



## Value Chain Analysis of the Broiler Industry in the Southern Sector of Ghana

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### Abstract

The livestock subsector especially broiler production plays a significant role in the livelihood and food security in Ghana. Several researchers in developing nations have employed value chain methodologies to investigate the linkages and the interactions of the various actors in the poultry sector. However, none of these studies comprehensively captured each actor's strengths, weaknesses, opportunities and threats, as well as the governance structure and profitability of the broiler industry. This paper fills this gap by analyzing the governance structure, value addition, determinants of profitability and prospect of the broiler industry using 290 respondents (180 broiler producers, 65 distributors and 45 retailers) from the Greater Accra, Ashanti and Bono Regions of Ghana. The study adopted the scoring analytical technique, net farm income (NFI), the modified Cobb-Douglas function and the SWOT (strengths, weaknesses, opportunities, threats) matrix for the analyses. The results revealed producers as the key governors with the highest value addition and return on investment. Distributors and processors on the other hand form informal cartels to monopolize their activities to increase bargaining power. Whilst credit access, education, business training, age and feed type influenced profitability, the broiler industry is threatened by high importation of frozen chicken, high taxes, lack of capital access and high cost of operation. The study recommends that the government should pursue measures to minimize the cost of operations through input-tax exemptions and reduce the importation of chicken products. Stakeholders should invest in input supply, processing technologies and transportation facilities to boost local production for profit gains.

**Keywords:** broiler production; Ghana; governance structure; profitability; value-addition

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### INTRODUCTION

Agriculture has historically been a vital element of the Ghanaian economy. The sector alone has helped reduce unemployment by 33.5% and contributed to the country's gross domestic product (GDP) from a negative value of 1.7% in 2007 to 4.8% at the end of 2018 (Zakaria et al., 2020). The livestock subsector serves as a 'safety net' and poverty reduction tool by providing

income for households. GSS (2019) noted that livestock including poultry plays a significant role in rural livelihoods and food security, shielding smallholder farm families from hardships.

Among the livestock subsector, poultry production has assumed an important role as a commercial activity with enormous potential for rapid economic growth. Poultry includes chicken (broiler and layer), turkeys, guinea fowls and ducks among others. The current poultry

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production in Ghana stands at about 59,000 metric tonnes (MT), whilst consumption is estimated to be 399,000 MT, leaving a huge gap that is filled by importation (Kassim et al., 2021; USDA and GAIN, 2022). However, the sector is challenged with several issues including the absence of active participation in value addition due to the heightened level of risk and uncertainties. This is further reinforced by inadequate market information, technical assistance, high-quality inputs and financial products (credit, savings, insurance) as noted by Anang et al. (2013). While production costs for broilers are estimated at about 1.5 USD kg<sup>-1</sup> in the efficient production systems in Brazil and the USA, in Ghana, production costs are more than twice as high (Andam et al., 2017). Processing and packaging costs are also higher since Ghana's broiler industry has not yet adopted the vertically coordinated production systems that have led to cost reductions in other countries (Andam et al., 2017). According to Naggujja et al. (2020), the current production capacity to meet local demand is about 20%, leaving a gap of 80% for imports. Due to these challenges among others including incoherent governance structure, a lot of the local producers have abandoned their business because of less profit gains (Khan and Afzal, 2018). Meanwhile, Mensah-Bonsu et al. (2019) suggested the need to identify the strengths and opportunities among all the actors in the broiler chain for competitive benefits.

Recently, value chain analysis has grown in prominence, mostly for identifying and prioritizing interventions and developing strategies for sectors (Amaya et al., 2020; Findlay and Hoekman, 2021; Knez et al., 2021). Researchers like Pietrobelli and Saliola (2008) and Bolwig et al. (2010) in developing nations have employed value chain methodologies to capture the linkages as well as the interactions of the various key participants in all stages of the poultry sector. However, none of these studies comprehensively captured each actor's strengths, challenges, opportunities and threats, as well as the governance structure, profitability and determinants of the broiler industry.

The ensuing discussions strongly suggest an urgent need to look more holistically at the broiler value chain as a system of interacting actors, each with its values, strengths, weaknesses, opportunities and threats. In this context, this paper seeks to analyze the value chain of the broiler industry in the southern sector of Ghana by identifying and mapping the various

actors, their functions and existing linkages; examine the governance structure along the value chain; determine the value-added by each actor; analyze the profitability and their determinants; and identify the strengths, weaknesses, opportunities and threats that exist along the broiler value chain in the southern sector of Ghana. It is believed that the findings and recommendations of this paper can be adopted for sustainable agricultural production and replicated in other developing countries.

## MATERIALS AND METHOD

### Study area and data collection

The study was carried out in the southern sector of Ghana including Greater Accra, Ashanti Region and Bono Regions due to the prevalence and significant share of the country's commercial broiler production (21.1%, 14.2% and 13.7%, respectively) in the selected regions (Tuffour and Oppong, 2014; Amanor-Boadu et al., 2016; Yevu and Onumah, 2021). The study locations also have large broiler markets (live broiler export to neighboring countries and for local markets) and poultry laboratory centers to boost the broiler industry (Yevu and Onumah, 2021).

