output of the intervention of chicken egg production among the farmers.

Methodology

Southwest Nigeria comprises of six states and represents a geographical spread between latitude 6°N and 4°S and longitude 4°W and 6°E. The region is bounded in the East by Edo and Delta States, in the north by Kwara and Kogi States in the west by the Republic of Benin and in the south by the Gulf of Guinea (Faleyimu *et al.*, 2013). The climate is typically equatorial with average annual rainfall between 150 and 1480mm with temperature range of 18 to 35°C. The vegetation comprises of fresh water and mangrove swamp, lowland and woodland forest spreading inwards to Ogun and Ondo States with another spread of derived/southern guinea savannah towards the northern boundary (Agboola, 1979 in Faleyimu, 2013; FMANR 1997). The population is predominantly agrarian with the larger percentage living in rural communities where they derive their livelihood. The rich alluvial soil supports the production of food crops such as cassava, maize, yam, soybean, cowpea, and tree crops such as cocoa, citrus, coffee,

kolanut, cashew, mango and oil palm. The climate also allows rearing of livestock such as goat, pig, sheep and poultry (Olaseni *et al.*, 2004; Amusa *et al.*, 2015). The southwest region is noted for its large concentration of commercial poultry farms and hatcheries**.** In 2017, thirteen (13) smallholder farmers were selected among farmers who participated in the baseline survey in 2015. They were trained on improved management techniques, after which they were empowered for the establishment of the pilot model farms with 105 pullets, feed and medication, in addition to technical backstopping offered by scientists and extension agents of the selected states. In 2018, the project was extended to seventeen (17) additional farmers to make a total of 30 poultry farms/participants in the intervention project sponsored by KAFACI in collaboration with IAR&T, Ibadan. The new farmers were selected after assessment of their farms for the facilities put in place as part of their counterpart support for the project and the locations of all the participating farmers in the project were geo-referenced. However, in the course of the intervention project, three of the farmers were dropped due to inadequacies in the data collected arising from poor record keeping and non-compliance with project specifications. Consequently, data from 27 farms were used for the analyses.

The weekly data collected on stock size, number of birds infected with diseases, number of birds lost to mortality, quantity of feed and medication given, cost of feed and medication, quantity of eggs produced and sold were used in the data analysis. As well, revenue from sales of eggs and culled birds were also used in analyzing the farm budget analysis to determine the cost and returns to chicken egg production across the farms. The Variable cost and Revenue from egg production were estimated as shown below.

$$GM_i = \sum_{i=1}^{n} GR_i - \sum_{i=1}^{n} VC_i \ , \quad (i = 1,2,3, \ldots\ldots\ldots, n) \quad (1)$$

Where;

$$\sum_{i=1}^{n} GR_i = \sum_{i=1}^{n} Q_{ij} P_{ij} + \sum_{i=1}^{n} Q_{ik} P_{ik} \ , \quad (i = 1, 2, 3, \ldots\ldots, n) \quad (2)$$

$$\sum_{i=1}^{n} TVC_i = \sum_{i=1}^{m} X_{ij} P_{ij}, (i = 1, 2, 3, \ldots n, \ j = 1, 2, 3) \quad (3)$$

GM_i = Gross margin for farmer i
GR_i = Gross Income for farmer i
VC_j = Total variable cost for farmer i
Q_{ij} = Quantity of egg produced by farmer i
P_{ij} = Price per egg for farmer i
Q_i = Quantity of culled old stock for farmer i
P_{ik} = Price per Unit of culled old stock for farmer i
X_{ij} = Quantity of input j used for production by farmer i (j =1: Pullet, 2: Feed, 3: Medication, 4:labour)
P_{ij} = Price per unit for input j used by farmer i

Similarly, productivity increased is crucial to sustainable growth in any agricultural industry. The study therefore determined the trend in productivity of the smallholder farmers using Total Factor Productivity (TFP). Following *Akpan et al.* (2011); Akintayo and Rhaji (2011); Ukoha *et al.* (2010), an individual farming household's TFP is given by;

$$TFP_i = \frac{Y_i}{TVC_i} = \frac{Y_i}{\sum P_{ij} X_{ij}} \quad (4)$$

However, then $TFP_i = \frac{Y_i}{TVC_i} = \frac{1}{AVC_i}$ (5)

This was then compared across year, education level and gender.

Results and Discussion

The geo-referenced location of the participating farmers in the project is as shown in Figure 1.

