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Original Research Article

Analysis of Farmers' Characteristics on Productivity of Commercial Broiler Production Units in Mukono District

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Abstract: Poultry meat is one of the fastest growing components of Uganda's meat production, consumption, and trade. However, it is estimated that more than 80 % of the small holder dominated sub-sector use traditional family-based production systems which limit production efficiency. This research analyzed the farmers' characteristics and productivity of commercial broiler production units in Mukono District. Using a cross-sectional survey, 302 broiler farmers were randomly selected from five sub-counties of Mukono District. Data were analyzed using the descriptive statistics to characterize broiler farmers, whereas, ordinary least square regression analysis was carried out to assess factors affecting productivity of commercial broiler production units. Results showed that majority were males (53.31%) and married (92.72%). Most (60.26%) had primary as their highest level of education attained. The average age was 45 years with average household size of 7 members. Similarly; majority (91.04%) had land under poultry farming ranging from 0.25 to 3 acres. Feeds cost (P≤0.05), veterinary cost (P≤0.001), farmer's level of education (P≤0.05), extension services (P≤0.001), age of a household head (P≤0.001), land ownership (P≤0.05), and labour type (P≤0.05), showed a positive and significant influence on productivity, whereas, poultry farming experience (P≤0.001), land under poultry farming (P≤0.001), distance to the nearest market (P≤0.05), and record keeping (P≤0.05), negatively and significantly influenced productivity. In conclusion, education level, land under poultry farming, and membership to a group were distinct among farmers who were productive and those that were not. Productivity of commercial broiler farming was majorly influenced by several farmers' socio-economic characteristics.

Keywords: Productivity, farmers' characteristics.

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1. INTRODUCTION

In Uganda, agricultural sector is a corner stone of the economic and social life of the people (Diao *et al.,* 2010; Benin *et al.,* 2012). The sector employs over 70% of the population and contributes a bigger percentage to the total GDP (EPRC, 2013). Livestock production, as one component of agriculture, covers 40 % of agricultural output and it also plays an important role in the national economy as it contributes 11 % of the total GDP (Proctor, 2014). The diverse agro ecology and agronomic practice prevailing in the country together with the huge population of livestock in general and poultry in particular could be a promising attribute to boost up the sector and increase its contribution to the total agricultural output as well as to improve the living standards of the poor livestock keepers (Salami *et al.,* 2010). Poultry production, as one segment of livestock production has become an important enterprise not only to Uganda but also the entire world (FAO, 2015). This is attributed to the poultry's fast growth and returns, nutrition potential, limited space requirement, and lower capital requirement compared to other agricultural enterprises (Mirakzadeh, *et al.*, 2010). The enterprise has evolved from less productive local chickens under backyard system to the current commercialized and specialized farms, where specific types of chicken such as broilers have been developed through continuous breeding (Sonaiya, 2013). However, there is still limited adherence to good management principles and technical

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aspects in production and breeding. This reduces productivity of producers and the national economies (Allahyari, *et al*., 2011). Improving productivity of poultry enterprises is important for household economic livelihood enhancement in the developing world (Ohajianya, *et al*., 2013). There has been a renewed interest in rural poultry production (Minga *et al.,* 2014). However, the sector is characterized by low productivity (Ekou, 2013). Despite the constraints, the Ugandan poultry business is evolving steadily from subsistence to commercial production, through the introduction of specialized niches within the business such as; hatcheries, exotic breeds such as broiler for Meat production). However, little is known on the effect of farmer characteristics on productivity of broilers. Therefore, this study focuses on the effect of social, economic and institutional characteristics of farmers on productivity of commercial broiler production units in Mukono district.

2. MATERIALS AND METHODOLOGY

2.1. Study Area

This study was conducted in Mukono district (Latitude:0.480567; Longitude:32.770567) in Central Uganda, sharing borders with Kayunga District to the north, Jinja District to the east, Kalangala District to the south-west, Kira Town and Wakiso District to the west, and Luweero District to the north-west. (Figure 1). The district was purposively selected based on the fact that the majority of the poultry farmers are intensively involved in commercial broiler production. Consequently, five sub counties selected for the study were those that were majorly involved in commercial broiler production.