The study adopted a mixed approach to obtain both qualitative information through focus group discussions (FGD) and quantitative data (for statistical analyses) through structured questionnaire administration. Quantitative data collected from each actor (producers, processors and distributors) covered their production, operational and financial information. A total of 180 broiler producers (sole ownership and partnership) were obtained from the three regions (60 each) with the help of extension personnel using a random sampling technique. Snowball sampling was employed in capturing information from 65 distributors and 45 retailers due to their small number and dispersed nature from the three regions.

Three FGDs among the actors in each region, totaling nine, were conducted. Ten participants including both male and female were involved in each FGD to understand, map and identify the actors. Actor characteristics, trade flows and interconnections, as well as the behavioral habits observed along the chain, were obtained (Kaplinsky and Morris, 2000). In addition to the FGD, information from key stakeholders (president, vice and secretary of the poultry farmer's association, group of farmers,

distributors and processors) was obtained. Before the main data collection, a pilot survey was conducted to validate the suitability and appropriateness of questions. Through this process, errors identified were omitted to ensure that quality data were obtained for the analysis.

### Analytical perspective

#### *Profile and existing linkages among actors*

This study considered the framework proposed by the Foreign Investment Advisory Service (FIAS) (Subramanian, 2007) to map the core chain linkages among the broiler actors. FIAS described each activity in the chain as consisting of three main elements: source, make and delivery. The 'source' refers to the process of procuring goods and services as inputs for production, 'make' concerns to the processes necessary to transform raw or intermediate inputs into a finished product, whilst 'delivery/use' denotes to moving of finished products or services to either the next production activity or to the final consumer.

In this study, a flow diagram is used to establish all the operational stages that the broiler meat moves through from the point of production until it reaches the consumer. This follows closely to what Austin (2007) described as the production chain linkages. Austin (2007) also proposed horizontal relationships which refer to those elements in the chain that are not directly part but whose activities have an impact on the performance of the value chain. These include technical advice, financial services, food safety standards and government policies that affect the broiler industry. The mapping of activities and actors in the chain is outlined and generated from a primary survey and FGD according to Rosales et al. (2017).

#### *Governance structure along the chains*

Gereffi et al. (2005) defined governance as authority and power relationships that determine how financial, material and human resources are allocated and moved within a chain. Governance analysis allows the understanding of how a chain is controlled and coordinated when certain actors in the chain have more power than others. The scoring exercise adopted by Kaplinsky and Morris (2000) in terms of 'importance' and 'influence' the actors exert was used. 'Importance' is assessed as the actor's ability to significantly affect the operations of the chain, whilst 'influence' means the power to exert control on other actors or situations along the chain.

To determine the power relations, actors in the broiler value chain were required to respond to indicators pertaining to profit, bargaining power, protection from competition and information concentration (Pervan et al., 2017). Respondents were asked to score their positions in terms of the 'influence' and 'importance' they exert on each of the indicators. The higher the score (between 0 and 100%), the higher the level of importance and influence, indicating dominance along the value chain.

### Estimation of costs, value-added and returns

The broiler value addition focuses on aspects of a product that make it desirable to a consumer and identifies the most cost-effective method of producing it. It usually strikes the right balance between the product's quality and cost (fixed and variable components) as noted by Jakub et al. (2015).

#### *The fixed cost estimation*

Fixed cost items do not vary with the level of production and may include housing, drinking troughs, feeding troughs, wheelbarrows, spades and other inputs for production. The fixed cost components for processors are a freezer, weighing scale, gas cylinders, stoves, utensils, storage housing and other cooking equipment. The fixed cost component recorded for broiler distributors is storage housing to keep the leftovers of birds and transportation of logistics. A summation of the depreciated fixed cost components generates the total fixed cost. Brierley (2016) expressed the fixed cost as Equation 1.

$$TFC_j = \sum_{i=1}^n FC_j \quad (1)$$

Where,  $TFC_j$  = the total fixed cost,  $FC_j$  = the depreciated fixed cost of the  $i^{\text{th}}$  item.

#### *Variable cost estimation*

Variable costs vary directly with the level of operation and include the cost of labor, transportation, electricity, some taxes, fuel, drugs, feed, day-old chicks (DOCs) and packaging materials for producers. The variable costs for distributors include those for matured broiler birds, rent, drugs, transportation, tax, marketing and loading. Transportation, water, fuel, matured broiler birds, tax, ingredients and packaging materials were among the variable cost items considered for the processors. The total variable cost per actor was obtained by summing the product of the unit price of the various variable items and the quantity used. Brierley (2016) and

Onumah et al. (2020) specified the variable cost as Equation 2.

$$TVC_j = \sum_{i=1}^n p_i x_i \quad (2)$$

Where,  $p_i$  = the unit price,  $x_j$  = quantity.

#### Estimation of total cost

Total cost is the summation of total fixed cost and total variable cost incurred by each actor (Brierley, 2016). Mathematically, total cost is expressed as Equation 3.

$$TC_j = TFC_j + TVC_j \quad (3)$$

Where,  $TC_j$  = total cost incurred by 'j' actor,  $TVC_j$  = total variable cost incurred,  $TFC_j$  = total fixed cost incurred. This paper reports on average cost for all the actors and is specified as: Average  $TC = \frac{TC_j}{N}$ , where  $N$  = number of respondents.