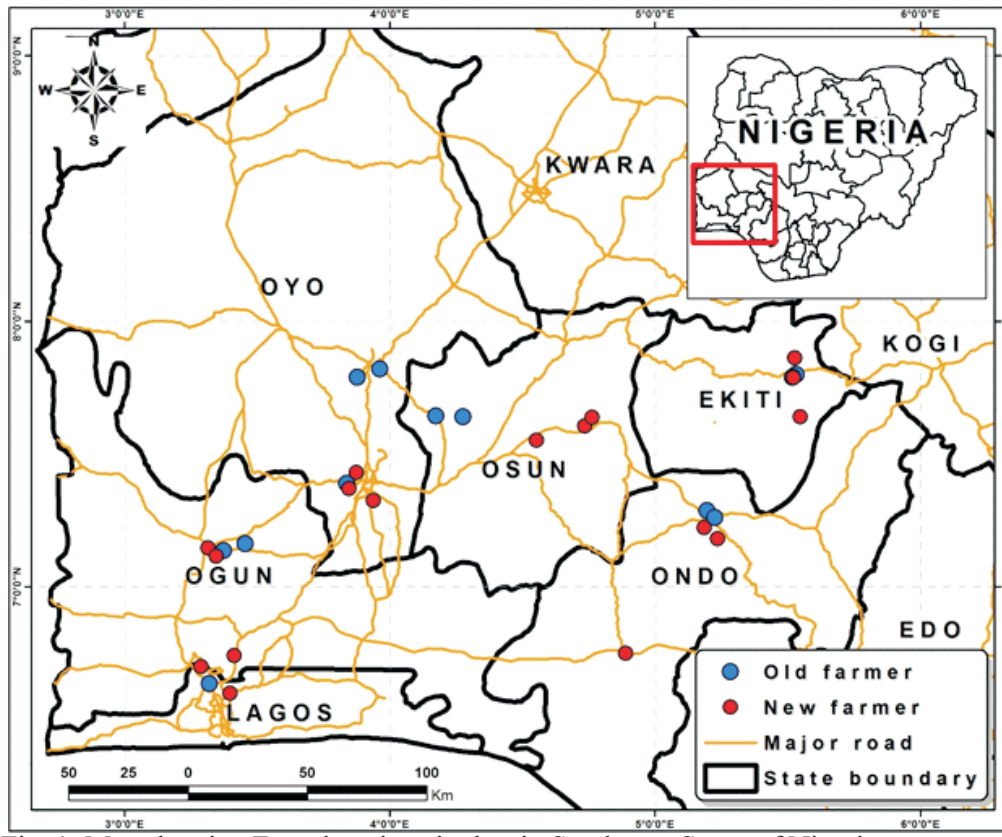

Fig. 1: Map showing Farm locations in the six Southwest States of Nigeria

Socio-economic characteristics of the farmers

The distribution in Table 1 points to the dominance of male (71%) among poultry farmers, while 86.8% of the population were married. Majority of the farmers were between 21 and 60 years of age while 13.2% were above 60 years. Average age of the farmers was 47.68years. The results also showed that 78.9% of the farmers were educated beyond secondary school although majority 23.7% had educational training in agriculture-related disciplines. The results also suggested that 42.1% of the farmers were not new entrants into the enterprise having spent not more than 5 years in poultry production. However, 57.9% have spent more than 10 years in poultry production. In addition to the years of experience, 89.5% of the farmers have attended previous training in poultry production while 10.5% had no previous training in poultry production prior to their participation in the intervention project.

The results have shown that majority of the farmers were within productive years and educated for greater capabilities to access technical information required for informed managerial decision for enhanced productivity. Onuk *et al.* (2017) also reported that 58.3% of broiler farmers had tertiary education thereby pointing to the vantage position of education as a prerequisite attribute for successful poultry production. However, about half of the farmers are new entrants suggesting the crucial need for training for the enhancement of their managerial

