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Research Article

CURRENT STATE OF PIG FARMS AND FACTORS INFLUENCING THEIR COMMERCIALISATION IN GHANA: A CASE STUDY OF THE ASHANTI REGION

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ABSTRACT
The move towards intensive commercial pig production in Ghana is increasing at an unprecedented pace albeit financial, feeding and swine flu challenges. Coupled with religious, traditional and social marginalization, the industry has suffered from poor growth for many years. In order to describe the current state and challenges facing the pig industry and the major factors influencing its commercialization in Ghana, 110 pig farms within five Districts in the Ashanti region were studied. Increasing pressure on land (77.27%), poor markets (87.27%) and disease threats (91.82%) were the major factors influencing the adoption of intensive pig farming which increased farmers' financial responsibilities. Major problems faced by intensive farmers included scarcity and high cost of feed and frequent disease outbreaks which destroyed their markets that forced many farms to close down annually. The size of the farms, number of staff, source of water, location of the farm, feeding, infrastructure, farm hygiene, marketing and security were all influenced by the financial capital of the farmers. Poor waste management practices and farm locations were potential hazards to public health. The farms were hardly threatened by thieves or wild animals. There is much promise in the pig industry currently. Provision of feed subsidies and credit to farms and stabilizing market prices are interventions government can adopt to woo local and foreign investors, grow the industry, and reduce unemployment and meat import. Improved hygiene and better waste management on farms could reduce disease outbreaks and zoonoses transmission.

Keywords: *Pigs, Pig farming, Intensive, Commercial, Ghana, Ashanti Region*

INTRODUCTION
Data on pig farming in Ghana in peer-reviewed journals are hard to find. The research articles or reviews addressing issues on pigs are basically nutrition-based and fails to provide a history of the industry or describe its present conditions and challenges (Okai *et al.*,2001; Okai, 2007; Okai and Boateng, 2010). Pig population in Ghana was estimated at 355,000 in 1996, 347,000 in 1997, 339,000 in 1998, 332,000 in 1999, 324,000 in 2000 and 310,000 in 2002 with a growth rate of negative 3.7% (Veterinary Services Directorate, 2001; FAO, 2005). In 2002, 23.55% of consumed pork and 3,257 live pigs were imported into Ghana to make up the deficit in pork and pigs supply to the market (FAO, 2005). These statistics show the decline in pig production in the country as compared to cattle, sheep, goats and poultry whose production increased across the same time periods. Obviously, the declining pig population underscores the presence of challenges facing the industry which have not been addressed. Moreover, studies probing into and reporting the cause of this decline are limited, making it difficult to implement appropriate interventions. Sumberg and colleagues (2013) reported a similar data deficiency in Ghana's poultry sector.

This dearth of authentic data on pig farming in the Ghana is but a reflection of the marginalisation the industry has faced for traditional, religious, frequent disease outbreaks, health and hygienic reasons (Okai *et al.*, 2001; Okai and Boateng, 2010). Until recently, pigs were reared by most farmers extensively or semi-intensively with modest supplementation with household and school, institutional (e.g. hotels and restaurants) 'leftovers'. Pigs were thus commonly seen scavenging for food on refuse dumps, eating

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human excreta and wallowing in gutters and swamps (Okai and Boateng, 2011). The subsequent stench emanating from the environment of the pigs made them proscribed in several communities. Moreover, the presence of Islam and certain Christian denominations in Ghana, that proscribe the rearing and eating of pork, stifled the industry (Okai *et al.*, 2001; Okai and Boateng, 2010)

More concerning of late, are the sporadic outbreaks and 'unguarded' media coverage of the untreatable African swine fever and H1N1 pandemics (since 1999) in certain regions of Ghana. In addition, there are general perceptions of pigs being full of fats, worms and diseases among the Ghanaian populace and these factors, in tandem, have affected the pork market and stalled the growth of the industry as more investors are attracted to the poultry industry (Osei, 2013; Okai and Boateng, 2010).

Regardless of these setbacks, the industry has enjoyed boom periods in between sporadic localized swine flu outbreaks. Currently, pig farming has become the most commercialized form of livestock farming after poultry in Ghana and this change has had its attendant challenges (Osei, 2013; Okai *et al.*, 2001). In 1980, the government organized a Pork Show to make pork appealing to the public (Okai and Boateng, 2010) due to the potential in the pig industry to reduce Ghana's balance of trade in meat products (FAO, 2005).