#### Value-addition estimation

The value added by producers, distributors and processors was calculated by subtracting the price at which a primary input was acquired by an actor from the price at which they sold their finished goods (Cassing, 1996). This is expressed as Equation 4.

$$VA = SP - VP \quad (4)$$

Where,  $VA$  = value added,  $SP$  = selling price,  $VP$  = the value of primary input that is purchased from the preceding stage. Consistent with Anang et al. (2013), the study computes the value addition along the chain per one bird.

#### Profitability and its determinants

The profitability of the actors along the broiler value chain was analyzed using the net farm income (NFI) technique. Onumah et al. (2020) reported that this analytical model is a better approach compared to the gross margin (GM) technique due to the inherent consideration of both fixed and variable costs for the computation of total cost. The NFI is expressed as Equation 5.

$$NFI = \text{Total revenue (TR}_i) - \text{Total cost (TC}_i) \quad (5)$$

Where, the total revenue is specified as  $TR = \sum_{i=1}^N PQ_i$ . The  $P$  = the average price of a bird and  $Q_i$  = the number of boiler birds sold by the  $i^{\text{th}}$  actor. Drawing from Mensah-Bonsu et al. (2019), computations were conducted per 100 birds for cost and revenue to facilitate comparisons across the actors. This paper further

computes the return on investment (ROI) (Equation 6) for each actor as a measure of the profitability of the various actors along the value chain.

$$ROI = \frac{NFI}{TC} \quad (6)$$

To analyze the determinants of profitability for the various actors and consistent with Wu and Banker (2010); Cheng and Han (2014); Onumah et al. (2020), the modified Cobb Douglas profit function as seen in Equation 7 was adopted. The traditional and subsistent farming enterprise assumptions were employed as the underlying principles for variable selection (Akinola and Adeyemo, 2008).

$$Y = AX_1^{\beta_1} X_2^{\beta_2} \dots X_n^{\beta_n} e^{k_1 Z_1 + k_2 Z_2 + \dots + k_n Z_m} \quad (7)$$

$$Z = \begin{cases} 1 \\ 0 \end{cases}, \text{ Dummy variable}$$

The modified Cobb–Douglas model is expressed as Equation 8.

$$\begin{aligned} \ln NFI_i = & \beta_0 + \beta_1(\text{Access to credit}_i) + \\ & \beta_2(\text{Gender}_i) + \beta_3(\text{Education}_i) + \\ & \beta_4 \ln(\text{Household size}_i) + \\ & \beta_5 \ln(\text{Experience}_i) + \\ & \beta_6(\text{Business training}_i) + \\ & \beta_7 \ln(\text{Age}_i) + \\ & \beta_8(\text{Extension contact}_i) + \\ & \beta_9(\text{Farm ownership}_i) + \\ & \beta_{10}(\text{FBO membership}_i) + \\ & \beta_{11}(\text{Type of feed}_i) + \varepsilon_i \quad (8) \end{aligned}$$

Where,  $\beta_0$  = constant term;  $\beta_{1-11}$  = coefficients to be estimated of the following explanatory variables; access to credit, gender, education, business training, extension contact, farm ownership, farmer based organization (FBO) membership and type of feed are measured as dummy variables;  $\varepsilon_i$  = error term. Education involves dummies for primary, junior high, senior high and tertiary, with no education as a base. Household size, experience and age are measured as continuous variables. Extension contact, farm ownership, FBO membership and type of feed are peculiar to producers.

#### SWOT matrix

The SWOT (strengths, weaknesses, opportunities, threats) analysis is frequently used among the scientific techniques that evaluate possible factors acting as bottlenecks

Table 1. Variable selection for SWOT matrix analysis

Strength indicator	Weakness indicator	Opportunity indicator	Threat indicator
Skilled human resources	Financial constraints	Support from development project	Competitor with high technology
Easy access and direct distribution channel	Poor management	Culturally acceptability by many people in the sub-region	Tax increments
Fulfillment of consumer's preferences	Small scale of production, processing and distribution	Growing demand	High-cost production
Contribution to livelihoods of rural households	Limited availability and access to improved technology	Access to industry information	Lack of capital access
Low mortality rate		Availability of unskilled labor	Importation
<b>High Profit</b>			

or opportunities for prioritizing developmental strategies within a specific sector (D'Adamo and Rosa, 2016). The SWOT analysis investigates two major kinds of influencing elements: *internal factors* (strengths and weaknesses) and *external factors* (opportunities and threats) to support operational decisions (Kurttila et al., 2000; Falcone et al., 2020). SWOT analysis was used to identify measures to enhance the profitability of the Swiss wood supply chain (Oswald et al., 2004); to investigate the biofuels sector in Kentucky (Catron et al., 2013), to evaluate the role of forest fuel management in wildfire prevention in Spain (Marino et al., 2014) and to assess the effectiveness of joint forest management in Southern Burkina Faso (Etongo et al., 2018). Lucian (2015) also used the SWOT analysis to investigate the poultry meat chain in Romania.