Table 1: Demographic Characteristics of Farmers

Characteristics	2017	2018	Total
Sex			
Male	10 (76.9)	17 (68.0)	27 (71.0)
Female	03 (23.1)	08 (32.0)	11 (29.0)
Marital Status			
Single	03 (23.1)	02 (8.0)	05 (13.2)
Married	10 (76.9)	23 (92.0)	33 (86.8)
Age			
≤20 years			
21 – 40	04 (30.8)	07 (38.0)	11 (29.0)
41 – 60	08 (61.5)	14 (56.0)	22 (57.9)
Above 60	01 (7.7)	04 (16.0)	05 (13.2)
Average Age (SD)	44.84 (9.21)	49.16 (11.68)	47.68 (10.96)
Level of Education			
Primary			
Secondary	05 (38.5)	03 (12.0)	08 (21.1)
College of Education/ Polytechnic	03 (23.1)	11 (44.0)	14 (36.8)
University	05 (38.5)	11 (44.0)	16 (42.1)
Educational Discipline			
Agriculture	03 (23.1)	06 (24.0)	09 (23.7)
Non-agriculture-based discipline	10 (76.9)	19 (76.0)	29 (76.3)
Years of Experience in poultry			
1 – 5	07 (53.9)	09 (36.0)	16 (42.1)
6 – 10	03 (23.1)	09 (36.0)	12 (31.6)
11-15	01 (7.7)	02 (8.0)	03 (7.9)
16 – 20		02 (8.0)	02 (5.3)
Above 20	02 (15.4)	03 (12.0)	05 (13.2)
Previous Training			
Yes	13 (100)	21 (84.0)	34 (89.5)
No		04 (16.0)	04 (10.5)

Source: Computed from field data (2018).

capabilities in chicken egg production. The importance accorded training by the farmers is evident in participation of the majority of the farmers in previous training of poultry production as a way of bridging the gap that could have been created by having their educational pursuits in other discipline outside agriculture. The positive influence of farmers' experience and educational attainment on capabilities to access production incentives, managerial capabilities and productivity has been established in literature (**Teklewold *et al.*, 2006;** Yusuf and Malomo, 2007; Otunaiya *et al.,* 2014; Onuk *et al.,* 2017).

Productivity of chicken egg farmers

Productivity is a necessary precursor for sustainable growth in any agricultural enterprise. The results in Table 2 show the average stock size and mortality rate of farms in 2017 and 2018. There was a decrease in average mortality rate of farms from 42.74% in 2017 to 7.76% in 2018 thereby implying a tremendous improvement in managerial capabilities of the farmers in chicken egg production. Similarly, average egg production per farm increased from 3,977 eggs in 2017 to 18,254 eggs per farm in 2018. Relative to stock size at each period, average egg per bird was significantly higher in 2018 (211 eggs) than average egg per bird in 2017 (36eggs).

Subsequently, the average total benefit per farm increased from N225,599.58 in 2017 to N638,758.25 in 2018 while the average total variable cost per farm were

comparable between the two periods. Consequently, the gross margin increased from a net loss of -N157,097.73 in 2017 to a net benefit of N281,025.93 in 2018. The average Total Factor Productivity of the Farms was significantly higher in 2018 (0.05) than 2018 (0.01) thereby stimulating an increase in the Rate of Return on Investment (RRI) from -38.62% in 2017 to 75.90% in 2018 (Table 3). The comparison of the performance of farms based on level of education and sex of farmers shows that those who attended tertiary institutions recorded lower mortality rate on their farms but had greater TFP and average eggs per bird than those who had secondary school education. However, there were no significant differences (P>0.05) in the performance of male and female chicken egg producers (Tables 4 and 5). These results point to the positive influence of level of education on managerial capabilities and productivity of farmers (Table 4). The decrease in mortality and the increase in average egg per bird between 2017 and 2018 points to improvement in the managerial capabilities of the farmers. Saka *et al.* (2017) also reported a mortality rate of 37.8% for poultry farmers in Southwest Nigeria. The high mortality rate in 2017 translates to loss of investment and earning potentials among farmers. However, the effect of further training was evident on the managerial capabilities of the farmers in 2018 with reduction in mortality rate and consequently, the income earning potential of the farms through greater egg production per bird. The reduction in mortality rate also resulted in greater number of culled spent layers for sale thereby adding to the income accruing to the farmers. The results also show that cost of feed accounted for 59.34% of the total variable cost thereby pointing to an area where further intervention can boost the productivity potential of farms. Heise *et al.* (2015) has noted that the rapid increase in price of feed in recent times limits the capacity of farmers to procure quantity of feed sufficient for efficient poultry production thereby hindering productivity growth in the industry. However, in recent time, an initiative of the government under the Agricultural Transformation Agenda (ATA) of the Nigerian government targeted supply of feed to livestock farmers at subsidized rate as done for fertilizer in the crop sub-sector of the Nigerian agriculture. Such effort if adequately sustained could go a long way in reducing production cost in the poultry industry and thus make the industry to be more profitable through greater productivity at reduced cost. In addition, renewed efforts at training farmers on cost effective feed formulation can go a long way in reducing the cost of feed and enhance feed quality assurance.

