Perceived governance structure and constraints in the pig supply chain in Ghana

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ABSTRACT

This study examined farmers' perceived governance structure including contracting and power relations, and actors' constraints in the pig supply chain. A multi-stage sampling procedure was used to obtain cross sectional data from producers, collectors and processors. The empirical results revealed that contractual relationships between farmers and other actors are uncommon in the pig supply chain, with only 9.9% of the farmers and 12.5% of processors having verbal contracts with other actors in the supply chain. The two most constraining factors of the producers, collectors and processors were the high cost of inputs and poor access to credit. Overall, the producers are perceived to rank highest in terms of bargaining power and information concentration, while collectors and input suppliers have the highest influence on profit and protection from competition. The role of producers' speculation of the market power and training on contracting are critical to enhancing their performance in the pig supply chain.

Keywords: governance structure, market power, contracts, Ghana

Introduction

The livestock sector is important to the Ghanaian economy although its contribution to the gross domestic product remains low (7.5%) (Ghana Statistical Service, 2013). Nevertheless, the sector creates employment opportunities, thereby improving rural livelihood, food security, and financial reserves of the actors in the supply chain (Perera and Jayasuriya, 2008; Sesay, 2016).

The livestock supply chain includes all the activities needed to bring a product (e.g. live animals, meat, milk, eggs, leather, fibre, manure) from production, processing and distribution to final consumers (International Fund for Agricultural Development (IFAD), 2006). The stakeholders include middlemen or firms who perform activities such as transporting, processing, storing, selling, buying, packaging of a product before it finally gets to the consumer. In addition, government agencies that set rules and formulate policies (e.g., Ghana Standard Authority, Food and Drugs Board, Ministry of Food and Agriculture), and information brokers who keep the market players informed about prices and quantities play key roles in the livestock supply chain.

The term 'governance' is defined as the processes by which transactions are coordinated between two or more actors, either within the boundaries of a single organization or between two or more organizations to ensure that they are smooth (Ruuska *et al.,* 2010). Governance structure seeks to explain the rules that operate in a supply chain, how actors are coordinated and regulations that govern value generation in the supply chain. It consists of a set of coordination mechanisms including verbal contact, written contract, spot market contract, horizontal integration, vertical integration that allow supply chain actors to cooperate and minimize opportunistic behavior (Williamson, 1985; Gereffi *et al.,* 2005; Raynaud *et al.,* 2005; Zhang and Aramyan, 2009; Wever *et al.*, 2010). Food supply chain governance increases competition among actors, mitigates conflict,

promotes cooperation among actors, and streamlines the supply chain by getting rid of superfluous or unnecessary activities and specifies the roles of the actors, thereby improving product quality and minimizing cheating in the supply chain (Williamson, 1999; Vorst and Beulens, 2002; Adger *et al.,* 2003; Vurro *et al.,* 2010; Vlajic *et al.*, 2012; Lumineau and Henderson, 2012; Rota *et al.,* 2013).

Numerous studies have revealed that livestock farmers get cheated by other actors in the supply chain (e.g. traders and middlemen). This happens because of weak market systems, information asymmetry, poverty and weak bargaining power arising from illiteracy and low social status (e.g. IFAD, 2006; Lightfoot and Scheuermeier, 2007; Jitmun and Kuwornu 2019; Jitmun *et al.*, 2019).

Generally, the challenges of the Ghanaian livestock industry vary across key stakeholders. In the case of the producer and processor, poor quality of carcass is a major problem due to improper handling of animals prior to slaughter (Adzitey, 2013; Adzitey *et al.*, 2011). The other challenges confronting the sector include high utility costs, low credit support, uncertain government policy, poor information sharing among actors and unfair distribution of ultimate value of output, (indicating poor governance in the supply chain), and limited input services including commercial breeding, access to and availability of veterinary care and extension agents. These result in low productivity of pigs in terms of feed conversion and reproduction rate (IFAD, 2006; Mensah-Bonsu, 2010; International Livestock Research Institute (ILRI), 2011).

Several studies have highlighted the role of governance structure, trust, cooperation and bargaining power in food supply chains, however, empirical evidence of these indicators in the piggery sector in Ghana is scanty or non-existent (Nash, 1950; Rubinstein, 1982; Webber and Labaste, 2010; Zajac and Olsen 1993; Kuwornu *et al.*, 2004; 2005; 2006a; 2006b; 2009a; 2009b; 2018a; Kuwornu, 2006; Kuwornu and Saqib, 2017; Promme *et al.*, 2017; Saqib *et al.*, 2018; Sathapatyanon and Kuwornu, 2019).