In order to provide a more scientific and credible data on pig farming in Ghana, its present conditions, challenges, future prospects and the factors influencing its commercialization, this study was carried out among pig farmers, District and regional veterinarians and animal scientists within Ashanti Region, Ghana due to proximity to the University and the relatively well developed commercial pig farming activity in the Region. This study aimed to provide a platform for future research into all aspects of commercial pig production.

MATRIALS AND METHODS

Methods

Ethical Clearance and Informed Consent

Approval for the study was obtained from the Faculty of Pharmacy, KNUST. An informed consent form which explained the purpose of the study was sent to the veterinarians, farmers' associations, proprietors and farm managers by the principal investigator. Where necessary, a verbal consent was obtained from each interviewee using prescribed methods (Bourgeault, 2010; Padgett, 2012).

Study Area

The study was conducted in five Districts within the Ashanti Region of Ghana: Ejisu Juaben (12 towns), Atwima Nwabiagya (12 towns), Bosomtwe and Atwima Kwanwoma (5 towns) and Kwabre-East (10 towns) Districts. These Districts lie on the outskirts of Kumasi, the second largest city in Ghana. The pig farms were mostly sited in the outskirts of the towns far away from the residences of the communities (at least a kilometer or more). These Districts were selected with the help of the Regional Veterinary Office, Kumasi, due to the presence of well organized pig farming systems and pig farmers cooperative associations.

Sampling

The list of pig farmers within each District was obtained from the pig farmers associations. The farms were chosen from villages and towns to obtain a fair representation of the whole District. Extensive and semi intensive pig farmers were avoided due to their little involvement in the keeping and welfare of the pigs. Farms in which the farmers were not available were also left out. The sampling was also done based on the total number of farms in a District. Districts with more farms had more farms selected and vice versa. Forty three farms were selected from Ejisu-Juaben District, 24 from Bosomtwe and Atwima Kwanwoma Districts, 21 from Kwabre East District and 22 from Atwima Nwabiagya District. Thus a total of 110 farms were studied. A few farms which did not belong to the farmers' associations were also studied. Proximity was considered in choosing farms in a town or village to avoid obtaining very similar results as closer farms are more likely to have similar conditions.

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Categorization of Farms

Farms were categorized into three depending on the size of their sow herds. Farms with sow herds below 100 were categorized as small scale farms. Farms with sow herds between 100 and 400 were categorized as medium-scale farms and those with sow herds above 400 were categorized as large scale farms.

Data collection

A structured questionnaire was used to interview the farmers and observe their practices. Data collection was done by one principal investigator and a field assistant. The questionnaire was divided into two sections: the first section contained close and open ended questions for interviewing farmers and the second section was for observing the general conditions, locations, resources and size of the farms. Other information collected included waste management, farm environments, educational level of staff, pig nutrition, funding and challenges faced by pig farmers. The questionnaires were pre-tested on a pilot basis with veterinarians, veterinary technicians and selected farmers in the Ejisu-Juaben District. Interviews were conducted in the local language, *Twi*.

Interviews were conducted with the proprietors and all the staff of the farm or any present part time or hired staff and collated into the farm's data profile. Each farm was visited at least twice at scheduled times and the interviews and observations for each farm took between two to three hours. The data collection extended from May to December, 2012 to cover both rainy and dry seasons.

Interviews with Key Informants

Interviews were conducted with ten key informants in the pig industry. They included veterinarians and veterinary technicians from the Districts and at the regional offices, executives of the pig farmers' associations as well as leading researchers in Veterinary Medicine and Animal Sciences Departments of the local University, Kwame Nkrumah University of Science and Technology (KNUST). The interviews focused on getting their views on the history and current developments within the pig industry and challenges faced by pig farmers. All interviews with the farm informants were in English. Their views and recommendations were used as indicators to assess the observations and interviews obtained from the farms to meet the study's objectives.