Table 2: Trend in stock size of layers and egg production by years

Stock Structure	2017	2018	Total	F-statistics
Initial Stock size	107.69 (9.71)	82.88 (25.31)	91.34 (24.25)	11.49 ***
Present Stock Size	62.15 (25.97)	76.08 (23.38)	71.31 (24.86)	2.82
Mortality rate (%)	42.74 (22.02)	7.76 (6.50)	19.72 (21.63)	55.17***
Mean Egg Production	3,977.62 (2,783.72)	18,254.80 (8,719.03)	13,370.5 (9,946.96) 2913.51)	32.73***
Egg Production per Bird	36.51 (25.07)	211.82 (66.91)	151.85 (101.05)	82.30***

Source: Computed from field data (2018).

Table 3: Cost and return analysis on egg production

Stock Structure	2017	2018	Total	F-statistics
Benefit from Eggs	101,291.89	486,598.24	354,782.91	31.06***
	(68,065.43)	(242,897.04)	(272,193.41)	
Benefit from Spent layer	124,307.69	152,160.0	142,631.58	2.82
	(51,934.87)	(46,761.52)	(49,723.79	
Total Benefit	225,599.58	638,758.25	497,414.49	26.06***
	(105,236.42)	(280,179.34)	(306,543.17)	
Pullet Cost	161,538.46	1111,888.0	128,873.68	24.84***
	(14,560.88)	(34,166.65)	(37,360.39)	
Feed Cost	204,596.54	223,956.32	217,333.24	0.51
	(72,890.30)	(81,864.17)	(78,465.57)	
Drugs and Medication Cost	16,562.31	21,888.00	20,066.05	1.71
	(7,200.60)	(12,030.30	(12,030.30)	
Total Variable Cost	382,697.31	357,732.32	366,272.97	0.43
	(83,531.10)	(123,324.78)	(110,780.50)	
Net Benefit	-157,097.73	281,025.93	131,141.52	53.69***
	(121,227.17)	(196,257.86)	(272,250.95)	
Total Factor Productivity (Egg)	0.01 (0.01)	0.05 (0.02)	0.04 (0.02)	66.81***
RRI (%)	-38.62 (32.48)	75.90 (44.61)	36.72 (68.30)	66.84***

Source: Computed from field data (2018).

Table 4: Performance of Chicken Egg Farmers by Level of Education

Performance Indicators	Educational Level		F-Statistics
	Secondary School	Tertiary	
Mortality Rate (%)	33.68 (26.03)	16.01 (19 11)	4.63**
Egg per Bird	92.26 (93.59)	167.74 (98.35)	4.79**
Total Factor Productivity	0.03 (0.02)	0.04 (0.02)	3.96**

Table 5: Performance of chicken egg farmers by gender

Performance Indicators	Sex		F-Statistics
	Male	Female	
Mortality Rate (%)	22.48 (23.68)	13.76 (15.53)	1.35
Egg per Bird	145.62 (105.04)	165.35 (94.77	0.31
Total Factor Productivity	0.04 (0.02)	0.04 ((0.02)	0.37

Conclusion

This study has shown the enormity of the challenges as regards achieving sustainable growth through improved farm level productivity among smallholder chicken egg producers. The challenges of high mortality rate and high cost of feed are two crucial factors hindering profitability of the enterprise. While enhanced managerial capabilities should be pursued through constant training, monitoring of biosecurity compliance among farms and facilitation of improved access to veterinary and technical support services, access to quality feed at subsidized rate or training on farm level cost effective feed formulation can add to the earning potential of market-oriented smallholder chicken egg farms.

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References

Adesehinwa, A. O. K., Saka, J. O., Oyegbami, A. Omole, A. J., and Gyoung-Rae, C. 2016. Production

systems and constraints in market-oriented smallholder chicken production in Southwest states of Nigeria. *Journal of the Korean Society for International Agriculture*.28(4): 459-466.

Adeyemo, A. A. and Onikoyi, M. P. 2012. Prospects and challenges of large scale commercial poultry production in Nigeria. *Agricultural Journal* 7(6):388-393

Agboola, S. A. (1979). An Agricultural Atlas of Nigeria, Oxford University Press, Nigeria. P. 248.