The piggery sector is one of the key subsectors of the livestock industry in Ghana, nevertheless is the industry faces numerous challenges including high cost of inputs and imbalance power relations (IFAD, 2006; Mensah-Bonsu, 2010). The governance in the Ghanaian piggery supply cannot be fully understood without analyzing the coordination mechanism (bargaining power, profit, information concentration and protection from competition) that exists among the various actors in the supply chain, as the governance structure and the constraint variables could influence performance of the supply chain. Therefore, the objective of this study are twofold as follows: i) to explore the governance structure among the actors in the pig supply chain, and ii) to examine the constraints faced by the actors in the supply chain.

Materials and methods

Governance structure

The form of contractual agreement, terms and nature of contract that exist among actors in the chain were described using percentages.

For this study, power is defined as the level of importance and influence each actor exerts in reference to some selected indicators i.e. profit, bargaining power, protection from competition, and information concentration (CATRD, 2006; Gerrefi *et al.,* 2005; Dolan and Humphrey, 2000). The cardinal scoring approach adopted by Kaplinsky and Morris (2001) and CATRD (2006) was used to estimate the selected indicators to judge the "importance" and "influence" an actor exerted on other actor(s). The strength for all the actors (i.e. input suppliers, producers, processors and collectors) perceived by each given actor (respondent) on each of the indicators summed up to 100%, from a possible range of 0 to 100 % for each actor. The average of the scores assigned by the actors for each indicator was calculated. The higher the mean score (%), the higher the level of influence for a given indicator. The actor group which receives the highest mean score (%) for each indicator from the scoring of the respondents was considered as the dominant player in the pig supply chain.

Identification and ranking of constraints of pig supply chain actors

The constraints facing actors at each stage of the supply chain were identified from the literature and during the pre-testing of the questionnaire used for the data collection. The respondents ranked these constraints from the most pressing to the least pressing, and they were analyzed using the Garrett ranking technique specified in equation (1) as follows:

$$y = \frac{100(R_{ij} - 0.5)}{N_J} \quad (1)$$

Where: y = % position of the score, R_{ij} is the j^{th} constraint of the i^{th} respondent and N_j is the total number of constraints ranked by the j^{th} respondent. The most pressing constraints were discussed. This technique is appropriate because of the merit it has over Kendall's coefficient of concordance as it controls for inter-regional and environmental differences. The order of merit given by the respondents for the constraints was converted into scores with the help of the ranking table given by Garrett and Woodworth (1969). The constraint with the highest mean score was considered as the most pressing.

Sampling and Data

A multi-stage sampling procedure was employed to solicit data from 123 respondents in the pig supply chain through the administration of three different structured questionnaires for pig farmers, processors and collectors respectively. The respective questionnaires were pre-tested with five farmers, two processors and two collectors.

The first stage of the sampling was to purposively select the Eastern and Greater Accra regions due to considerably high livestock production in the southern part of Ghana. In the second stage, 42 pig farmers were randomly selected in the Greater Accra region from a list of 178 pig farmers obtained from Creating Competitive Livestock Entrepreneurs in Agribusiness (CCLEAr) database and 39 pig farmers were selected from the Eastern region, based on their farm size (above 10 pigs per farm). Thus, data were obtained from a total of 81 pig farmers.

With processors, 40 retail-processors were selected based on their availability and scale of production using the snow-balling technique. Finally, two collectors (local assemblers) were interviewed based on their availability using the snow-balling technique.

Results and Discussion

Governance structure among actors in the supply chain

This section presents the supply chain mapping of the pig industry in Ghana, the existence of contracts, and power relations among actors in the supply chain. The supply chain mapping of the pig industry is presented in Figure 1, and shows the flow of pig and pig products from producers to customers as well as a sequence of linkages among the various actors operating in the chain. The producers obtained inputs from both small- and large-scale input suppliers. The pig producers sold their live animals to processors (54.5%), consumers directly (33.8%) and collectors (9.1%). Only a few (2.6%) of the live animals were sold to organizations like FBOs. Processors processed their purchased pigs into either cut fresh meat (pork, 28.2%) or grilled/roasted pork (71.8%) for sale directly to consumers. The collectors who serve as middle men in the supply chain sold half (50%) of their pigs to processors and the other half (50%) directly to consumers. The study did not identify intermediary retailers between processor and consumers. The study revealed that the collectors in the pig supply chain were very few.