This paper considers the SWOT to offer viable strategies based on plausible combinations of strengths, weaknesses, opportunities and threats as outlined in Table 1 (Falcone et al., 2020). The results from the SWOT matrix are presented in a cobweb structure in which the middle takes a value of 0.00, representing the least weight. The outer cortex/edge takes a value of 1.00, representing the highest weight. For this study, more focus was placed on values ranging from 0.4 and above.

## RESULTS AND DISCUSSION

### Mapping of value chain actors in the broiler industry

Figure 1 describes the movement of birds among actors in the broiler value chain from production to the end-user as seen in similar

studies (Austin, 2007; Rosales et al., 2017). The study found that after about 8 weeks of production, almost 98% of the broiler birds are ready to be marketed at an average weight of 2.4 kg with only about 2% of the birds lost to disease outbreaks, theft and or own consumption. This indicates that broiler farmers are highly efficient in their operations with low mortality rates.

Findings demonstrated that approximately 42% of broiler birds are directly exported by producers to neighboring countries like Cote d'Ivoire through contracting, whilst 30% are sold to distributors (wholesalers), 2% to retailers, 10% to processors and 14% directly to consumers. These farmers directly sell to the neighboring countries due to their inability to process these live birds into dressed and cut parts (drumstick, breast, thigh, wings, backs and necks) attributable to insufficient processing centers and low taste for unprocessed poultry.

Ortega and Tschirley (2017) noted that the sale of perishable goods like meat products to neighboring countries is common in developing countries. Aslam et al. (2020) also found that farmers in Africa sell an appreciable amount of produce at the farm gate to consumers to minimize transportation costs. Out of the 30% supply received by distributors, 15% is channeled to exporters and the rest to marketing hubs in cities or other parts of the country for retailers (3%), processors (1%) and consumers (11%). Processors with 11% transfer 1% of what they receive to retailers and 10% directly to consumers, whilst retailers sell all what they receive (6%) to consumers. Broiler retailers and processors typically have cages or stands in marketplaces

where they sell to final consumers regularly (Khairunnesa et al., 2020).

The broiler value chain is also supported by organizations and services that are not directly involved in production, processing or distribution such as input suppliers (DOCs and feed providers, other poultry equipment), technical and extension services, financial institutions, veterinary services, transport services and government organizations such as the Ministry of Food and Agriculture (MoFA), Food and Drugs Authority (FDA) and Ghana Standard Authority (GSA). The study revealed that farmers/producers obtain DOCs primarily from importers (95%) and on occasion, from local hatchery (5%). This result agrees with that of a previous study (Mensah-Bonsu et al., 2019), which recorded 90% of DOCs from importers. Farmers seek for technical advice from extension agents, MoFA and research institutions on management practices, and from veterinarians on vaccination and medication protocols as reported by Afakye et al. (2020). Financial service providers lend to actors along the chain while the transporters convey birds to marketing outlets. Islam et al. (2016) noted that regulatory bodies (FDA and GSA) are responsible for ensuring feed quality control and certification in the poultry value chain.

**The governance structure along the chain**

The governance structure is examined in relation to the share of profit, bargaining power, protection from competitors and information concentration by actors (Essegbey, 2009).

As shown in Table 2, some actors wield immense power and influence over the activities and operations of others in the chain. Producers exert the highest influence and importance in relation to the share of profit due to the possession of a higher number of birds compared to distributors and processors. This is because these large poultry farms in the country control a significant share of the poultry value chain and generate significant profits. Distributors were revealed to have the highest bargaining power, whilst processors exert the highest power in terms of protection from competition. Processors and distributors are usually small, so they form collusion (informal cartels) to monopolize their activities along the chain. They leverage their collusion to increase their bargaining power against competitors (Mondliwa et al., 2021). In terms of information concentration, distributors are seen to wield high importance and influence. This is because they transact business with all the actors hence having access to various information in the value chain. Among all the indicators, the profit share is considered as the main driver of the poultry industry (Adeyonu and Odozi, 2022). Thus, producers are regarded as key governors within the chain. They lead, coordinate and make choices on species to produce, the duration of the production cycle, time of delivery and market channel to sell to. Ncube (2018) in accessing the Southern African poultry value chain showed similar results, where producers were found to dictate the way standard birds are raised.