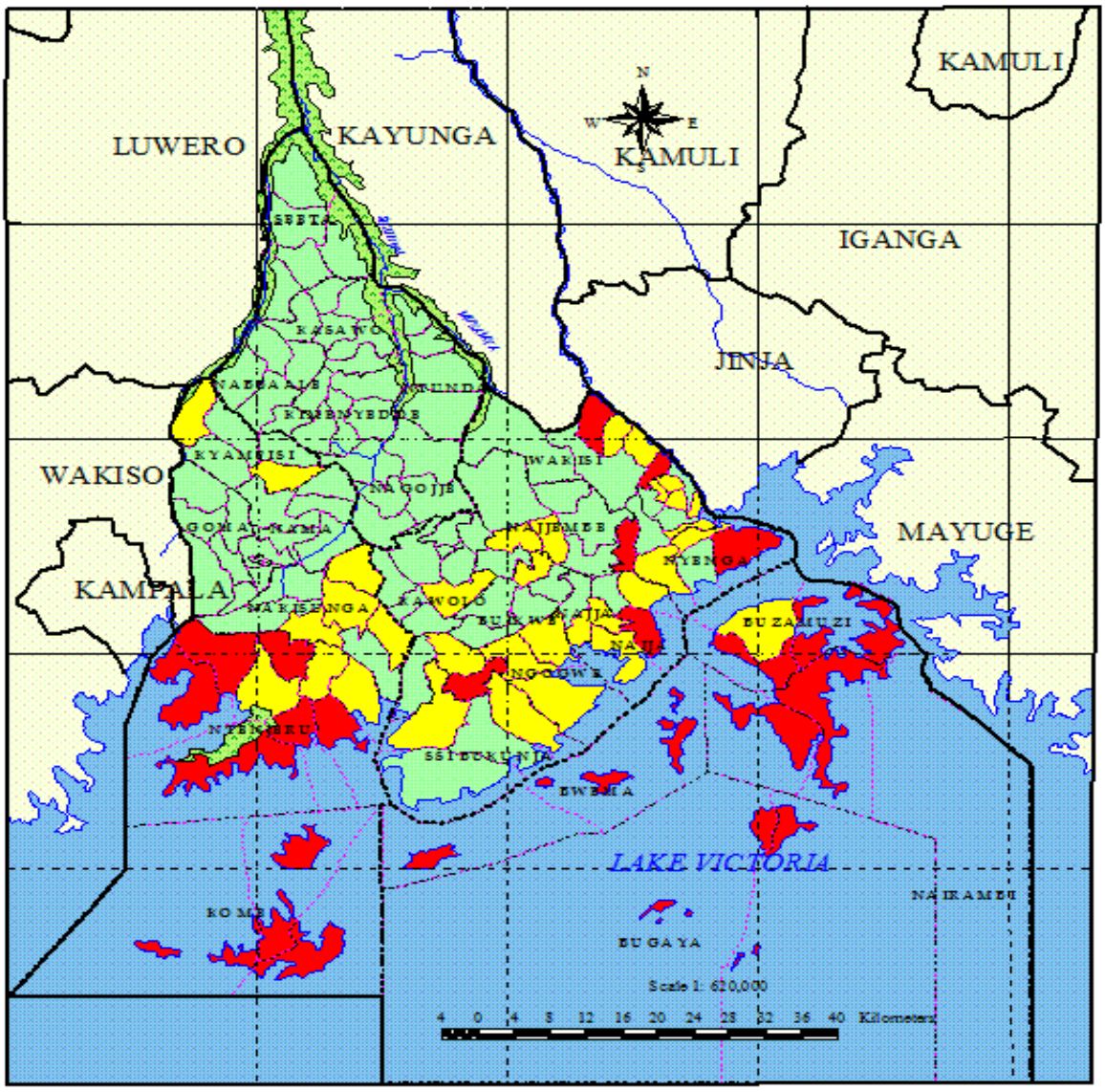


Figure1: Mukono District
Source: Mukono District HRV Profile

2.2. Research Design

The study adopted a cross-sectional survey research design which allows for collection of data from a cross-section of respondents at one point in time. This design was appropriate given that the study was interested in assessing the effect of social, economic and institutional characteristics of farmers on productivity of commercial broiler production units.

2.3. Study Population and Sampling Design

The study population consisted of only farmers involved in commercial broiler production. Multistage sampling technique was used to select the study sample. Mukono district was purposively selected basing on the fact that majority of the poultry farmers are involved in commercial broiler production. Five sub-counties intensively involved in commercial broiler production were purposely selected from which a sample of 302 broiler farmers was randomly selected while following procedures of Yamane (1967).

2.4. Data Types and Data collection

This study used cross-sectional primary data that was collected using a pre-tested researcher administered structured questionnaire. The questionnaire contained questions on socio-economics and institutional characteristics of commercial broiler farmers, and questions on commercial broiler production and related practices. Data on farmers' socio-economic characteristics (Farmers' income, education, farm size, family size, gender, age, and marital status), institutional factors (Access to markets, access to credit, farmer organization, access to media and access to inputs) and production (Stocking density, mortality rate, sales, costs of feed resources, veterinary cost, cost of initial stock, among others) were collected.

2.5. Data Analysis

Descriptive analysis was then performed in SPSS, before the data was exported to STATA v. 14 for econometric analysis. Descriptive statistics and simple inferential statistics involved computations of means and standard deviations for continuous farmers' characteristics, and frequency distribution for categorical farmers' characteristics. In order to test for difference in continuous characteristics between commercial broiler farmers who were productive and those who were not, the study used the students' t-test to test for significant difference between mean characteristics for those who were productive and those who were not. Similarly, the non-parametric chi-square test of association was used to test for significance of association between farmers' status of production and categorical farmers' characteristics. Productivity of commercial broiler production units was determined as a proxy of benefit-cost ratio (BCR), following the approach of Kawsar *et al.,* (2013). It was measured with the following formula;

$$Productivity = \frac{Benefits\ (Sales)}{Costs\ of\ production}$$

Benefits: Total earnings from commercial broiler farming per bird / batch during recent past year
Costs: Total costs incurred in broiler farming per bird/ per batch.