Analysis

The questionnaires, observations and interviews were structured into subthemes that guided the analysis. Quantitative data from questionnaires were entered into Microsoft Excel© software 2010 (Microsoft Corporation, USA). Qualitative data and descriptive answers were computed in verbatim text into Microsoft Word© software 2010 and manually analyzed per putative methods (Bourgeault, 2010; Padgett, 2012).

BESULTS AND DISCUSSION

Results

Farm Characteristics

Management Structure and Farm Size

Fifty-eight percent of the farms (n=110) were medium scale farms whiles 17.3% and 24.6% were respectively small and large scale farms. Approximately 69.2% (n=104), representing 72 farms were directly supervised by the owners themselves with the help of supporting staff while 25.0% were supervised by farm managers. In a few cases (5.8%), the farms were managed by both the proprietor and farm manager. The number of staff depended on the size of the farm and wealth of the proprietor.

Small scale farms were mainly managed by the proprietors and their family. The labour of interested children in the farmers' neighborhood was also used in these farms. Medium-sized farms had a mixed management structure in that 82.8% (n=64) were managed by the proprietors with employed staff whiles 17.2% were supervised by employed farm managers and the proprietors. Larger farms (24.6%) were wholly managed by farm managers who reported to the proprietors. Some proprietors also served as farm managers themselves in large farms though this was very common in medium-scale farms. The farm labour employed in medium-scale farms and large scale farms ranged between one to two and three to

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five respectively. Many small and large scale pig farms (52.7%) carried out the business as a part time job. The farmers were mainly males supported by their families. Only two female farmers (in Ejisu at Ejisu-Juaben District) were encountered. The average number of years in the industry ranged from a month to twenty eight years.

Educational Level of Farmers

The farmers on the average were secondary school or A-level certificate graduates while the employed staff were in most cases Junior high school graduates or school drop outs experienced in the industry (Table 1). Ejisu-Juaben District recorded the highest number of responding farms and highest number of farmers with tertiary education, which was 17% of all the respondents. The educational level of the proprietors and farm managers had little relationship with the size of the farm.

Table 1: Educational Level of Farmers per District

Educational Level	Ejisu-Juaben (n=24)	Bosomtwe and Atwima Nwabiagya (n=6)	Kwabre East (n=2)	Atwima Nwabiagya (n=12)	Total (n=38)
Basic-Secondary	20 (83%)	6	2 (100%)	12 (100%)	34 (89%)
Tertiary	4 (17%)	0	0	0	4 (11%)
Grand Total					38

Source and Level of Farming Knowledge

Most (87.3%; n=110) farm managers had learned about pig farming from their friends who had recommended it to them. A minority (12.7%) of these farmers had learned about the industry from their parents, teachers, neighbours or relatives who also kept pigs. Of this latter class, there were those who worked as farm managers in their youth for their neighbours, teachers, parents or relatives. Only one farmer (in Onwe town, Ejisu-Juaben District) had a bachelor's degree in agriculture from KNUST. This farmer had a better understanding though he was less than two years into the industry. Three other farmers had a bachelor's degree in other disciplines. The highly educated farmers were more informed about the business, followed a more systematic method of husbandry and understood the reason behind every practice. The majority of the farmers who learnt the farming from experience and from friends were relatively less informed in pig science albeit being very skillful. These farmers depended more on the veterinarians in disease management than their highly educated colleagues. Nevertheless, the difference in skill and productivity was negligible. Moreover, on-farm and on-station training offered and/or sponsored by several donor and/or sponsor agencies are organized for members of the pig farmers association.

Farm Infrastructure

Pig farmers had to build pig houses to prevent their animals from straying into peoples' farms to vandalise their crops, avoid pig thefts, reduce disease outbreak and avoid their wallowing in mud to reduce public appetite for pork. Two types of infrastructure were common in all the Districts (Table 2) and there was a strong relationship between the farm size and infrastructure. Twenty four per cent (24.1%) of the farms, especially in the Ejisu-Juaben District, used very simple and inexpensive housing for their pigs due to the huge financial capital involved in modern housing units. Most of the farms with wooden structures (61.5%) were within the small scale category. Only two (7.7%) and eight (30.8%) farms in the large and medium-scale farms respectively used wooden structures. Each housing type had concrete floors sloping into drains. There were a few farms which had both wooden and block walls but were classified as blocks with galvanised iron houses because the wood formed a small portion of the wall.