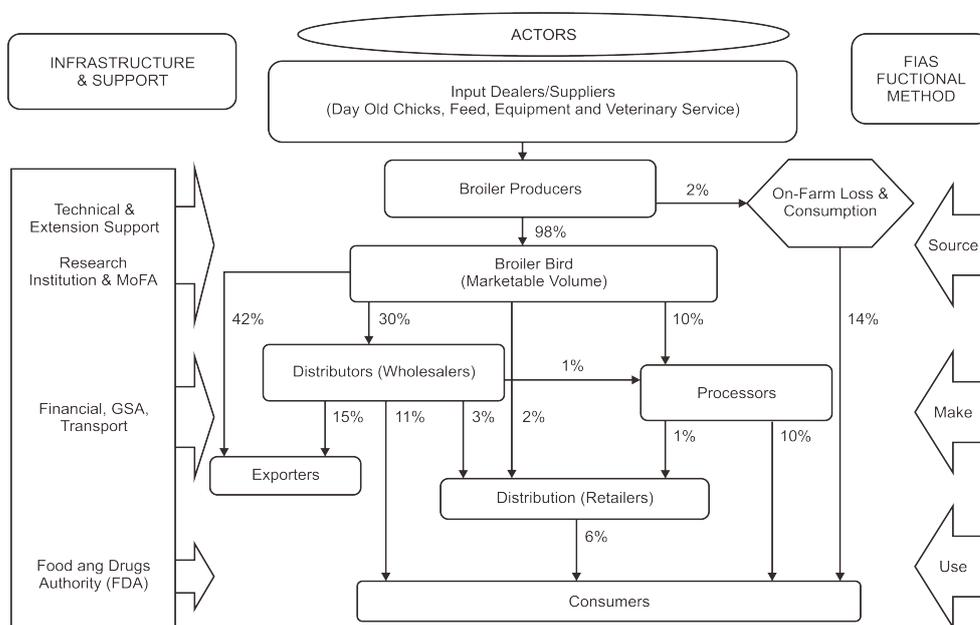


Figure 1. Map of value chain actors in the broiler industry

### Estimation of value addition, NFI and ROI

Actors along the broiler chain have different cost and revenue streams due to differences in the type of value-addition and the end product. Table 3 presents the costs incurred in adding value, the revenues accrued, the value-added and the returns on investment of each actor.

Broiler processors incurred the highest cost (GH¢ 2405.4) due to the high variable cost of inputs such as poultry birds (8 weeks or older). This is followed by distributors (GH¢ 2364.5) and then producers (GH¢ 1143.2). The processors utilized the market to earn the highest income of GH¢ 3360.0 with a NFI about GH¢ 954.6. This is followed by distributors with GH¢ 3128.0 and GH¢ 763.5 NFI. Producers accrued the lowest revenue of GH¢ 2156 but had the highest NFI of GH¢ 1012.8 due to the lowest cost of GH¢ 1143.2 along the chain because of low production cost. This finding is consistent with the report of Mensah-Bonsu et al. (2019) that producers were the highest profit earners in the poultry business.

The study further revealed that producers add a value of GH¢ 15.7 representing 45.2%, followed by processors (GH¢ 11.0) with a percentage of 31.7%. Distributors added the least value of GH¢ 8.0, representing 23.1%. The producers' high-value addition might be linked to activities such as the provision of a housing unit, feeding, vaccination and medication (Ahiale et al., 2019). Processors also added value by dressing the bird

(killing and de-feathering, icing) and cutting it into parts. Distributors, mainly sell broiler birds in the same state as purchased from the producer. They only feed, provide medication at some point and transport the birds to market centers.

Producers had the highest ROI of 89%, which is consistent with earlier findings of the highest share of profit. This may imply that for every GH¢ 1.0 investment in producing broiler birds, producers generate an additional GH¢ 0.89. The ROI derived from the study is higher than the 56% obtained by Etuah et al. (2020) in their study on profitability and constraints of broiler production in the Ashanti Region of Ghana. Kaliba et al. (2018) argued that producers over the years have adopted improved production methods, use of improved breeds, equipment and management practices for improved productivity. Processors and distributors had 40% and 32% of returns on their investments respectively.

### Determinants of profitability among the various actors in the chain

Results of factors influencing the profitability of actors in the broiler value chain are presented in Table 4. Access to credit was revealed to be positive for all three actors but was only statistically significant at a 1% level for distributors. This indicates that distributors may have properly managed the credit received from financial institutions for their relatively

Table 2. Power relations among the actors in the broiler value chain

Indicators	Importance		Influence	
	Highest	Lowest	Highest	Lowest
Share of profit	Producer	Processor	Producer	Distributor
Bargaining power	Distributor	Processor	Distributor	Producer
Protection from competition	Processor	Producer	Processor	Distributor
Information concentration	Distributor	Producer	Distributor	Processor

Table 3. Estimated cost, NFI and ROI among actors

Items	Actors		
	Producer	Distributors	Processors
Fixed cost	142.8	50.1	112.1
Variable costs	994.1	2,292.5	2,269.3
TC	1,143.2	2,364.5	2,405.4
Selling price	22.0	31.0	35.0
TR	2,156.0	3,128.0	3,360.0
Value added	15.7	8.0	11.0
Gross margin (GM)	1,155.6	813.5	1,066.7
Net farm income	1,012.8	763.5	954.6
ROI	0.89	0.32	0.40

Note: TC = total cost; TR = total revenue; ROI = return on investment

higher variable cost (Table 3) to increase their profit by 1.46%. The result confirms the assertion that access to credit brought additional working capital to distributors that enhanced their distribution volume for profit gains (Harianto et al., 2019).

Gender was estimated to positive among all the actors but only significant with producers. The study revealed that male producers earn higher profits (0.939%) than their counterparts females. It may be explained that broiler production is laborious and time demanding making it difficult for females to fully engage in it. Females double to be caretakers of the home,

and hence unable to spend enough time and energy during the production cycle. This result however is a direct contradiction to the result of Hassan (2017) who found higher profits for female poultry producers compared to male farmers.