The observed productivity ranged from 0.002 to 3.812 with the mean and standard error (SE) of 1.412 and 0.021 respectively. The commercial broiler farmers were classified into two categories on the basis of their productivity following the slightly adjusted procedures of Kawsar *et al.,* (2013) (0.002-1.000: Not productive, and 1.003-3.812: Productive). Ordinary least square regression model was used to assess factors affecting productivity of commercial broiler production units as presented below;

$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 \ldots\ldots\ldots \beta_nX_n + \varepsilon i$

Where;
Y: Dependent variable (productivity of commercial broiler farmers),
β_0: intercept,
β_{1-n}: Coefficient of the explanatory variables,
X_{1-n}: Explanatory variables (social, economic and institutional variables).

Variables considered include; X_1 = Age, X_2 = Marital status, X_3 = Years of farming, X_4 = Gender, X_5 = Farm size, X_6 = credit, X_7 = Extension services, X_8= Education εi is the error or disturbance term with zero mean and constant variance (0, σ2).

3. PRESENTATION OF RESULTS

3.1. Socio-economic characteristics of the broiler farmers (n=302)

Table 1 indicates the socio-economic characteristics of commercial broiler farmers interviewed. These were categorized into two productivity categories, including not productive and productive categories with productivity ranging from 0.002-1.000 and 1.003-3.812, respectively. This was done while following the slightly adjusted procedures of procedures of Kawsar *et al.,* (2013). Results showed that majority (53.31%) of the broiler farmers were males compared to females (46.69%) with no significant association between productivity and gender. Similarly, most (92.72%) of the farmers were married. There was no significant association between marital status and productivity. Furthermore, results indicated that most (60.26%) of the broiler farmers had primary as their highest level of education attained whereas only 1.98% attained tertiary education with significant ($P \leq 0.05$) association between level of education and productivity. The average age for broiler farmers was 45years with most (48.68%) of them ranging from 20 to 35 years, with no significant association between household age and productivity.

Table 1: Comparing socio-economic characteristics of broiler farmers by productivity

Variable	Productivity						Chi^2/t-stat	Mean diff	P-value
	Overall mean		Not Productive (0-002-1.000)		Productivity (1.003-3.812)				
	Freq	%	Freq	%	Freq	%			
Gender									
Male	161	53.31	19	54.30	142	53.18	0.4751		0.491
Female	141	46.69	16	45.70	125	46.82			
Marital status									
Married	280	92.72	31	88.6	249	93.26	0.0357		0.850
Single	9	2.98	1	2.90	8	3.00			
Divorced	4	1.32	3	8.60	1	0.37			
Widowed	9	2.98	0	0.00	9	3.37			
Education level									
No formal education	32	10.60	2	5.71	30	11.24	2.0992	1.900	0.022*
Primary level	182	60.26	26	74.28	156	58.44			
Secondary level	82	27.15	7	20.00	79	29.59			
Tertiary level	6	1.98	0	0.00	2	0.74			
Age of House hold head									
20-35	147	48.68	17	48.56	130	48.67	-1.0838	-2.733	0.287
36-45	70	23.18	11	31.43	59	22.09			
46-55	54	17.88	4	11.43	50	18.73			
56-65	25	8.26	2	5.72	23	8.61			
66 and above	6	1.98	1	2.86	5	1.87			
House hold size									
1 to 5	85	28.15	9	25.71	76	28.48	-0.2667	-0.133	0.604
6 to 10	184	60.93	22	62.87	162	60.67			
11 to 15	33	10.92	4	11.43	29	10.86			
Total land size (Acres)									
1 to 50	285	94.34	31	88.58	254	93.03	1.2174	3.133	0.117
51 to 100	10	3.30	2	5.72	8	2.98			
101 and above	7	2.31	2	5.72	5	1.86			
Land under poultry farming (Acres)									
0.25 to 3	275	91.04	32	91.44	243	91.02	1.5848	0.553	0.042*
3.1 to 6	23	7.61	2	5.72	21	7.86			
6.1 to 9	4	1.32	1	2.86	3	1.12			
Years of poultry farming									
1 to 10	220	72.84	14	40.00	195	73.05	-0.7016	-1.267	0.489
11 to 20	39	12.9	10	28.57	32	11.98			
21 and above	43	14.21	11	31.44	40	14.97			
Land ownership									
Owned	293	97.02	20	57.14	156	58.43	2.2155		0.330
Hired	9	2.98	15	42.86	111	41.57			
Labour type									
Home labour	172	56.95	20	57.14	152	56.93	0.1357		0.713
Hired	130	43.05	15	42.86	115	43.07			
Record keeping									
Keeps records	210	69.54	27	77.15	190	71.16	2.5328		0.282
Does not	92	30.47	8	22.86	77	28.84			

Freq: Frequency, %: Percentage

Source: Survey 2022

The average household size was seven members, across all households who were productive and those who were not. However, there was no significant association between productivity and household size. The average land size was 51.84acres with most (94.34%) of them having individual land ranging from 1 to 50 acres. There was no significant association between land size and productivity. Similarly, majority (91.04%) of broiler farmers had land under poultry farming ranging from 0.25 to 3 with no association between land under poultry farming and productivity. Most (97.02%) of the broiler farmers owned their land with no significant association between land ownership and productivity. Results further showed that majority (69.54%) of the farmers kept farm records with no significant association between record keeping and productivity. Home labour was the most (56.95%) applied source of labour compared to hired one, however, there was no

significant association between labour source and productivity.