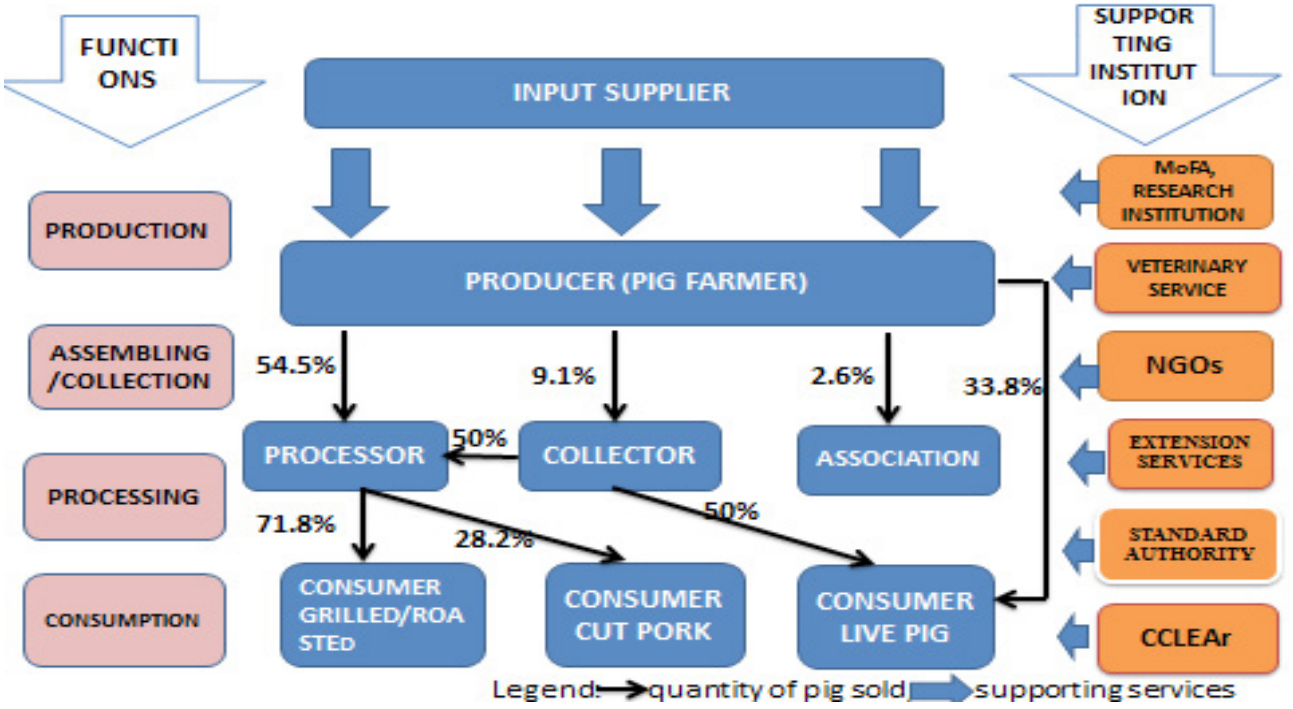

Fig. 1: Linkage among actors along the pig supply chain

Technical advice from MoFA (extension services) and other institutions like CCLEAr provided information on the best practices to be adopted by the producers. Veterinary services provided by mostly private firms enabled the producers and collectors to follow good health practices for their stock. Services offered by the Ghana Standards Authority and the Food and Drugs Authority on food safety standards and phytosanitary control assisted processors to improve on the quality of products that meet the specifications required, especially for the packed products. There was no formal financial assistance to the actors in the pig supply chain. The actors obtained financial assistance from family and friends.

Table 1 summarizes the existence and types of contract among actors in the pig supply chain and Table 2 specifies the nature of these contracts. Contractual relationship between farmers and other actors was uncommon in the pig supply chain. The majority (90.1%) of producers interviewed had no form of contract with other actors in the supply chain, while only 9.9% had contractual agreements with other actors. None of the collectors had any form of contract with their customers. With the processors, 12.5% had contracts with their customers whereas the majority (87.5%) did not have any form of contract with their customers. These results may imply that actors in the pig supply chain lack knowledge and understanding of the importance of contracts. Hence, education on contractual agreements and their relevance may be necessary.

