Structure, Conduct and Performance of Onion Market in Southern Ghana

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Abstract

The local onion market in Ghana is dominated by 'on the spot' market relationships with little or no coordination of chains to improve quality and performance. This study examines the market structure, conduct and their influence on the performance of the onion market in the southern part of Ghana, using data from 180 actors, comprising 80 farmers, 40 wholesalers and 60 retailers. Descriptive statistics, Gini coefficient, Lorenz curve, Herfindahl-Hirschman index and Garett ranking were the methods of analysis used. The results showed that traders were operating in an oligopolistic market with Gini coefficients of 0.62 and 0.56 for wholesalers and retailers, respectively. The findings also revealed that farmers (69%) were more open to contracts than wholesalers (20%) and retailers (11%). Moreover, onion production proved to be costly for farmers as they had a negative return of 1.55% on their investment while wholesalers and retailers made positive returns of 29.85% and 31.1%, respectively. Finally, high production cost, high marketing cost and unavailability of storage structures were ranked as the most pressing constraints to farmers, wholesalers and retailers, respectively. It is recommended that the government, donor support agencies for agriculture and local NGOs come to the aid of farmers by providing them with fixed assets at a subsidized price. This will relieve the farmers from heavy losses which threaten the future food security of the country.

Keywords: horticulture; market performance; marketing system; profitability; smallholders

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INTRODUCTION

Onion production is very important to the economy of Ghana as it forms an essential part of our diets and provides employment for Ghanaians (MoFA, 2012). Akrofi et al. (2016) posit that it is difficult to assume a traditional Ghanaian dish without an onion, indicating its dominance in the kitchen. Its cultivation is dominated by women (Rabiou et al., 2018) and this provides a huge opportunity for the government to use the value chain of onion

as a strategy for women empowerment programs in Ghana. Besides, rural-urban migration is low in areas where onion cultivation remains the main income-generating activity (ASNAPP, 2011). This commodity is largely grown in the northern regions of Ghana where it provides jobs for young people mainly during the long dry season (MoFA, 2012). During the major dry season, many young people who would usually migrate to the southern part of Ghana in search of jobs stay to cultivate onion. Hence, onion farming can reduce the rural-urban drift,

which is at its peak during the dry season. Although the Ghanaian onion market is growing at 11% per annum, it is largely driven by importation from Niger, which accounts for about 57% of the market share (ASNAPP, 2011; Akrofi et al., 2016). The annual average value of Ghana's onion imports in 2011 and 2016 were 13,418,000 USD and 9,206,000 USD, respectively (FAOSTAT, 2016). This is worrying given the potential of the crop to thrive in Ghana. Notwithstanding the demand and opportunity the onion market provides, most farmers claim they are not able to break even during annual glut periods due to the lowering of price (Abdulai et al., 2017). Farmers' risks are worsened by the high perishability of onions, which reduces their bargaining power and rather increases that of the buyers. Eventually, farmers' profit distribution in the chain is affected. Although challenging, the common factors indicate that farm profit can be achieved by reducing cost through economies of scale and input-output improvement, as well as increasing revenue through production capacity expansion and better crop prices. These intertwined features should be included in any design or promotion of sustainable agricultural systems and agricultural technologies (Simtion, 2015; Tey and Brindal, 2015).

The Government of Ghana has instituted programs such as "Planting for food and jobs and One village one Dam" to increase local food supply. Aidoo et al. (2012) argued that reducing food marketing costs through efficient and effective marketing systems is as important as producing more food. Horticultural market inefficiencies and lack of infrastructure have negative repercussions on the general economy due to their results in high market prices and dwindling market growth (Aidoo et al., 2012; Mossie et al., 2020). Under the aforementioned imperfect market situation, there remains the need for a thorough study of onion production and marketing to reveal the nature of profit distributions, the characteristics of the market which inform the conduct of market participants and subsequently, market performance. This paper addresses the questions: what are the characteristics, structure, conduct and performance (SCP) of onion marketing channels in Southern Ghana and what are the associated constraints? According to Abdulai et al. (2017) and Ocholi et al. (2021), there is information

asymmetry in the onion market that allows intermediaries to distort prices leading to market imperfections. With developments in the onion marketing sector, Niger, for instance, makes a lot of foreign earnings from exporting about 95% of local production. Ghana has derived plenty of benefits from developing the production and marketing system of cocoa. Similar successes can be chalked if the onion market is targeted for development as done by Niger. With better marketing strategies, Ghana will be able to meet its local demand and export to other countries. To devise appropriate marketing strategies, it is necessary to examine the structure of the market, the behavior of the actors in reaction to the market structure and the performance of the major actors in the market.

According to Bukar et al. (2015), economists have frequently used the SCP framework to examine the effectiveness of marketing systems and industrial performance. It has evolved to provide insight into the behavior of actors in the industrial sector (Ayele et al., 2017). The framework includes analytical tools for examining the relationship between market structure and market participant's behavior as well as its impact on the overall market performance of the entire market (Jabbar, 2010; Bukar et al., 2015).

Phuu (2016) has noted that imperfect market structure is divided into three categories on both the supply and demand sides: monopoly, monopolistic competition and oligopoly on the supply side and monopsony, monopsonist competition and oligopsony on the demand side. According to Tung et al. (2010), the market's behavior is determined by how sellers and buyers interact with one another. Furthermore, the firm's structure has an impact on the actors' behavior in that the greater the degree of concentration, the greater the likelihood of anti-competitive behavior, such as collusion (Rajendran, 2015; Ayele et al., 2017).

Although the horticulture sector has been critical for most agrarian African economies, contributing to poverty reduction and food security, the sector has received little attention (Aliyi et al, 2021). According to Aliyi et al. (2021), major poverty reduction strategies across the continent should be based on increasing agricultural production and promoting market efficiency by increasing peasant farmers' access

and integration, as well as formalizing market interaction exchange.

Based on the report by the Ministry of Food and Agriculture (MoFA), onion cultivation covers 8,530 hectares, with an annual production of around 65,000 metric tons, supporting many smallholder farmers. However, Abdulai et al. (2017) reported that no empirical data existed or were made available to the public confirming the profitability of vegetable production and marketing in Southern Ghana. That notwithstanding, analyses of market performance and efficiency are crucial for effective policy formulation and decision-making.