3.2. Institutional Characteristics of the Broiler Farmers (n=302)

The institutional characteristics of the broiler farmers are presented in table 2. Results showed that majority (67.22%) of the broiler farmers were members of farmers' group with highly significant (P≤0.001) association between membership to group and productivity. Only 35.39% of the broiler farmers had access agricultural credit with no significant association between access to credit and productivity.

Table 2: Comparing institutional characteristics of broiler farmers by production efficiency

Variable	Productivity						Chi^2/t-stat	Mean diff	P-value
	Overall mean (n=302)		Not Productive (0-002-1.000)		Productivity (1.003-3.812)				
	Freq	%	Freq	%	Freq	%			
Membership to a group									
Member	203	67.22	21	60	182	68.16	30		0.000***
Non-member	99	32.78	14	40	85	31.84			
Distance to market									
0.1 -10	203	67.22	18	51.43	185	69.26	-0.3888	-1.68	0.649
11 to 20	55	18.21	8	22.86	47	17.6			
21 and above	44	14.54	9	25.72	35	13.09			
Access to credit									
Access	107	35.39	12	34.29	95	35.58	2.8571		0.091
No access	195	64.57	23	65.71	172	64.42			
Access to veterinary services									
Access	96	31.79	11	31.42	85	31.83	1.4666		0.0166*
No access	206	68.21	24	68.57	182	68.16			
Access to market									
Access	233	77.15	29	82.86	208	77.90	0.4162		0.812
No access	69	22.84	6	17.14	59	22.10			
Access to transport									
Access	300	99.34	15	42.86	139	52.06	0.5357		0.464
No access	2	0.66	20	57.14	128	47.94			

Freq: Frequency, %: Percentage

Source: Survey 2022

Similarly, only 31.79% broiler farmers had access to veterinary services compared to 68.21% that never had and there was no significant association between access to veterinary services and productivity. Majority (99.34%) of the broiler farmers did not have access to means of transport. Most (67.22%) of the broiler farmers had distance to the market ranging from 0.1 to 10 km, however, there was no significant association between distance to market and productivity.

3.3. Effect of Farmers' Characteristics on Productivity of Commercial Broiler Production

Results for Ordinary least square regression estimates of the effect of social-economic and institutional characteristics of broiler farmers on production efficiency in the study are presented in table 3. Cost of the feeds, veterinary cost, cost of initial stock, feed resources, farmer's level of education, age, poultry farming experience, land under poultry farming, access to extension services, distance to the nearest market and years of farming were the major determinants of productivity among commercial broiler farmers,

Table 3: Effect of farmers' characteristics on productivity of commercial broiler production units

Variables	Coefficient	Standard error	t-stat	P>t
Feeds cost	3.48E-10	2.19E-10	1.58	0.011*
Labor costs	-2.57E-08	1.52E-07	-0.17	0.866
Veterinary costs	5.03E-08	1.30E-07	0.39	0.008***
Charcoal costs	1.23E-08	2.26E-08	0.55	0.586
Initial cost of stock	5.09E-09	1.08E-09	4.71	0.000***
Feed resource	0.0443889	0.0148395	2.99	0.003***
Gender	-0.0262735	0.0488411	-0.54	0.591
Marital status	0.012673	0.02263	0.56	0.576
Education level	0.0000802	0.0001824	0.44	0.021*
Age of household head	0.0010848	0.0012071	0.9	0.007***

Variables	Coefficient	Standard error	t-stat	P>t
Membership to a group	0.0770226	0.0253673	3.04	0.003***
Household size	-0.0050664	0.0041567	-1.22	0.224
Land size	0.0000577	0.0002597	0.22	0.024*
Land under poultry farming	-0.0002063	0.0085849	-0.02	0.001***
Years farming	0.000402	0.0015699	0.26	0.028*
Years poultry farming	-0.0019187	0.0015009	-1.28	0.002***
Distance to market	-0.0014402	0.0008503	-1.69	0.051*
Access to credit	-0.0258505	0.0238745	-1.08	0.28
Access to extension services	0.0023589	0.0057595	0.41	0.002***
Access to market	0.0005	0.0017134	0.29	0.771
Access to transport	0.0003591	0.0018292	0.2	0.845
Land ownership	0.0254026	0.0275072	0.92	0.037*
Labour type	0.0308818	0.0524643	0.59	0.057*
Record keeping	-0.0008193	0.0007317	-1.12	0.024*

***, **, * indicates significance at 1%, 5% and 10% respectively Obs. summary: Number of observations = 302; F (38, 264) = 1775.19; Prob > F = 0.0000; R-squared=0.9936; Pseudo R^2 = 0.993