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Table 2: Types of Farm Structure Adopted by Farmers Across the Districts

Farm Structure Type	Ejisu-Juaben (n=43)	Bosomtwe & A. Kwanwoma (n=24)	Kwabre East (n=21)	A. Nwabiagya (n=20)	Total (n=108)
Wooden Walls and Palmed Roof	17	4	2	3	26 (24.07%)
Block Walls with Galvanised Iron	26	20	19	17	82 (75.93%)

Reasons for Adopting Intensive Farming

Farmers gave several reasons for their adoption of intensive pig farming. Eighty seven percent (87.3% (n=110) stated that it made the animals attractive for consumption and thus increased their markets as they were not free to wallow in mud and feed on refuse and on human excreta whiles 91.8% said it saved the animals from disease outbreaks. Seventy four percent (76.4%) adopted housing the animals as it gave them oversight on the pigs' feeding, which increased their growth rate for faster marketing whereas 62.7% said it kept them from having problems with their neighbours who would otherwise complain about the pigs. Seventy seven percent (77.3%) believed housing the animals provided land security as they had to buy the land and were not afraid of being forced to relocate in the future.

Disease Management

The disease management habits of the farms have thoroughly dealt with in another publication (OseiSekyere, 2014). Briefly, however, farmers used iron dextran and multi-vitamin injections to prevent anaemia in newly born pigs. Many farms, especially the medium and large scale ones kept multivitamin injections for animals that showed signs of weakness or had anorexia. Anthelminthics like ivermectin® and/orlevamisole® were used for the treatment of endo- and ecto-parasite infestations. Several types of antibiotics were kept in store for the treatment of various pig diseases except African swine fever. Drugs were administered by farmers or their experienced colleagues except in difficult situations where the veterinarian was called in. Pigs were lost to idiopathic causes but most commonly to diarrhoea. Most drugs were administered intravenously through the ear. Powdered oral medicines indicated for poultry were used occasionally in a few farms.

Farm Hygiene and Waste Treatment

The farm hands cleaned the stys with water and periodically with disinfectants like Quincide® in the morning and in the evening before feeding the pigs; however, this was not common in many (37.27%; n=110) small and medium scale farms. Consequently, the stys were cleaner just before the pigs were fed and dirty at all other times. The faeces were shovelled and dumped behind the stys. Some of the farms sweptor washed the faeces through the drainswhiles cleaning the sty floors. The latter practice led to choked drains behind the stys which was a common sight in most farms irrespective of size categorization. A few farmers dumped their faeces a distance from the stys either on the soils or in dug out pits. The liquid waste was left to run out onto the soil behind the pig house. Hence, it was not uncommon to find a hill of decaying pig faeces behind every pig house, filling the farm environment with stench and flies.

One rare practice which was only observed within the Ejisu-Juaben District was the use of water to bath the pigs continually. A few number of farms within this District had water ponds within which the animals wallowed. Farms that carried out better hygienic practices had nicer and healthier animals and cleaner stys. A few farmers covered the whole pig house with insecticide treated nets to kill insects. Medium-scale and large scale farms had continually clean floors.

Farm Environment and Locations

Fifty eight out of 108 farms (53.7%) were located near water bodies vis-à-vis 50 (46.3%) farms that were not.

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Table 3: Water Bodies Around Farms in the Ashanti Region

Water Body	Ejisu-Juaben (n=20)	Bosomtwe and Atwima Kwanwoma (n= 7)	Kwabre East (n=11)	Atwima Nwabiagya (n=10)	Total (n=48)
Stream	13 (65%)	1 (14%)	9 (82%)	6 (60%)	29 (60%)
River	3 (15%)	5 (72%)	1 (9%)	4 (40%)	13 (27%)
Lagoon	4 (20%)	1 (14%)	1 (9%)		6(13%)
Grand total	20	7	11	10	48

Pig farms were not located near residential areas, except in a few instances. The traditional prohibition on pigs and the religious belief of certain Christian denominations and Muslims deter many people in some communities from rearing pigs, besides their strong odour and noise make them intolerable. Consequently, pig farms were almost always located near swampy or marshy areas that are not suitable for human settlement or most agricultural activities. In certain towns in the Bosomtwe and Atwima Kwanwoma and Kwabre East Districts, they were only allowed near refuse dumps which were normally distant from homes. This situation is forcing many farmers to acquire their own land on farm lands located within bushes or forests far away from human residence. This was the case with many large-scale and medium-scale farms.