The work of Akrofi et al. (2016), for instance, looked primarily at the farming practices employed in onion production and their effects on onion output. Abdulai et al. (2017) conducted a similar research to determine the performance of spring onions, cabbage and lettuce agents in peri-urban Kumasi. Obviously, there is a knowledge gap in, especially, the nature of the structure and conduct of contemporary onion marketing systems in Ghana. The study provides a detailed description of the various actors in the chain, how farmers get their products sold through the available alternative market channels, the level of information flow in the chain, the governance structure and the margin

distributions in the chain. Non-governmental organizations and policymakers will benefit from the information from this research to better target the needs or pressing constraints in the chain. Finally, marketers, extension agents, farmers (and farmer associations) will also use the research findings to improve their service and or margins.

MATERIALS AND METHOD

Study area and data

The study was conducted in the Kwahu South District and Kumasi Metropolis of Ghana (Figure 1 and 2). The Kwahu South District is located on longitude 0°55" W and 0°20" W and latitudes 6°35" N and 6°45" N of Ghana (GSS, 2017). Kumasi Metropolis, on the other hand, is situated between latitudes 6°35" N and 6°40" N and longitudes 1°30" W and 1°35" W.

The study used data collected from farmers, wholesalers and retailers across two regions in the Southern belt of Ghana. The data on farmers were gathered in the farming areas around the Abram River basin in the Kwahu South District of the Eastern Region of Ghana. Primary data on wholesalers and retailers were also obtained at Anloga and Kwadaso onion markets in the Kumasi metropolis of the Ashanti Region.
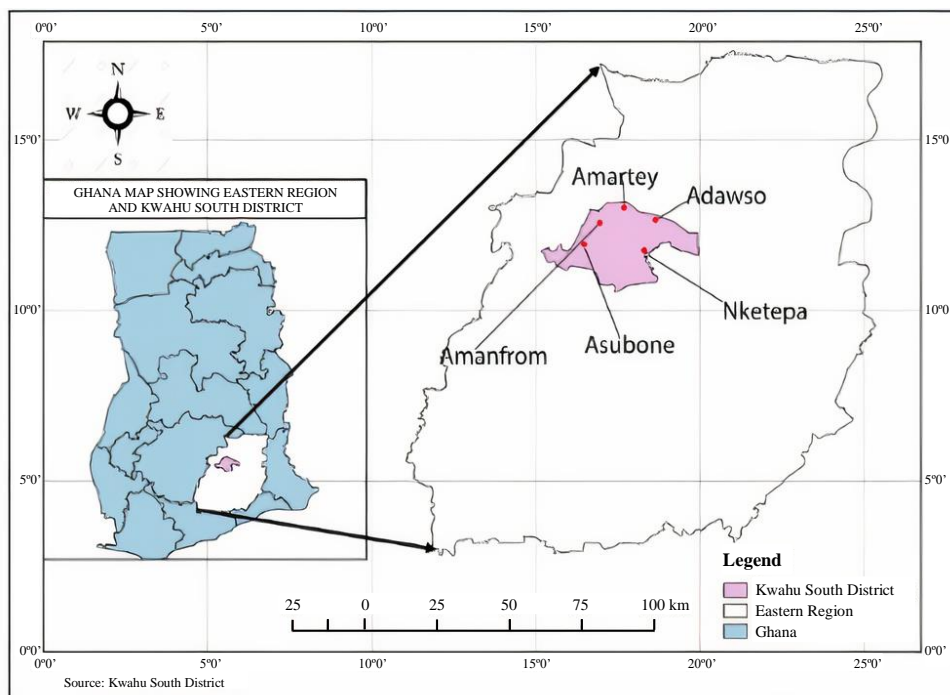

Figure 1. Map of Kwahu South District of Ghana
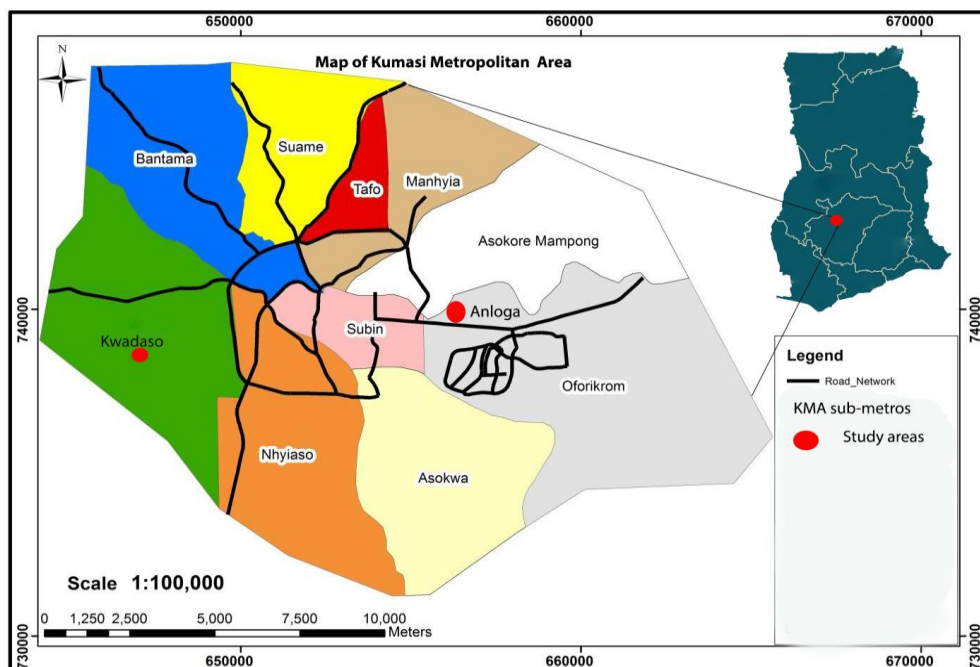Source: Department of Architecture, KNUST (2019)

Figure 2. Map of Kumasi Metropolis of Ghana
Source: Department of Architecture, KNUST (2019)

A two-stage sampling technique was employed to select onion farmers. In the first stage, Kwahu South District was purposively selected based on the report by Akrofi et al. (2016) that the district is among the largest onion-producing areas in southern Ghana. Consultations were made with the district's agricultural department to select five major onion-producing communities based on the total land size allocated and the number of farmers. A list of onion farmers within each community was generated and used to prepare a sampling frame. Eighty (80) producers were randomly selected in the second stage based on the number of farmers in each community.