Source: Survey 2022

Commercial broiler farmers, with a significant F- value of 0.000 and R^2 for the estimated regression of 0.9936 (99.36%). Feeds cost showed a positive and significant (P≤0.05) influence on production efficiency. Veterinary cost and cost of initial stock positively and significantly (P≤0.001, P≤0.001) influenced production efficiency among broiler farmers whereas labour cost negatively influenced it with no significance difference (P≤0.647). Farmer's level of education showed a positive and significant (P≤0.05) influence as well as access to extension services which showed a highly positive and significant (P≤0.001) influence. Similarly, age of a household head had positive and significant (P≤0.05) influence on production efficiency in the study area. On the contrary, poultry farming experience showed a highly negative and significant (P≤0.001) relationship with production efficiency, as well as, land under poultry farming (P≤0.001). Distance to the nearest market and years of farming negatively and significantly (P≤0.05, P≤0.05) influenced production efficiency in the study area. Land ownership and labour type positively and significantly (P≤0.05, P≤0.05) influenced production efficiency among farmers. On the contrary, record keeping negatively and significantly (P≤0.05) influenced production efficiency. Gender, household size, access to credit and market, among others, had a negative relationship with commercial broiler production efficiency among farmers, whereas, marital status and access to transport, among others, showed a positive relationship.

4. DISCUSSION OF RESULTS

4.1. Socio-Economic and Institutional Characteristics of Commercial Broiler Farmers

Results showed that majority of the broiler farmers were males compared to their female counterparts. This imbalance in gender could partly be explained by the economically lucrative nature of the broiler farming enterprise which tends to attract men into the business (World Bank, 2009). In addition, women are less exposed to agricultural technologies (Abdullah & Adila, 2013) and do not own assets and are always subsistence oriented than male counterparts which considerably upsets their level of involvement agricultural production (Peterman, Berhram, & Quisumbing, 2010). These results are in agreement with those by Kinyanjui *et al.,* (2010) and Guo *et al.,* (2015) who reported that goat farming was mainly dominated by males. Wachira *et al.* (2014), Otunaiya, *et al*., (2015), Ajibola *et al.,* (2020) and Samshunnahar *et al.,* (2015) also reported that agricultural production was mainly dominated by males. This is also consistent with the findings of Chekene & Chancellor (2015) and Martin *et al.,* (2012) whose results indicated that rice farming was dominated by males. Sarris (2001) reported that largely in African agricultural societies the families commonly headed by males. However, findings also contradict with previous research (Adejobi *et al.,* 2011; Achoja and Okoh, 2013; Camillus *et al.,* 2014) which suggests that African women dominate small-scale agricultural production. Ogola *et al.,* (2010) also indicated that dairy goat rearing was majorly carried out by females. Most (92.72%) of the farmers were married. Marriage aids in creating family labour since both women and children can participate in agricultural production and use of technologies (Ogunlade *et al.,* 2012). According to Mwatawala *et al.,* (2019), most of the African farmers live in families to facilitate the production of their farms. The members of the families are crucial in the provision of the workforce for farm activities. Similar results were also observed by Chandio & Yuansheng, 2018 in their study on determinants of adoption of improved rice varieties in northern Sindh, Pakistan. Most of the broiler farmers in the study had attained formal education. The high literacy level in the study area is strength in improving broiler production, since literate communities are more likely to take risks and thus more inclined to commercialize and take up new technologies (Homann *et al.,* 2007). Educated farmers are found to be able to