Table 1: Existence and types of contract among the actors along the supply chain

	Producer (N=81)		Collector (N=2)		Processor (N=40)	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Existence of Contract						
Yes	8	9.9	0	0	5	12.5
No	73	90.1	2	100	35	87.5
Total	**81**	**100**	**2**	**100**	**40**	**100**
Type of Contract						
Verbal Contract	8	100	-	-	5	100
Written Contract	0	0	-	-	0	0
Total	**8**	**100**	**-**	**-**	**5**	**100**

Source: Survey data, 2016

Both the producers and processors who had contracts with their customers had verbal contractual agreements. About 63% of the producers who had contracts with their customers were provided with inputs and only a few (25%) obtained technical assistance (Table 2). These results are consistent with Suzuki *et al.* (2008) who revealed that buyers provide Ghanaian pineapple farmers with variety of inputs to guarantee quality and quantity of the final output. The results showed that 50% of the producers with contractual agreements had product supply contracts.

Table 2: Nature of contract that existed among the actors

Nature of contract	**Producer**		**Processor**	
	Yes	No	Yes	No
Provision of inputs	5(62.5%)	3(37.5%)	2(40%)	3(60%)
Provision of technical assistance	2(25%)	6(75%)	0	5(100%)
Provision of finance/ credit	0	8(100%)	0	5(100%)
Supply of product	4(50%)	4(50%)	4(80%)	1(20%)
Provision of transport	0	0	0	5(100%)

Source: Survey data, 2016

Approximately 40% of processors who had contracts with other actors had provision of input as an element of the contracts that existed between them and their customers. The majority (80%) of processors that had contracts with their customers had supply of products/ services as part of their agreements.

Table 3 presents the outcome of a scoring exercise in relation to how the actors perceive the level of importance of the indicators of power relations, which is termed the governance structure. Actors who have higher scores in relation to these indicators are considered as the key governors in the supply chain (Dolan & Humphrey, 2000).

Table 3: Perceived percentage share of power along the pig supply chain

	Indicators			
	Profit	**Bargaining power**	**Protection from competition**	**Information concentration**
Producer perception				
Input supplier	13.6	12.3	32.8	13.9
Producer	18.4	26.3	13.6	31.9
Processor	32.5	25.5	17.6	15.4
Collector	**35.3**	**35.8**	**34.6**	**38.6**
Processor perception				
Input supplier	11.9	11.3	**42.6**	13.0
Producer	**42.1**	**51.9**	28.0	**53.2**
Processor	25.1	21.9	18.3	15.2
Collector	22.1	15.1	14.4	20.0
Combined perception				
Input supplier	13.0	12.0	**35.9**	13.6
Producer	26.1	**34.4**	18.3	**38.8**
Processor	30.1	24.4	17.8	15.3
Collector	**31.0**	29.4	28.0	32.6

Source: Survey data, 2016

The results showed that collectors were perceived by producers to have the highest influence on all four indicators, namely profit, bargaining power, protection from competition, and information concentration. However, the processors also had a different view as they perceived producers to have the highest influence in terms of profit, bargaining power and information concentration, and input suppliers to have the highest influence in terms of protection from competition. Overall, the producers had the highest influence in terms of bargaining power and information concentration, whereas collectors and input suppliers had the highest influence in terms of profit and protection from competition, respectively. Contrary to the findings of this study, Owusu-Agyei (2010), revealed that distributors in groundnut value chain in Ghana have the highest influence in terms of profit. Nevertheless, our findings are consistent with Owusu-Agyei (2010) that the distributors had the highest influence in terms of bargaining power, information concentration and protection from competition. Our results are also contrary Clottey (2014) who reported that processors in the Kassena Nankana East District of Ghana were perceived to have the highest influence in terms of profit and bargaining power but to have the least influence in terms of protection from competition and information concentration. In general, it can be concluded that power does not belong to one particular actor in the supply chain, but it is spread in the supply chain, and it could differ from one product to another.

Constraints of actors along the pig supply chain

The results of the constraints facing actors in the pig supply chain are presented in Table 4.