Kumasi metropolis was chosen based on the report by ASNAPP (2011) on the value chain of onion in Ghana, suggesting that Anloga onion market in the Ashanti Region, Techiman Central market in the Bono East Region and Agbogbloshie market in the Greater Accra Region are the three biggest onion markets in Ghana. Angloga and Kwadase markets were purposely selected since they were the preferred destinations for onions coming from Kwahu South District. Forty (40) wholesalers were randomly selected from a list of traders in Angloga while snowballing was used to identify the first 60 retailers visiting the Kwadaso market early in the morning.

The total sample size for the study was 180, comprising 40 wholesalers, 60 retailers and 80 onion farmers. Table 1 shows the number of respondents and their respective towns/ communities from which they were selected. The table shows that majority of the respondents were from Adawso (51%) and Amanfrom (35%).

Table 1. Sampling of farmers

Town	Sample	Percentage (%)
Amartey	6	8
Amanfrom	28	35
Adawso	41	51
Nketepa	3	4
Asubone	2	3
Total	80	100

Methods of data analysis

Measurement of market structure, conduct and performance (SCP)

Descriptive statistics was used to describe the socio-economic characteristics of the respondents and markets and a flow chart was utilized to describe the marketing channels. The SCP model was also employed in analyzing the structure, conduct and performance of the onion market.

Market structure

In the traditional SCP model, the market structure is analyzed using market concentration,

product differentiation strategies and the barriers to entry. To measure the market concentration, the Gini coefficient, Lorenz curve and Herfindahl-Hirschman Index (HHI) were employed. According to Tiku et al. (2012), the Gini coefficient can be computed using the formula in Equation 1.

$$GC = 1 - \Sigma XY \qquad (1)$$

Where; GC represents the value of the Gini coefficient, X represents the percentage of sellers in the market and Y represents the cumulative proportion of sales. The GC ranges from 0 to 1; values which are closer to 0 indicate perfect equality and thus, there is no difference between the market shares held by individual actors. Conversely, values close to 1 indicate perfect inequality: only one actor or few actors control(s) the entire market (Tiku et al., 2012; Bannor and Oppong-Kyeremeh, 2018). In imperfect markets, the general rule of thumb is that a market share above 50% but less than 100% is oligopolistic (Phuu, 2016). Lorenz curve was used in the identification of the market structure and power determining the degree of competition in the onion markets (Bannor and Oppong-Kyeremeh, 2018). When the Lorenz curve is closer to the equality line, it shows that there is perfect equality in the distribution of onion quantity handled for all actors in the industry and vice versa. The Herfindahl-Hirschman Index (HHI) has been used widely in several industries to measure market concentration. The HHI squares the market share ratios of all firms or individuals and finds their sum. Mathematically, it is given by the formula in Equation 2.

$$HH = \sum_{i=1}^{n} S_i^2 \qquad (2)$$

Where; S_i represents the market share percentage held by the ith firm while n represents the total number of firms in the industry. The minimum ratio of HHI is zero (0) and indicates many equal-sized firms. Also, HHI of one (1) means only one firm is in the market and therefore enjoying a monopoly. With the HHH, the European Commission et al. (2004) have developed a scale to analyze the level of concentration. These include:

HHI below 0.10 - unconcentrated market
HHI > 0.10 < 0.20 - mildly concentrated market
HHI above 0.20 - highly concentrated market

The degree of price collusion was determined by assessing whether there existed trade associations or unions regulating the practices of market actors. The extent of product differentiation techniques was analyzed using the issue of firms employing several means to differentiate their products from competitors.

Direct barriers to entry such as possession of an operating license may not be observable in many agricultural markets in developing economies. However, indirect barriers such as the average start-up capital required to enter a market and the level of technicality involved in the business may exist (Phuu, 2016).

Market conduct

To determine the conduct of the market participants, the following variables were used:

Advertising and sales promotion: The kind of advertisement and promotion employed in the market may suggest the conduct of actors, which may be aggressive or gentle.

Terms of the sales agreement: These terms stem from the relationship between the buyer and the seller. Two forms of relationship were examined, viz. the spot market relationship and the contract agreement. In a spot market relationship, the seller is free to choose who to sell to and how much to charge. However, when a contractual agreement is established, both actors behave differently than in the open market relationship (Phuu, 2016).

The price collusion activities: Two main types of collusion activities are done at the marketplace, viz. tacit and explicit collusions. Explicit collusion may occur when individual firms communicate directly to raise the price of goods in the marketplace. Conversely, tacit collusion may occur when firms communicate indirectly by monitoring competitors' actions and prices.

Market performance

The performance of the market was assessed using gross and marketing margin techniques, returns on investment and market efficiency analyses of producers, wholesalers and retailers.

Profit margin analysis: Zu et al. (2014) argue that the net profit margin measures how efficiently market actors put all resources to good uses. This study used both gross margin

and net margin analyses for measuring the financial performance of onion farmers and traders, respectively. These performance indicators are presented as Equations 3 and 4.

$$GM = TR - TVC \qquad (3)$$

$$NM = TR - TC \qquad (4)$$

Where; GM is gross margin, NM represents net margin, TR is the total revenue of onion market actors and TC is the total cost of production. TR and TC were calculated as Equations 5 and 6.

$$TR = price \times quantity \qquad (5)$$

$$TC = TFC + TVC \qquad (6)$$

Finally, the net margin percentage was computed as Equation 7.

$$NMP = \left(\frac{Net\ margin}{Total\ Revenue}\right) X\ 100 \qquad (7)$$

Where; TC represents total cost, TFC is the total fixed cost of onion market actors and TVC is the total variable cost of production.

Returns on investment (ROI): This measures the value that is accrued to the business for every cedi invested. The formula used was in Equation 8.

$$ROI = \left(\frac{Net\ margin}{Total\ Production\ Cost}\right) \qquad (8)$$

Marketing efficiency: The marketing efficiency in the onion market was computed. It measured how effective the marketing system in Kumasi metropolis was with regards to using few resources to obtain a high output. Following Haruna et al. (2012) and Adegbite and Adejobi (2018), it was measured as Equation 9.

$$M_e = \left(\frac{Net\ marketing\ Margin}{marketing\ cost}\right) X\ 100 \qquad (9)$$

Equation (8) is for a channel, hence it includes all the net marketing margins and net marketing costs for each actor on a channel. A wide positive difference in the farm-gate and final consumer price will indicate high marketing efficiency values. According to Haruna et al. (2012), a high

marketing efficiency should not be celebrated as it may suggest that some actors are being made worse off. For example, traders with a higher marketing efficiency may be receiving abnormal profits while the farmers may be making losses.