Education variables are estimated to be positive under all actors and statistically significant with respect to distributors and producers. However, the effect of primary school education on producers are identified to be negative though the relationship is weak (Table 4). The study found that distributors and producers who have some level of education

Table 4. Estimates of the determinants of profitability for the various actors along the value chain

	Distributors		Processor		Producers	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Access to credit	1.464***	0.495	0.428	0.352	0.146	0.134
Gender	0.946	0.582	0.263	0.167	0.939***	0.181
Primary school	2.811***	0.653	0.345	0.303	-0.005	0.247
MSLC/JHS	2.324***	0.692	0.104	0.247	0.656***	0.246
SHS/Technical/Vocational	3.659***	1.053	0.623*	0.354	0.666**	0.257
Tertiary					0.860***	0.293
Household size	-1.097*	0.622	0.259*	0.139	0.260***	0.087
Experience	0.370	0.490	0.761***	0.198	0.862	0.743
Business training	0.019	0.527	0.340**	0.154	0.284	0.198
Age	-13.714**	6.300	0.388	0.261	-0.466**	0.233
Use of extension service					0.216	0.192
Farm ownership					-0.380***	0.122
Member of FBO					0.184	0.131
Type of feed used					0.563***	0.166
_cons	47.626	18.843	5.456	0.850	10.348	0.943
Observation	55		42		170	
Prob > F	0.000		0.000		0.000	
Adjusted R-squared	0.6202		0.8599		0.6111	

Note: MSLC = middle school living certificate; JHS = junior high secondary; SHS = senior high secondary; FBO = farmer based organization

The results of the modified Cobb–Douglas model is expressed as:

LnNFI (Distribution)

$$= 47.626 + 1.464(\text{Access to Credit}) + 0.946(\text{Gender}) + 2.811(\text{Primary}) \\ + 2.324(\text{MSLC/JHS}) + 3.659(\text{SHS/TECH/VOX}) - 1.097\text{Ln}(\text{Household Size}) \\ + 0.370\text{Ln}(\text{Experience}) + 0.019(\text{Business Training}) - 13.714\text{Ln}(\text{Age})$$

LnNFI (Processors)

$$= 5.456 + 0.428(\text{Access to Credit}) + 0.263(\text{Gender}) + 0.303(\text{Primary}) \\ + 0.104(\text{MSLC/JHS}) + 0.623(\text{SHS/TECH/VOX}) + 0.259\text{Ln}(\text{Household Size}) \\ + 0.761\text{Ln}(\text{Experience}) + 0.340(\text{Business Training}) + 0.388\text{Ln}(\text{Age})$$

LnNFI (Producers)

$$= 10.348 + 0.146(\text{Access to Credit}) + 0.939(\text{Gender}) - 0.005(\text{Primary}) \\ + 0.656(\text{MSLC/JHS}) + 0.666(\text{SHS/TECH/VOX}) + 0.860\text{Ln}(\text{Tertiary}) \\ + 0.260\text{Ln}(\text{Household Size}) + 0.862\text{Ln}(\text{Experience}) \\ + 0.284(\text{Business Training}) - 0.466\text{Ln}(\text{Age}) + 0.216(\text{Extension Contact}) \\ - 0.380(\text{Farm Ownership}) + 0.184(\text{FBO Membership}) + 0.184(\text{Type of Feed})$$

(primary, middle/junior or senior high school/ Technical/Vocational and tertiary) increased their level of profit. The result supports the argument that educated actors could adapt to modern technologies for higher productivity (Onumah et al., 2018) and apply various marketing principles to their business and thereby make the best from their market transactions (Khan and Afzal, 2018; Onumah et al., 2018; Mukta et al., 2019). Khan and Afzal (2018) also noted that educated actors especially producers are also to diagnose sick and unhealthy birds for medical attention, thereby increasing broiler output for profit gains.

The effect of household size on profit is estimated to be positive for processors and producers but negative under distributors. The result indicates that an increase in household size by a member would result in a 1.1% reduction in profit of distributors. This may imply that distributors with larger household sizes may apportion some of the marketable birds for household consumption requirements thereby reducing the number of birds sold and hence a reduction in profit. Also, an increase in a producer's household size by one member would result in a 0.260% increase in profit. This may suggest that producers with larger household sizes may involve family labor in production, resulting in reduced cost in activities to increasing their profit as demonstrated by Etuah et al. (2020).

This study found that the experience had a positive and significant effect on the profit of processors. A one-year gain in experience by the processor may lead to an increase in profit by 0.761%. This finding corroborates the assertion by Tuffour and Oppong (2014) that poultry actors who have been in business for a considerable length of time may enhance their output gains through efficient management practices to increase profit. However, the result of the study is contrary to the conclusions from Yevu and Onumah (2021) and Onumah et al. (2018) who argued that more experienced actors turn to shun innovative new ideas for profit maximization. Receiving business training is revealed to have a positive and significant effect on the profit earned by processors. Processors who received business training, for example on the need to process poultry birds into cut-parts increased their profit by 0.34%. This is expected as Lee (2009) and Mukta et al. (2019) noted that in-service training for businesses increased output and hence profit.