process information and search for appropriate technologies to alleviate their production and marketing constraints than uneducated farmers (Feder and Slade, 1994). It is also believed that education gives farmers the ability to perceive, interpret and respond to new information much faster and adopt new technology than their counterparts without education (Anley *et al*., 2007). Similar results were revealed by Adesiyan, (2014), who found out that layer and broiler enterprises are mostly operated by attendants who attained formal education. Another study by Alexis *et al.,* 2021 reported that over 55% of coffee farmers Gakenke district of Rwanda had primary level of education while another 24% were illiterate. The average age for broiler farmers was 45years with most (48.68%) of them ranging from 20 to 35 years. This finding indicates that respondents were mostly middle-aged and able-bodied. This is an indication of active youth involvement in broiler farming activities. Young members are characterized by being energetic and providing readily available labour force for their animals, therefore high productivity (Offor *et al.,* 2018). These are also active and can withstand the rigors of technology (Okunlola *et al.,* 2011 and Masinde 2018). This means that the active group is engaging in farming as their major economic activity. Similar results were revealed by Folorunso, and Dawang, (2016) who found out that most farmers (72%) were of middle age (25-50). Tadesse *et al.,* (2020) and Okwu and Ioorka (2011) also found the age group between 21 to 45 years as the most prevalent among farmers. The mean household size of the broiler farmers was approximately 7 members. This is above the national average of 4.7 (UBOS, 2014). This can be attributed to the fact that most of the respondents in the study were from rural agricultural households that usually have large household sizes. The number of members of a household points to the availability of labor (Deressa *et al*., 2011). Larger household sizes make it easy for farmers to implement labor-intensive adaptation strategies (Nyangena, 2008). On the contrary, Ogundele and Okoruwa (2006) reported that a large family size does not necessarily translate into a higher use of family labour because some of the young able bodied family members may prefer other jobs than farming. Additionally 72.84% of the respondents were ranging between 1-10 years of broiler farming experience. This indicates that as experience exceeds 10 years, farmers' involvement in broiler production tends to diminish. An average of 10 years' experience in broiler farming is advantageous since it encourages prompt adoption of technologies (Obinne, 1991). Farmers with more experience are in a better position to adapt new agricultural innovations as they have more knowledge about different interventions (Maddison, 2006). Ozor and Nnaji (2010) and Ofuoku (2011) posited that the higher the number of years that farmers have been engaged in agriculture, the more likely it is that they are able to adopt smart agricultural technologies. Present findings are contrary to those of Ochago (2018) and Alexis *et al.,* (2021) who reported a range of 11-20 years of farming experience among farmers in Uganda and Rwanda, respectively. The average land sizes under broiler farming of approximately 1.63 acres points to the fact that most farmers in the district are smallholders. Pellikka *et al*., (2013) noted that high population growth in the area puts pressure on the land hence the small pieces of land. In the African culture, land size signifies resource endowment; therefore farmers with larger pieces of land are better placed to adapt agricultural innovations (Tazeze *et al*., 2012). Farmers with larger pieces of land are more expected to adopt improved technologies compared to counterparts with small land since they can afford to apportion part of their fields to try out the improved technology (Emana *et al.,* 2012). On the contrary, findings in the present study showed that majority of the broiler farmers had land between 1 to 50 acres. Majority (69.54%) of the farmers kept farm records. This could be attributed to the fact that broiler farming even at subsistence level is taken to be a business and must follow the protocol of doing business. Results showed that a less percentage of the farmers could access agricultural credit, meaning majority of respondents could hardly obtain any credit for broiler production. Access to agricultural credit is very crucial for acquisition of the most essential agricultural inputs for example feed resources and farm implements since they help in broiler productivity. Atieno (2001) reported those formal financial institutions especially banks are characterized by long application procedures, a factor which limits access to credit. Inability to access credit hinders farmers' adaptation to broiler production as they lack capital to purchase inputs (O'Brien *et al*., 2000). In Kenya, high loan interest rates, fear of defaulting, poor group cohesiveness among farmers and lack of collateral are the main challenges faced by Kenyan farmers in their bid to obtain credit (Republic of Kenya, 2013c). Similar findings were reported by Sebatta *et al.,* (2019) who identified lack of credit access as one of constraints to sustainable intensification of coffee production in the Mount Elgon region of Uganda. Results showed that majority (67.22%) of the broiler farmers were members of farmers' group. This could be attributed to the fact that this approach was the generally adopted model for agricultural development by both government and other donors (Bahigwa *et al.,* 2005; Adong *et al.,* 2013). The primary motivation for belonging to a group is that it offers farmers the opportunity to obtain credit. This is the case, especially nowadays as many financial institutions have evolved and require borrowers to be in groups in order to be given loans thereby enabling the lenders to reduce the problem of adverse selection (Atieno, 2001). Group membership also serves as a form of collateral by providing necessary peer-reference for lenders in ascertaining a borrower's credit-worthiness. Farmer groups are increasingly being used by agricultural extension providers to train a wider audience through Farmer Field School (FFS), an approach that has been shown to increase productivity

and incomes (Davis *et al*., 2012). The participatory nature of FFS enables the farmers involved to acquire management skills and adopt self-tested and preferable technologies. In a related study, Odame *et al*., (2008) observed that farmers had formed groups for the purpose of processing tomato into tomato jam, tomato sauce and tomato paste, which helps in reducing losses and getting better prices for their produce. Only 31.79% broiler farmers had access to veterinary services compared to 68.21% that never had. Extension services help in revealing opportunities of adopting agricultural technologies to farmers. However, limited extension contacts by farmers hinder their access to information on adoption decision (Ghimire and Huang, 2015). Extension officer to farmer ratio is very low at 1: 900 against the FAO-recommended ratio of 1:400 (Manfre & Nordehn, 2013). Such minimal extension contacts limits diffusion of knowledge to farmers and this impedes agricultural productivity growth. According to Jones (2003), extension agents avail agricultural information that helps farmers to make timely decisions regarding agricultural management practices.