Garett's ranking technique

The constraints faced by the various actors were analyzed using the Garett ranking technique. The percentage position using this technique is given as Equation 10.

$$Percentage\ Position = \frac{100\left(R_{ij} - 0.5\right)^o}{N_j} \qquad (10)$$

Where; R_{ij} = Rank given for the ith variable by the jth respondent; N_j = Number of variables ranked by the jth respondent. Respondents were asked to rank constraints in order of decreasing importance. The most pressing constraint was ranked as one (1) while the least important was ranked as last. The Garett formula was used to generate a percent position for each rank, which was then converted to a score using the Garett tables. The scores were then added together and divided by the population to determine the mean scores. The mean scores were then graded.

RESULTS AND DISCUSSION

Socioeconomic characteristics of actors

Table 2 presents the socioeconomic characteristics of the actors in the marketing channels. Male dominance in the production of onion was evident as 90% of the producers were males. This result is consistent with Abrha et al. (2020) who noted that male-headed households were 93.4% whereas female-headed households were 6.6% across the onion-producing areas in Medebay Zana district of northern Ethiopia. Female household heads were discouraged from farming generally due to housekeeping duties, constant fluctuations in prices, as well as high start-up and working capital. They also faced more challenges finding buyers.

The retailer market was however dominated by females (80%). The wholesaler's market was made up of 100% males. Few of the wholesalers opined that the high cost of capital could be the most important reason preventing women's participation while the majority could not pinpoint the problem. The implication is that males

dominate onion farming and wholesale marketing, while females concentrate on retailing. This finding corroborates the results reported by Aidoo et al. (2012) and Wongnaa et al. (2019). The results suggest that the majority of the farmer population was less than 50 years old. ASNAPP (2011) attributed this to the laborious nature of onion farming, which requires energetic people. Similar results were recorded for the wholesalers and retailers (Table 2). Most farmers (82%) received formal education with the majority graduating from junior high schools. This level of education improved the farmers' understanding of onion farming provided by extension officers. Most wholesalers (52.5%) and a relatively high percentage of retailers (46.7%), on the other hand, had no formal education. This finding compares well with the similar finding reported by Mohamed (2018) even though it contradicts those of Taye et al. (2018).

Table 2. Socio-demographic characteristics of the respondents

Variable	Farmers		Wholesalers		Retailers	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Gender						
Male	72	90.0	40	100.0	12	20.0
Female	8	10.0	0	0.0	48	80.0
Total	80	100.0	40	100.0	60	100.0
Age group (years)						
Below 21	0	0.0	0	0.0	4	7.0
21-34	24	30.0	0	0.0	8	13.0
35-48	27	34.0	25	62.0	40	66.0
49-62	19	24.0	12	30.0	4	7.0
Above 60	10	12.0	3	8.0	4	7.0
Total	80	100.0	40	100.0	60	100.0
Educational level						
No formal education	14	17.50	21	52.5	28	46.7
Primary school	25	31.25	9	22.5	12	20.0
Middle school/JHS	29	36.25	6	15.0	16	26.7
SSS/SHS	8	10.00	4	10.0	4	6.7
Training college	1	1.25	0	0.0	0	0.0
University	3	3.75	0	0.0	0	0.0
Total	80	100.00	40	100.0	60	100.0
Marital status						
Married	68	88.0	38	95.0	48	80.0
Single	12	15.0	2	5.0	12	20.0
Total	80	100.0	40	100.0	60	100.0
Religion						
Muslim	11	13.8	35	87.5	49	81.7
Christian	65	81.3	5	12.5	11	18.3
Traditionalist	1	1.3	0	0.0	0	0.0
Pagan	3	3.8	0	0.0	0	0.0
Total	80	100.0	40	100.0	60	100.0
Farm holdings (ha)						
0.4-4	70	87.50	-	-	-	-
4.4-8	3	3.75	-	-	-	-
8.4-12	2	2.50	-	-	-	-
12.4-16	3	3.75	-	-	-	-
16.4-20	2	2.50	-	-	-	-

The study also found that 88% of producers, 95% of wholesalers and 80% of retailers were married. The average household size of farmers was 7 while wholesalers and retailers had household sizes of 5 and 4, respectively (Table 2). This shows that farmers had the highest dependency ratio among all the actors even though it serves as a source of labor to support onion production. This result corroborates the findings of Wongnaa et al. (2019) that the average household size from a sample of farmers was 8.

The average farm size of Kwahu South District onion farmers is 2.55 hectares, with land productivity of 33 kg ha^{-1} (Table 2). Almost one-half of the farming households hold less than 2 hectares of land (5 acres). This is consistent with similar findings reported by GSS (2017). The average farm size of 2.55 ha in the area attests to the fact that there is medium scale production ongoing in the district as reported by Opoku-Ankomah (2000) when compared with GSS (2017), which has claimed that the majority of onion production in Ghana is on a small scale (less than 2 ha). Two of the farmers indicated that they were past winners of the regional best farmers' award. They had farm sizes above 19 ha producing over 1000 bags of onion individually.