Alabi, R. A., Esobhawan, A. O and Aruna, M. B. 2006. Econometric determination of contribution of family poultry to women's income in Niger-Delta, *Nigeria. Journal of Central European Agriculture* 7(4):753-760

Akintayo, O. I., and Rhaji, M. A. Y. 2011. Determinants of Total Factor Productivity in Rainfed lowland Rice production system in Nigeria, *Journal of Agriculture, Forestry and the Social Sciences* (JOAFSS) Vol. l9, No 1.

Akpan, S. B., Aya, E. E., Essein, U. A., Akpan, O. D., and Bassey, N. E. 2011. Analysis of Total Factor Productivity among Small-Holder Vegetable Farmers in Akwa-Ibom State, Nigeria.

Nigeria Journal of Agriculture, Food and Environment. 7(4): 68-74

Akanni, I. A. 2007. Effect of Micro-Finance on Small Scale Poultry business in South Western Nigeria. *Emirate Journal of Food and Agriculture* 19(2):38-47.

Apantaku, S. O. 2006. Analysis of participation of farmers in participatory poultry production research in Lagos State, Nigeria. *Livestock Research for Rural Development* 18 (7) 2.

Amusa, T. A. C. U. Okoye and A.A. Enete, A. A. 2015. Gender-based vulnerability and contributions to climate change adaptation decisions among farm households in Southwest Nigeria. *American-Eurasian Journal of Agriculture and Environmental Science* 15 (9): 1779-1789.

FAMNR 1997. Nigeria: National Agricultural Research Strategy Plan: 1996-2010. Bukar Shaib, Adam Y. Aliyu and J. S. Bakshi (eds.) Department of Agricultural Sciences, Federal Ministry of Agriculture and Natural Resources, Abuja , Nigeria.

Faleyimu, O. I., Agbeja, B. O. and Akinyemi, O. 2013. State of forest regeneration in Southwest Nigeria. African Journal of Agricultural Research. 8(26): 3381 - 3383

NBS (2018). New GDP at 2010 constant basic prices (naira million) – quarterly (2000 - 2017) https://nigerianstat.gov.ng/elibrary?queries[search]=GDP

Heise, H. Crisan, A., and Theuvsen, L. 2015. **The poultry market in Nigeria: Market tructures and potential for investment in the market.** *International Food and Agribusiness Management Review* 18(A):197-222.

Olaniyi, O. A., Adesiyan, I. O. and Ayoade, R. A. 2008. Constraints to utilization of poultry production technology among farmers in Oyo State, Nigeria. *Journal of Human and Ecology* 24(4): 305-309.

Olaseni, O., Agbeja, B. O. and Adeyoju, S. K. 2004. Dynamics of forest revenue system collections and forestry development in Ondo State, Nigeria, between 1991 and 2000. *Food Agriculture and Environment,* 2 (1): 365 –369.

Onuk, E. G. Umar, H. S. Girei, A. A. 2017. Influence of socio-economic characteristics on net farm income of broiler production in the southern agricultural zone of Nasarawa State, Nigeria. *Journal of Agricultural and Crop Research* 5(3):42-48.

Otunaiya, A. O., Ologbon, O. A. C. and Akerele, E. O. 2014. Analysis of Agricultural Loan Use Decision among Poultry Farmers in Oyo State, Nigeria. *International Journal of Poultry Science* 13 (2): 108-113.

Saka, J. O. Adesehinwa A. O. K. Oyegbami A., Omole, A. J., Gyoung-rae C., Young-joo S., Chongdae K., Sung W. K. and Iksoo J. 2017. The Effects of Health Management System on the Growth of Chicken Small Farm in Southwest States of Nigeria**.** *Korean Journal of Poultry Science* 44 (4): 225 233.

Yusuf, S. A. and Malomo, O. 2007. Technical efficiency of poultry egg production in Ogun State: Data Envelopement Analysis (DEA) Approach. *International Journal of Poultry Science* 6(9):622-629.

Teklewold, H., Dadi, L., Yami, A. and Dana, N. 2006. Determinants of adoption of poultry technology: a double-hurdle approach. *Livestock Research for Rural Development* 18 (3) 2006.

Ukoha, O. O., Okoye, B. C. and Emetu, J. 2010. Analysis and Determinants of Total Factor Productivity among Small-Holder Cassava Farmersin Ohifia L.G.A of Abia State. *Munich Personal RePEc Archive.* MPRA Paper No. 2615.pp 1-8

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