The age of an actor is estimated to be negative and statistically significant on the profit of distributors and producers. However, the effect of age on the profit of processors is identified to be positive but statistically insignificant. The study found that a year's gain in the age of distributors and producers may lead to a decrease in profit by 13.7% and 0.466%, respectively. The core work of distributors is the movement of birds from one point to the other and this involves traveling long distances. Traveling long distances might not be good for the elderly as it affects their productivity and in turn reduce their profits. Kusi et al. (2015) acknowledged that poultry production is a laborious work which might not favor the elderly who might not have the full strength to manage the herculean production practices thereby reducing their profits.

The farm ownership estimate is revealed to be significantly negative, indicating that producers who individually own and manage their farms are operating with less profit compared family and group owned farms mostly managed by hired people. The field survey revealed that family and group owned farms are usually large and may take advantage of economies of scale to increase productivity and profit Onumah et al. (2018). Moreover, hired managers usually give off their best especially when given targets with incentives to reach a certain output goal. These hired managers are typically employed with skills, innovative ideas, technological know-how and marketing expertise to enhance profitability. Though this result is contrary to the findings of Gourlay et al. (2019) that farm owners should refrain from sticking to old ways of production if they are to maximize output leading to increased profit.

The results on the type of feed used by producers showed a statistically significant effect on profit. Producers who use commercially prepared feed increased their profit by 0.563% more than their counterparts who use locally formulated feed. Though commercial feed is expensive, they are well formulated with the necessary ingredient for healthy and better poultry growth (Glencross, 2020). Thus, committing to better incentives such as subsidies to increase the use of commercial formulated feed would boost the poultry industry in Ghana. This is because farmers who locally prepare their poultry feeds are not able to combine the various ingredients in their right proportions for maximum growth of birds.

## SWOT analysis of the broiler value chain

### Analysis of internal broiler factors

This is categorized under strengths and weaknesses. The results from Figure 2 showed that contribution to the livelihood of households is identified as a major strength for processors and to some extent for producers and distributors. Actors were of the view that poultry is a major livelihood option that serves as a 'safety net' and poverty reduction tool, whilst providing income for households. GSS (2019) acknowledged that livestock including poultry plays a significant role in rural livelihoods and food security. Producers' strength also includes their ability to leverage on low mortality rate for higher productivity leading to increased profit as noted also by Abdul-Rahman (2017). Findings also revealed that easy access to direct distribution channels and availability of skilled human resources major strengths for distributors. Contrary to these results, Sattar et al. (2021) noted that factors influencing poultry production and distribution networks in Bangladesh became a challenge during the Covid-19 pandemic.

Small scale of operation, limited availability and access to improved technology, financial constraints were major weaknesses identified with processors. However, producers and distributors were revealed to be faced with access to improved technologies and poor management challenges. Aslam et al. (2020) found poor management to be

one of the challenges facing the chicken subsector in Pakistan. Birhanu et al. (2021) also found some of these weaknesses as major challenges to the progress of traditional village chicken production in Africa and argued the need to adopt an integrated approach to transform local production techniques into a commercially oriented production system with modern technologies through efficient financing structure.

### Analysis of the external environmental factors

Externally, support from development projects for the broiler industry is ranked as a major opportunity among all three actors (Figure 3). These supports may either come from the government such as the rearing for food and jobs, and removal of customs duties on poultry inputs; and from the private sector such as transportation and processing facilities (Kusi et al., 2015). Access to industry information was also ranked as a key opportunity by all actors, especially processors. Ready information on available inputs at affordable prices; accessible production, distribution, and processing technologies; and efficient market infrastructure for all actors can boost the development of the poultry industry (Wong et al., 2017).

The availability of unskilled labor is ranked as the third important opportunity, especially for processors. Causal labor could be obtained and given in-service training at a reduced daily wage to increase productivity. In a similar study