Onion market distribution channels

The marketing channel at Kwahu South District of Ghana is illustrated in Figure 3. The figure shows that the major players involved in the onion distribution in the study areas included the producers, wholesalers and retailers. Moreover, 92.5% of farmers sold the onion directly to wholesalers. The remaining 7.5% sold the commodity to consumers and retailers in the Kumasi Central market and other markets. The implication is that onion farmers normally sell their yields to wholesalers. From the producers' perspective, the wholesalers are mostly relatives and friends from three main markets, viz. the Agbogbloshie onion market in Accra and Kwadaso and Angloga onion markets in Kumasi (Figure 3). The findings of this study, however, are in contrast with those of Haruna et al. (2012) that the majority of tomato farmers (37.5%) sold their products to processors, 26.7% sold their yields to wholesalers, while 30% sold them to retailers, given that both onion and tomatoes are vegetables. The contrasting results may be because onions are normally not processed in Ghana but are liked and sold in the whole country. This makes the market channels available to onion farmers linear as presented in Figure 3.
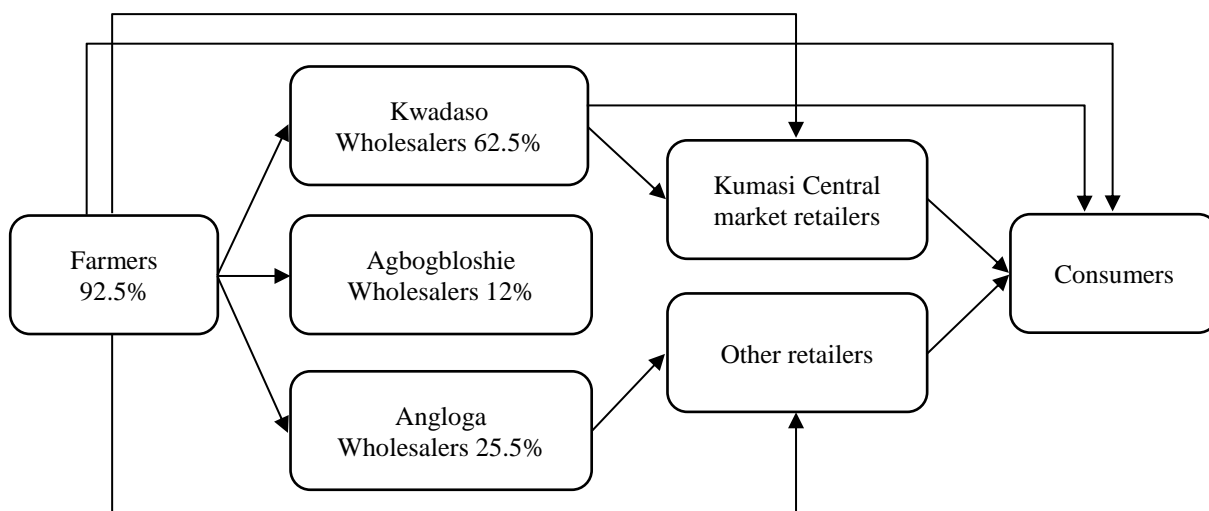

Figure 3. Channels of distribution of onion in the onion market

Structure, conduct and performance of onion market

Market structure of onion market

The Gini coefficients obtained for wholesalers and retailers as presented in Table 3 were 0.62 and 0.56 respectively. This signifies a strong oligopoly market structure, which therefore connotes high concentration in the onion market, where few big sellers control the pricing instead of demand and supply. A high oligopolistic

market underlines high market inefficiency. This finding is in line with those of previous studies conducted in Ghana and other parts of the world (Tiku et al., 2012; Haruna et al., 2012; Phuu, 2016; Ahmed et al., 2018). The results of the HHI are presented in Table 4, where 0.39 and 0.29 HHIs were indicated for wholesalers and retailers respectively. This confirms the existence of high market concentration. The HHIs of 39% and 29% also depict a very high level of income inequality in distribution among the traders. The market structure is further illustrated using the Lorenz curve (Figure 4). It can be inferred from the curve that the distribution of incomes across the marketing channel is not normal as the Lorenz curves for all actors moved away from the equality line. The further the curves move away from the line of equality, the more concentrated the market structure. All curves lay away from the equity line but the wholesalers' curve shows more inequality than the retailers.

It can be seen from Table 5 that the average capital required to cultivate a one-acre onion farm was GH¢ 5531 (914.22 USD), while wholesalers and retailers needed an average of GH¢ 15,025 (2483.47 USD) and GH¢ 637 (105.29 USD), respectively, to operate a profitable onion trading business. Retailers require a relatively lesser amount of capital to start trading and this may suggest a weaker barrier as compared to the wholesalers involving a huge sum of money. This result is in line with the findings of Moepeng (2013) and Phuu (2016) that potential vegetable farmers had to invest on average, an amount of 2,115.5 USD to start a profitable farm business.

Table 3. Gini coefficient analysis for traders

Group	No. Sellers	Proportion (X)	Cum. Prop of sellers	Total sales (kg)	Prop. Sales (Y)	Cum Prop of sales	(X)*(Y)
				Wholesalers			
1	15	0.38	0.38	513,500	0.12	0.12	0.05
2	11	0.28	0.65	682,500	0.16	0.28	0.08
3	8	0.20	0.85	985,400	0.23	0.52	0.10
4	6	0.15	1.00	2,017,600	0.48	1.00	0.15
Total	40	1		4,199,000	1.00		$\sum XY = 0.38$

GC = 1–$\sum XY$ = 1– 0.38 = 0.62

Group	No. Sellers	Proportion (X)	Cum. Prop of sellers	Total sales (kg)	Prop. Sales (Y)	Cum Prop of sales	(X)*(Y)
				Retailers			
1	20	0.33	0.33	59,800	0.15	0.15	0.05
2	18	0.30	0.63	79,820	0.20	0.36	0.11
3	14	0.23	0.87	111,800	0.29	0.64	0.15
4	8	0.13	1.00	140,660	0.36	1.00	0.13
Total	60	1.00		392,080	1.00		$\sum XY = 0.44$

GC = 1–$\sum XY$ = 1– 0.44 = 0.56

Table 4. HHI for traders

Population	Wholesalers			Retailers		
	Income (GH¢)	Market share ratio (X)	$\sum (X^2)$	Income (GH¢)	Market share ratio (X)	$\sum (X^2)$
Lowest 25%	2,569,300	0.06	0.004	580,387	0.10	0.010
Middle lower 25%	6,300,200	0.16	0.025	686,800	0.12	0.014
Middle upper 25%	8,808,000	0.22	0.049	1,411,340	0.24	0.058
Top 25%	2,227,100	0.56	0.311	3,172,750	0.54	0.294
Total	3,994,850	HHI	0.390	5,851,277	HHI	0.380