Table 4: Ranking of constraints of producers, collectors and processors of pig

Constraints	Producer		Collector		Processor	
	Mean score	Rank	Mean score	Rank	Mean score	Rank
High cost of inputs	74.84	1st	61.00	2nd	64.48	1st
Poor access to credit	63.70	2nd	82.00	1st	59.55	2nd
Low market prices for product	51.46	3rd	50.00	5th	45.33	6th
Unavailability of market information	47.97	4th	60.50	3rd	55.77	3rd
High transportation cost	47.70	5th	41.00	9th	51.10	4th
Poor quality feed	45.10	6th	24.00	10th	31.55	10th
Poor access to product market	44.59	7th	44.00	8th	46.96	5th
High incidence of disease and pest	43.11	8th	47.50	6th	32.92	9th
Poor access to extension services	42.15	9th	47.00	7th	36.15	7th
High incidence of theft	22.73	10th	52.50	4th	34.45	8th

Survey data, 2016

Pig collectors ranked poor access to credit as their most pressing constraint and poor-quality feed as their least pressing constraint, with mean scores of 82.00 and 24.00 respectively. They argued that their business is capital intensive, but they have no access to credit. The collectors further argued that unlike processors who can purchase their inputs on credit and pay back after selling, collectors are only allowed to buy what they can afford at a particular time. The pig processors ranked high cost of inputs as their most pressing constraint with a mean score of 64.48. They ranked poor access to credit and unavailability of market information as their second and third most pressing constraints, respectively.

Conclusions

Ghana's economy depends heavily on agriculture and approximately 50% of its workforce is employed in this sector, with households earning about 35% of their incomes from agricultural activities. The sector keeps performing poorly, however, it is important in meeting both national and international targets in ensuring food security and poverty reduction (Institute of Statistical, Social and Economic Research (ISSER), 2013; Kuwornu *et al*., 2018b). The livestock sector is still important to the Ghanaian economy, although its contribution to the national GDP remains low. It creates employment opportunities for the population and improves their rural livelihoods and food security (FAO, 2016; Mensah-Bonsu *et al*., 2019). In 2013, Ghana's livestock sector contributed about 1.5% to the national GDP and about 7% to the agricultural sector (Ghana Statistical Service (GSS), 2014; Mensah-Bonsu *et al*., 2019). The piggery sector is one of the key subsectors of the livestock industry in Ghana, nevertheless it is facing numerous challenges including high cost of inputs and imbalance power relations in the supply chain (IFAD, 2006; Mensah-Bonsu, 2010; International Livestock Research Institute (ILRI), 2011). The objective of this study were twofold: first, to explore the governance structure among the actors in the pig supply chain and secondly, to examine the constraints faced by the actors in the supply chain.

The governance structure of the pig industry is characterized by producers' and processors' activities, few active collectors' and no retailers' activities. Contractual relationships among actors in the pig supply chain were uncommon, and in the few cases where they existed the type of contract was verbal. Only 9.9% of the farmers had contractual agreements with other actors and only 12.5% of the processors had contracts with their customers. Skills in contractual agreements and relevance may be necessary as the structure for the pig

industry develops. With respect to power relations along the supply chain, producers perceived collectors to have the highest influence on all four indicators of market power (i.e. profit, bargaining power, protection from competition and information concentration). Overall, the producers had the highest influence in terms of bargaining power and information concentration, while collectors and input suppliers had the highest influence in terms of profit and protection from competition, respectively. In general, it can be concluded that power does not belong to one particular supply actor, but is spread along the supply chain. High cost of inputs and poor access to credit are the most constraining factors of the actors (producers, collectors and processors) in the pig supply chain. The findings indicate that the majority of producers are strategizing by using more swill than formulated feed, which is cost increasing. Unavailability of financial institutions locally and the collateral requirements for accessing credit facilities are a hindrance to access to credit. Financial institutions could strategize and open up more agencies in the farm sector in order to reach out to more small-scale agro-businesses with credit and under flexible terms. Cost efficient feed meals are needed by the piggery sector actors and it is important that feed millers and formulators fulfill buyers' needs and expectations for such meals, which would also help strengthen specialization.

This study is not without limitations, for example, it examined the governance structure and constraints in the pig supply chains in the Eastern and Greater Accra regions of Ghana. Expanding these investigations to other regions of the country would be an excellent opportunity for future research. Finally, a more detailed cost-benefit analysis (including net present value, internal rate of return, and payback period) of the pig supply chain actors in other regions of the country while taking account of the size of enterprises of the supply chain actors would be another great avenue for further research.

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