4.2. Effect of Farmers' Characteristics on Productivity of Commercial Broiler Production

Years of poultry farming was anticipated to have a positive effect on production efficiency of broiler production since experienced farmers were thought to have accumulated technical know-how over time and therefore were in a better position to produce efficiently. However, results in the current study indicated that poultry farming experience had a negative relationship with production efficiency. This finding contradicts those of Danso-Abbeam *et al.,* (2018) and Zakaria *et al.,* (2020) who reported positive influence of farming experience in participating in an agricultural extension program. Wairimu *et al.,* (2015) also suggested that farming experience significantly influenced the productivity of diversified cash crop farming among smallholder tea farmers in Gatanga District, Kenya. Farmers' experience has been reported to have an 'inverted U' relationship, initially, encouraging technology adoption and participation in extension programs, but later promoting dis-adoption of the same (Ainembabazi and Mugisha 2014). This is expected because with increasing poultry production experience, farmers become more self-reliant in poultry production, require less and less technical support. Such farmers would therefore opt not to participate in programs meant to enhance their knowledge and skills since the benefits from not participating in terms of saving time, usually outweighs the benefit of participating in such programs for such farmers. Extension contact positively and significantly ($p \leq 0.001$) influenced the broiler production efficiency in the study area. This implied that, frequency of extension visits for dissemination of information and advisory services would give the farmers more confidence to practice the recommended poultry production practices, hence efficient production. In fact, the influence of extension contacts can counter balance the negative effect of lack of years of formal education in the overall decision to adopt certain technologies, and can create better awareness about the potential gains of improved agricultural innovations. This is in line with Mihiretu, 2008 who observed that the variable for extension contact had a positive coefficient, indicating that adoption of quality rice management practice increases with increase in the number of extension visits and services offered to farmers. In a similar study, Awuni *et al.,* (2018) reported extension contacts to have a positive and significant impact on intensity of adoption, and that of Nkegbe and Shankar (2014) in northern Ghana, who also reported a positive effect of extension contacts on intensity of adoption of soil and water conservation practices. Furthermore, Danso-Abbeam *et al.,* (2017) also reported a significant and positive effect of extension contacts on the adoption of improved maize variety in northern Ghana. Mugagga (2017) and Mudzonga (2011) as well reported that extension contacts have a positive and significant impact on intensity of agricultural production. Zakaria *et al.,* (2020), in a study carried out in northern Ghana, reported a positive effect of extension contacts on intensity of adoption of climate smart agricultural technologies among rice farmers. Danso-Abbeam *et al*., (2017) also reported a significant and positive effect of extension contacts on the adoption of improved maize variety in northern Ghana. Education level showed a positive and significant ($P \leq 0.05$) influence on broiler production efficiency in the study area. Possible explanation is that educated farmers tend to be in better position to access research output reports and generally to update information about the risks associated with improved broiler production technologies and hence tend to spend more time and money on that. Literate farmers also oftenly serve as contact farmers for extension agents in disseminating information about agricultural technologies from government agencies (Adeola *et al.,* 2019). The result was consistent with the findings of Abegunde (2019) and Wamalwa (2017). Alene *et al.,* (2000) similarly found in their study in the central highlands of Ethiopia that intensity use of improved maize varieties was determined and significantly influenced by the education level of the farmers. Present findings are also supported by other previous studies such as the findings of Lelissa and Mulate (2002), Yitayal (2004). Komba *et al.,* 2019 on their study on the socio- economic factors influencing farmers ' perception on effectiveness of decentralized agricultural extension information and services delivery in Arumeru District , Tanzania, also found out that Academic qualifications of the respondents had a positive influence on the likelihood of the respondents to perceive the effectiveness of agricultural extension information and services delivery. However, Kolady *et al.,* (2020) made a diverging finding where education had an insignificant determining in precious agricultural technologies uptake in their study of determinants of uptake intensity of precious agriculture technologies in