Table 5. Summary of cost items

|	Farmers				Wholesalers				Retailers			
	Mean	Mode	Max	Min	Mean	Mode	Max	Min	Mean	Mode	Max	Min
Harvested (bags ha^{-1})	207.54	350.00	1500.00	10.000	-	-	-	-	-	-	-	-
Selling price kg	0.868	0.763	1.526	0.509	1.674	1.907	2.289	0.889	1.911	2.086	3.051	1.271
Start-up capital	914.215	826.446	1157.025	413.223	2483.471	1652.893	6611.570	991.736	105.289	66.116	495.868	8.264
Fertilizer ($ kg^{-1})	0.230	0.015	0.245	0.017	-	-	-	-	-	-	-	-
Pesticide ($ kg^{-1})	0.218	0.018	0.251	0.013	-	-	-	-	-	-	-	-
Seeds ($ kg^{-1})	0.182	0.030	0.331	0.008	-	-	-	-	-	-	-	-
Fuel ($ g^{-1})	0.083	0.017	0.116	0.033	-	-	-	-	-	-	-	-
Land rent ($ g^{-1})	0.198	0.051	0.218	0.007	-	-	-	-	-	-	-	-
Labour cost ($ g^{-1})	0.251	0.253	0.509	0.116	-	-	-	-	-	-	-	-
Wellington boots ($ kg^{-1})	0.017	0.002	0.007	0.000	-	-	-	-	-	-	-	-
Sprinklers ($ kg^{-1})	0.083	0.050	0.114	0.000	-	-	-	-	-	-	-	-
Pipelines ($ kg^{-1})	0.013	0.002	0.091	0.000	-	-	-	-	-	-	-	-
Water machine ($ kg^{-1})	0.021	0.002	0.233	0.000	-	-	-	-	-	-	-	-
Knapsack ($ kg^{-1})	0.003	0.002	0.043	0.000	-	-	-	-	-	-	-	-
Cutlasses ($ kg^{-1})	0.003	0.002	0.020	0.000	-	-	-	-	-	-	-	-
Hoes ($ kg^{-1})	0.002	0.000	0.017	0.000	-	-	-	-	-	-	-	-
Sacks ($ g^{-1})	-	-	-	-	0.003	0.002	0.005	0.000	0.038	0.033	0.051	0.002
Loading ($ kg^{-1})	-	-	-	-	0.005	0.018	0.038	0.002	0.020	0.025	0.083	0.003
Offloading ($ kg^{-1})	-	-	-	-	0.002	0.002	0.002	0.000	0.036	0.033	0.083	0.002
Toll ($ kg^{-1})	-	-	-	-	0.003	0.051	0.069	0.000	0.003	0.018	0.020	0.000
Transportation cost ($ kg^{-1})	-	-	-	-	0.200	0.169	0.334	0.167	0.033	0.051	0.084	0.002
Net ($ kg^{-1})	-	-	-	-	0.041	0.051	0.083	0.000	0.003	0.002	0.007	0.000
Polyethylene sheet ($ kg^{-1})	-	-	-	-	0.003	0.002	0.010	0.000	0.038	0.028	0.083	0.010
Bucket ($ kg^{-1})	-	-	-	-	0.002	0.002	0.017	0.000	0.033	0.041	0.066	0.002
Pallet ($ kg^{-1})	-	-	-	-	0.003	0.005	0.066	0.002	0.020	0.025	0.083	0.002
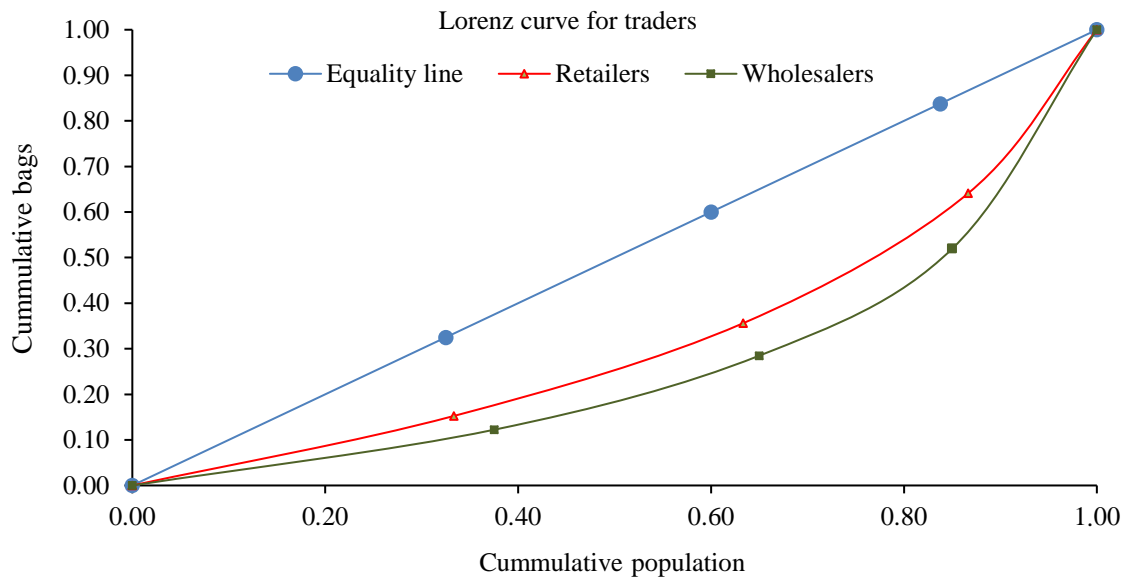
Figure 4. Lorenz curve for traders in the onion market

According to Wongnaa et al. (2019), age and knowledge provide an experience that allows farmers to develop methods of carrying out tasks efficiently and at the lowest possible cost, which is a prerequisite for building profitable businesses. Therefore, experience (age) is positively related to performance and the average number of years of experience of the actors may be a barrier to entry for some new individuals (Wongnaa, 2016). Based on Table 6, the mean years of experience for wholesalers was 22 years while that of retailers was 9 years. This may also suggest that the wholesale market was relatively more difficult to enter as a new entrant might need a lot of time to learn the core skills to thrive in the business.