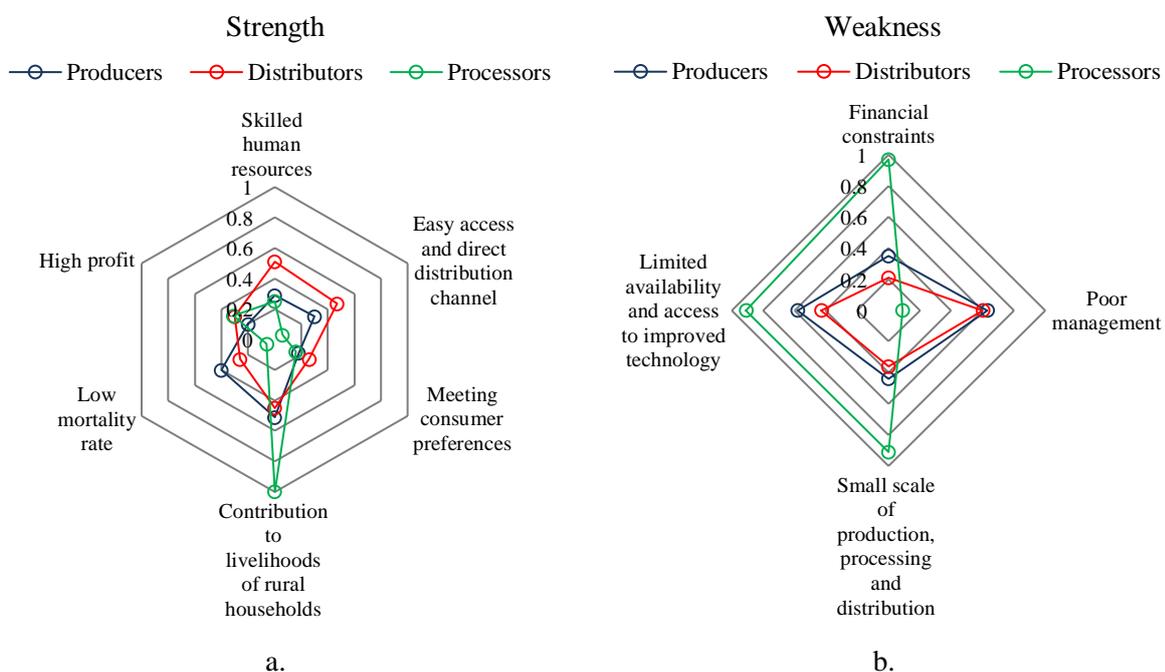


Figure 2. Results of SWOT analysis a) strength and b) weakness; internal factors of the broiler value chain

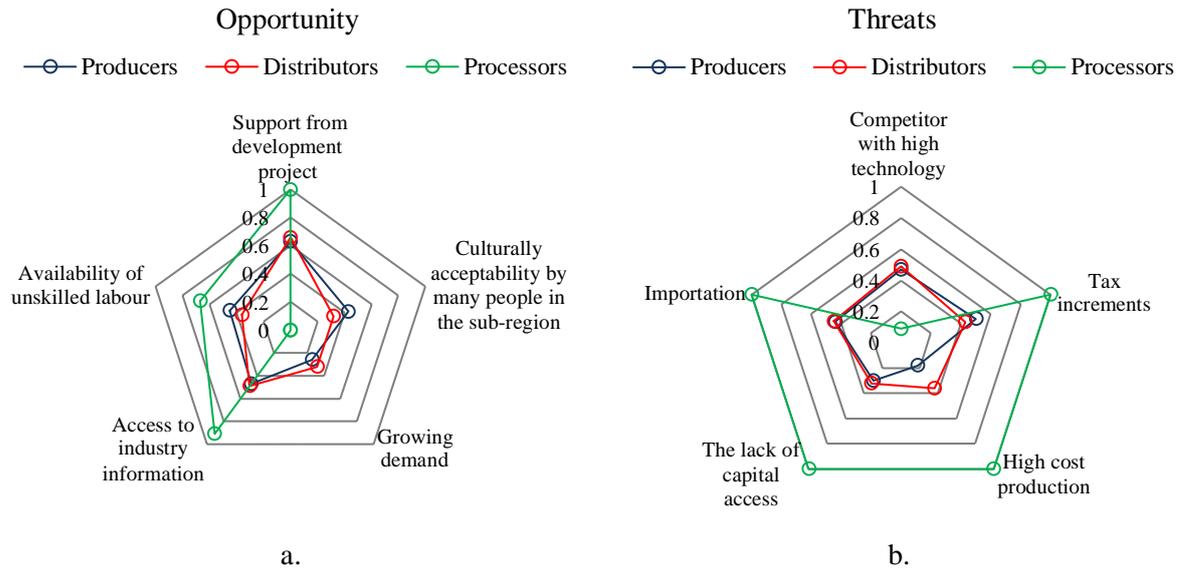


Figure 3. Results of SWOT analysis a) opportunity and b) threats; external factors of the broiler value chain

conducted by Dahlan et al. (2020), labor was noted as a major opportunity for the broiler industry. Importation of frozen chicken, increase in tax, lack of capital access and high cost of operation were highly ranked by processors, as well as by producers and distributors as major threats, though producers felt not threatened by high cost of production. As noted by Queenan et al. (2021), high importation undermines local actors' confidence to invest in business expansion.

## CONCLUSIONS

The paper revealed that producers in the broiler chain are regarded as the key governors, whilst distributors and processors who are smaller in size form cartels and leverage their collusion for greater bargaining power and protection against other investors. The study further demonstrated that access to credit, gender, education, experience, business training and type of feed positively influenced the profits of broiler actors. However, age and farm ownership had a negative effect on the profits of distributors and producers in the chain. The SWOT analysis internally revealed contribution to the livelihood of households as a major strength for processors, producers and distributors, whilst financial constraint is revealed as weaknesses among actors. Externally, support from development projects is ranked as a key important opportunity, whilst importation of frozen chicken is identified as a major threat in the poultry sector.

The study recommends all actors to ensure product upgrading and standardization to improve governance along the chain. Government and all stakeholders should carry out policy reforms that will ensure gradual reduction of imported chicken products, whilst pursuing measures to boost the local poultry industry for profit gains through cost minimization, investment in input supply, processing technologies, and provision of business training.

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