South Dakota, USA. Results showed a negative effect of credit on broiler production efficiency in the study area. This denotes that as farmers' access to credit increases, their desire to venture into other non-farm profit making enterprises also increases, and this eventually limits their investment in broiler production. This could also be attributed to the unpredicted diseases and market patterns of the area which puts farm enterprises at a risk. This observation was consistent with Aryal *et al.,* (2018) and Zakaria *et al.,* (2020) who reported diversion of farm credit to non-farm activities by farmers in the Indo-Gangetic Plains of India and Northern Ghana respectively. These findings are also in agreement with those of Verkaart *et al.,* (2017) who reported that farmers who accessed credit were more likely to adopt improved chickpea production practices. Mensah-Bonsu *et al.,* (2017) and Ullah *et al.,* (2018) also reported a significant and positive impact of credit on intensity of adoption of land conservation practices in Ghana and improved peach cultivars in Pakistan respectively. The negative effect of credit was in contrary with a study by Mugagga (2017) and Mudzonga (2011) who reported a significant and positive impact of credit on perceptions and response actions of smallholder coffee farmers to climate variability in montane ecosystems and farmers' adaptation to climate change in Uganda and Zimbabwe respectively. Results further showed a negative influence of land under poultry farming on broiler production efficiency in the study area. This implies that as land under poultry farming increases, broiler production efficiency decreases. However, this is in contrary to the findings of Abegunde (2019) (Wamalwa, 2017) Tesfay (2014) who reported that land size positively and statistically influence practice of good agricultural practices. These findings are also in disagreement with that of Bongiwe (2013) who conducted a study on factors affecting the productivity and profitability of vegetable production in Swaziland which revealed that the land significantly influenced profitability. Similar result was reported by Mugagga (2017) in a rural area of Kaato of Mount Elgon region eastern Uganda. Anang *et al.,* (2020), also reported that farm size had a positive influence on access to agricultural extension in northern Ghana. Relatedly, Danso-Abbeam *et al.,* (2018) as well observed that maize farmers who allocated more land to maize were more likely to participate in an agricultural extension program in Ghana. This finding is in agreement with the findings of Onu (2006); Bamire and Manyong (2003); Surri (2005). They reported that farm size significantly influences farmer's innovation utilization. Membership to farmers groups significantly ($p>0.05$) influenced broiler production efficiency in the study area. The coefficient was positive indicating that farmers that belonged to farmers' organizations or groups had high production efficiency compared to those that never belonged to groups. It is anticipated that by forming groups, farmers could be in a better position while bargaining for a reasonable market price for their produce. These findings are in agreement with that of Mwatawala *et al.,* (2013) who conducted a study on factors influencing profitability of small-scale tomato production in Mvomero District, Tanzania. In addition, feed resources positively influenced broiler production efficiency in the study area with a statistical difference among feed resources. This means that any changes in feed resources directly influences for broiler chicken production efficiency. Present finding are consistent with those of Sunarno *et al.,* (2017) who conducted a study on factors affecting broiler production in Wonogiri regency. Furthermore, the study findings revealed that age had positive relationship with broiler production efficiency in the study area. The finding of the study goes in line with Wamalwa (2017) and Kolady *et al.,* (2020) who reported that age posively influenced the uptake of improved practices. Adeola *et al.,* (2019) had similar findings in their study of investigating the determinants of adoption intensity of improved sweet potatoes varieties among farmers in Nigeria. However, findings in this study showed that adoption of climate smart agricultural practices was irrespective of gender. This was consistency with the study of Alene *et al.,* (2000) who reported that parameter of age of the farmer was statistically insignificant. Lungu (2019) similarly showed that gender played no significant role in the adoption decision of the household. This was quite a contrast from many other gender studies that have consistently found that men generally have greater control over household resources than women do, and as such, adoption gaps exist between men and women (reference). The finding is in line with Ofuoku *et al.,* (2006) who found that age is related to innovation utilization because the stage of life of farmers affects their attitude towards innovation usage. The older the farmers are the more likely they are willing to put farming related innovation into use. This finding does not agree with Lemchi *et al.,* (2003); Asiabaka *et al*., (2001); Odoemenem and Obinne (2010) who stated that the older the farmer becomes, the more risk averse he/she is, to utilize agricultural innovation. Farmers' marital status had a positive but insignificant relationship with with broiler production efficiency in the study area. Marriage aids in creating family labour since both women and children can participate in agricultural production and use of technologies (Ogunlade *et al*., 2012). The family determines how much family labour will be used on the farm (Tiamiyu *et al*., 2009). Results from the current study indicate that the coefficient of access to the nearest market was positive which indicates that farmers who had access to the nearest market were more likely to do broiler production as compared to those who never had access. Markets deliver a significant platform for farmers to collect and share information Nyangena (2007). As a result, access to the nearest market may aid sharing and exchanging information with farmers and other service providers (Maddison, 2007). Households with poor access roads and markets face higher transaction costs

in selling their outputs and accessing inputs. Findings are in agreement with those of Place *et al*., (2002) who noted that nearness to the market is an initiative for intensity of adoption. The results concur with Siziba *et al.,* (2011) who argued that access to market reduces the risks of getting the loss. Moreover, this finding is consistent with that of Martey *et al.,* (2012) in Ghana who viewed that market i warranty producer's flow of insight on market requirements and opportunity sets that allow effectively plan on commercialization of smallholder agriculture. Initial cost of stock positively and significantly ($p \leq 0.001$) influenced the broiler production efficiency in the study area. The higher the initial cost of the stock the larger the flock sizes and therefore the higher productivity in broiler poultry production. This could be attributed to the fact that larger broiler poultry farms utilized resources more efficiently than smaller layer poultry farms Esiobu, *et al*., (2015). In addition, Ohajianya, *et al*., (2013), reported that a percentage increase in flock size was associated with a 0.4% increase in layer productivity in the Imo state of Nigeria. Other similar studies are in Ojo, 2003; Oji and Chunkwuma, 2007; Folorunso and Dawang, 2016; Oleke, and Isinika, 2011 and Adepoju, 2008). However, the findings contradict with Widiyanti, *et al*., 2015; Adedeji, *et al*., 2013; Otunaiya, *et al*., 2015; Oyakhilomen, *et al*., 2015; Adesiyan, 2014) who found no significant relationship between flock size and layer poultry productivity. Veterinary costs positively and significantly ($p \leq 0.001$) influenced the broiler production efficiency in the study area. An increase in the quantity of drugs used is associated with an increase in productivity of the broiler poultry farm. Otunaiya, *et al*., (2015), also reported contrary findings for layer poultry farmers in Nigeria. Specifically, the study reported that a percentage increase in quantity of drugs used was associated with 0.26% decline in productivity. Unlike vaccines, use of drugs in layer poultry is associated with high disease prevalence in the poultry flock. Diseases such as: coccidiosis, infectious bronchitis, diarrhea, necrotic enteritis, fowl pox, fowl typhoid, collibalilos, avian leucosis among others were reported by some farmers and have an impact of reducing productivity of layer poultry.

5. CONCLUSION

Education level, land under poultry farming, and membership to a group were distinct between broiler farmers that were productive and those who weren't. Productivity of commercial broiler farming was significantly influenced by cost of the feeds, veterinary cost, cost of initial stock, feed resources, farmer's level of education, age, poultry farming experience, land under poultry farming, access to extension services, distance to the nearest market and years of farming.

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