Table 6. Summary statistics of actors

		Farm size (ha)	Household size	Experience (years)
Farmer	Max	19.60	36	54
	Mean	2.55	7	9
	Min	0.40	1	1
	std. dev	2.90	4.67	9.77
Wholesaler	Max	-	13	30
	Mean	-	5	22
	Min	-	2	10
	std. dev	-	3.25	8.08
Retailer	Max	-	11	27
	Mean	-	4	10
	Min	-	2	2
	std. dev	-	4.12	6.05

Conduct of actors in onion market

Table 7 demonstrates that 71% of wholesalers and 17% of retailers used phone calls to advertise or promote their onions. About 20% of wholesalers made use of social media to advertise or promote their products, while 9% utilized other methods, such as print media and word-of-mouth strategy. Wholesalers were much organized in the chain and had a closer relationship with their customers. Wholesalers gave onions to retailers on credit, hence a form of contractual relationship was created. From the retailers, it was observed that most of them (76%) did not advertise their onions. For the few that advertised their products (17%), their most frequent mode of advertisement was through

phone calls. Retailers had little close contact with consumers and as such did not collect information about their consumers. The few who contacted consumers had a relationship with food service centers which they alerted whenever they had fresh stock. The terms of the sale agreement are also presented in Table 7. Exchange can occur when an agreement is made between the producer and the buyer concerning the payment and delivery (Phuu, 2016). Onion farmers may decide with traders the payment scheme, price and delivery before production starts.

Table 7. Conduct and strategies of actors

Variable		Farmers (%)	Wholesalers (%)	Retailers (%)
Advertisement	Phone calls	11	71	17
	Social media	0	20	7
	Others	0	9	0
	None	89	0	76
	Total	100	100	100
Terms of trade	Contract	69	20	11
	Spot market	31	80	89

Table 7 shows that 69% of producers sold on a contract basis and 31% sold on the spot market system. About 20% of wholesalers marketed on a contract basis and 80% promoted on the spot market system. The wholesalers had a list of regular and faithful customers who determined the quantity and the price at which the onions would be traded although this sales strategy was not very popular as only 20% engaged in it. Furthermore, retailers had fewer contractual relationships, with only 11% having some level of agreement with buyers. Over 89% sold onions in the 'open market' or 'on the spot' to a diverse range of customers who frequently made a one-time purchase. This study observed that retailers having no contracted customers employed a more aggressive form of marketing and thus, in a bid to capture more market share, they used 'sweet words' and 'promises' to lure consumers. Aliyi et al. (2021) noted in his research on 'Profitability and market performance of smallholder vegetable production' in Ethiopia that contract marketing had a positive impact on the onion market at a significance level of 1%, implying that actors who had contracts were likely to sell off all their produce

The degree of collusion among market participants is also discussed. According to Kumar et al. (2016) and Felis and Garrido (2015), firms collude to limit the quantum of goods on the market or raise the price to make greater profits. There were no vibrant cooperative associations among all the actors. Farming activities and the decision on marketable surpluses were determined independently.

The absence of trade associations means that farming and trading are not regulated and actors determine their pricing based on their marginal cost of production (Ocholi et al., 2021). Producers did not have farmer-based organization to coordinate market supply and hence, give them less market bargaining power. Retailers likewise want to enjoy their independence and therefore not willing to cooperate. However, the wholesalers showed much enthusiasm as they had made necessary steps to establish an active association. Some wholesalers indicated that they had joined the Ghana Agricultural Producers and Traders Association (GAPTO), which helped them in facilitating the movement of onions across the border. Due to the lack of a functioning onion cooperative association to regulate market supply, there was no limit to the amount of onion one producer could send to the market or the quantum that could be traded.

Performance of actors in the onion market

The costs and returns from a one-hectare onion farm are presented in Table 8. Harvested onions were packaged in a 65 kg bag sack^{-1}. The average price for a 65 kg bag of onion was 49.59 USD. Farmers revealed that the market price per bag rose to an all-time high of 115.70 USD per 65 kg bag in December 2018. The gross margin and net margin analyses are also presented in Table 8. Farmers incurred a total variable cost of about 1,527.27 USD per hectare and generated total revenue of 2,841.32 USD per hectare. This resulted in a gross margin of 1,314.05 USD per hectare. The gross margin of 46.25% means that for every 1.00 USD worth of sales revenue

generated, farmers gained 0.4625 USD more, implying that onion farming is highly profitable when fixed costs are not considered. Yet, this percentage is on the low side when compared to gross margin percentages reported in previous studies (Haruna et al., 2012; Zu et al., 2014; Wongnaa et al., 2014; Phuu, 2016; Wongnaa et al., 2019). Table 8 also summarizes that the return on investment in onion farming was -1.55%, indicating that farmers make a loss of 1.55% on every dollar invested into the onion business per hectare. On average, wholesalers made sales of 1.977 USD per kg and incurred a total marketing cost of 1.387 USD per kg. This translated into a net marketing margin of 0.590 USD per kg and a net margin percentage of 29.85%. Therefore, for every 1.00 USD of revenue generated, wholesalers gained approximately 0.30 USD more. Retailers also made sales of 2.721 USD per kg and incurred marketing costs of 1.874 USD. This resulted in a net marketing margin of 0.846 USD, giving a net margin percentage of 31.1%. This, therefore, implies that retailers gain the most margin (0.311 USD) more for every 1 USD of revenue generated.

Table 8. Cost and return analysis for actors in the onion market

Variables	Farmer (USD)	Wholesaler (USD)	Retailer (USD)
Revenue	2,841.32	1.977	2.721
less variable cost			
Purchasing cost kg^{-1}		0.928	1.702
Seeds per ha	133.88	-	
Fertilizer (ha)	158.68	-	
Fuel cost (irrigation) (ha)	287.60	-	
Pesticides (ha^{-1})	119.01	-	
Sack (packaging)		0.010	0.017
Total labor cost (ha)	723.97	0.267	0.021
Market tolls		0.025	0.005
Value of losses	104.13	0.007	0.014
Total variable cost	1,527.27	1.236	1.759
Gross margin	1,314.05	-	-
Gross margin percentage	7.64	-	-
Less depreciation on fixed inputs			
Land per Ha	54.55	-	-
Cutlasses	9.92	-	-
Hoe	19.83	-	-
Knapsack sprayers	104.13	-	-
Water pumping machine	312.40	-	-
Pipelines	595.04	-	-
Sprinkler	257.85	-	-
Wellington boot	4.96	-	-
Net		0.002	0.050
Polyethylene sheet		0.083	0.066
Bucket		0.033	
Pallet		0.033	
Total fixed cost	1,358.68	0.150	0.116
Total cost	2,885.95		-
Net income	-44.63		-
Return on investment (%)	0.26		-
Total marketing cost ($ kg^{-1})	-	1.387	1.874
Net marketing margin ($ kg^{-1})	-	0.590	0.846
Net margin percentage	-	29.85	31.11
Marketing efficiency (%)	1.55	42.55	45.15

Table 8 further presents traders' marketing efficiencies. The marketing efficiencies of wholesalers and retailers were 42.55% and 45.15%, respectively. A positive marketing efficiency value indicates that traders reaped the benefits from their marketing efforts. Based on the efficiency values, it is clear that retailers outperformed wholesalers. The efficiency values obtained in this study are in line with those reported by Haruna et al. (2012) and Adegbite and Adejobi (2018) for tomato traders in Pwalugu in Ghana. From the return on investment and marketing efficiency analysis, while farmers lost money on their onion production business, wholesalers and retailers earned money. Also, retailers received the highest returns in the onion market followed closely by wholesalers while farmers made losses. This finding disagrees with reports of previous studies (Haruna et al., 2012; Zu et al., 2014; Abdulai et al., 2017; Wongnaa et al., 2019) that farmers were wrong for claiming that they were being cheated in the market as margins were not fairly distributed.

Constraints faced by actors

High production costs, high marketing costs and unavailability of storage structures were ranked as the most pressing constraints for farmers, wholesalers and retailers, respectively (Tables 9 and 10). Wongnaa et al. (2019) however reported that the most significant challenge faced by vegetable farmers in the Kumasi metropolis was the lack of land tenure security. Haruna et al. (2012) also reported that the main challenge for tomato farmers in the Upper East region of Ghana was low price. The current study produces similar results as the low price of onions was ranked second among onion farming households. However, this may be due to the poor quality of onions as compared to competitors from Burkina Faso and Niger. A report by Mohamed (2018), which contradicts the current study's findings, stated that onion traders in Adawama State of Nigeria faced a major challenge with getting access to credit. This was however ranked 6th for both wholesalers and retailers in the current study. The total losses to farmers amounted to 43.81 tons, representing 4% of the total weight of onions harvested (114.218 tons). Findings from this study suggest that the incidence of both pre-harvest and post-harvest losses was not a significant problem in the Kwahu South District in general. However, questions are raised as nearly 63% of all losses in the entire district were from Amanfrom (Table 11).

Table 9. Constraints faced by farmers in the onion market

Constraints	Mean score	Rank
High production cost	69.8	1st
Low market price	69.3	2nd
Pest and diseases	67.6	3rd
Road network	61.9	4th
High cost of irrigation	61.0	5th
Storage facility	59.2	6th
Buyer access	55.0	7th
Credit availability	49.8	8th
Land tenure insecurity	43.3	9th
Lack of price information	32.2	10th

Table 10. Constraints faced by traders in the onion market

Constraints	Wholesalers		Retailers	
	Mean score	Rank	Mean score	Rank
High marketing cost	71.5	1st	56.6	4th
Low output price	64.8	2nd	70.0	1st
Poor market sanitation	59.1	3rd	43.5	5th
lack of storage facilities	48.9	4th	43.0	6th
Lack of credit	42.0	5th	64.2	2nd
Others reasons	41.5	6th	59.9	3rd
Getting buyers	37.4	7th	37.9	7th

Table 11. Farm loses by town

Town	Tons	Percentage
Amartey	5.265	12%
Amanfrom	27.495	63%
Adawso	8.255	19%
Nketepa	1.625	4%
Asubone	1.170	2%
Total	43.810	-

This study further tried to determine the causes of losses at Amanfrom and presented the results in a radar diagram (Figure 5). It could be seen that pests and diseases were the leading cause of losses on the onion farm. Based on the interaction with experts from the district agricultural office and farmers, there was widespread whitefly invasion at Amanfrom which destroyed mainly vegetables. Pests and diseases caused 49% of the reported farm losses, while low soil fertility was the closest category scoring 29%. The least anchored problem was poor handling of produce, affecting the perishability of onions, which achieved only 4%. This result may suggest more conclusive evidence that government and scientific researchers need to respond quickly to the plight of the farmers to prevent further spread. Farmers may require more training and resources to deal with the diseases and also improve soil fertility.

The onion market in the study area was unhygienic, as is common in most agricultural markets in Ghana. Traders posit that it remains the duty of the Kumasi Metropolitan Assembly to ensure sanitation since they collect market tolls. Actors also revealed that they are not supported by the government, which has resulted in significant losses during the major season. Farmers were encouraged by the presence of the research team echoing unanimously that government should assist them.
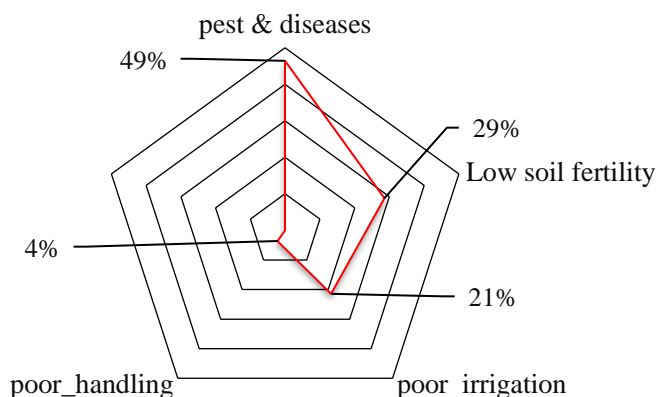
Figure 5. Radar diagram showing causes of onion farm losses

CONCLUSIONS

The study looked into the structure, conduct and performance of the onion market in southern Ghana. The main actors were farmers, retailers and wholesalers. The market structure was oligopolistic. Wholesalers were the highest performing actors in the market. Farmers had contractual relationships with input suppliers, eliminating the problem of where to sell. High production costs, high marketing costs and unavailability of storage structures were identified as the most pressing constraints for farmers, wholesalers and retailers respectively. The study suggests that new and effective ways of carrying out business activities should be researched to help each actor reduce variable costs. It is recommended that the government, donor support agencies for agriculture and local NGOs come to the aid of farmers by providing them with fixed assets at a subsidized price. This will relieve the farmers from heavy losses, which threaten the future food security of the country. Future works can focus on estimating the resource use efficiency of each alternative marketing channel available to actors in the vegetable chain.

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