Sources of Feed and Water

Commercially-prepared pig feed in Ghana are not popular due to their cost. Farmers made their own feed by collecting home and school food left overs, buying fish, soya beans, oyster shells, rice bran, biscuit waste, malt, maize bran and maize. They mixed these in their own proportions and fed it to the animals. Some farmers occasionally gave their animals grass, plantain and or cassava leaves. All the farms visited fed their pigs twice daily by putting the feed on the bare floor.

Feeding the pigs was a major problem for all farms due to the gluttonous nature of the animals coupled with higher costs and scarcity of food. The staple pig food on most farms was malt and cereal products which were difficult to obtain continually in larger proportions due to competition from other livestock farmers and humans. These circumstances made the raw materials used by the farmers to formulate feed for the pigs very expensive and few farmers were able to afford them continually. Hence certain small farms, especially within the small scale category, commonly had emaciated pigs. The number of pigs kept on the pig farm was therefore dependent on the farmers' ability to afford feed. Excess pigs were sold and mating was kept under strict control to regulate the population. The pig farmers associations (within the various Districts) invited specialists from KNUST and the District veterinaries to advise them on the formulation of feed and other management practices. But these recommended feed are quixotic for most farmers due to cost and accessibility.

Table 4: Sources of Water for Pig Farms Per District

Water source	Ejisu-Juaben (n=36)	Bosomtwe& A. Kwanwoma (n=11)	Kwabre East (n=14)	A. Nwabiagya (n=20)	Total (n=81)
Well	32(88%)	8 (73%)	11 (79%)	11 (55%)	62 (77%)
Stream	2 (6%)	1 (9%)	3 (21%)	0	6 (7%)
Rain water	0	0	0	1 (5%)	1 (1%)
Pipe	2 (2%)	2 (18%)	0	8 (40%)	12 (15%)
Grand total	36	11	14	20	81

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Every farm visited had its own water supply system. This was necessary for the constant hygiene of the farm and well-being of the animals. Most pig farms had no access to water used by the community and had to find their own due to their locations. Among the pig farmers surveyed, well water and bore holes were commonest (76.5%). A few of them used pipe water, nearby streams and rain water (Table 4). The wells were more reliable than the other water sources due to its unfailing water supply. A few farmers went further to use pumps to force water from the wells into storage tanks which supplied the whole farm. The water from the wells, streams and rains were used exclusively for the pigs; human use was limited to domestic purposes except drinking. Pigs were manually watered through in-built water basins in the stys. Wells and boreholes were not common on small scale farms.

Security

None of the farmers provided human security for their animals—except in few cases where they provided houses for the workers on the farms. These on-farm workers consequently served as security for the animals at all times. This was due to the relative absence of threat to the animals from humans and wild animals. Though the animals were reared in bushy areas and in isolated places, there was hardly a report of theft or attack from wild animals except in one case in a town in Ejisu-Juaben District where one resident was accused of occasionally breaking into the farm at night to steal the pigs.

Funding

Generally, pig farmers financed their farms from their own savings. Very few farmers solicited the help of relatives or resorted to loans in starting their farms (Table 5). After their establishment however, many farmers tried to access loans to aid them feed their animals. Sourcing for and obtaining loans was difficult for the farmers due to collateral requirements and the exorbitant interest rates. Farmers within the District's associations were better able to source for some loans through the aid of the association; but this source was not always reliable due to the large number of applicants. The sources of funding tabulated in Table 5 below are not mutually exclusive as one farmer can use all three avenues to support his farming activities.

Table 5: Sources of Funding for Pig Farmers

Source of Funding	Ejisu-Juaben (n=43)	Bosomtwe & A. Kwanwoma (n=24)	Kwabre East (n=21)	A. Nwabiagya (n=20)	Total (n=108)
Self	40	24	21	20	105
Family (Extended)	3	0	0	0	3
Credit Financing	18	6	0	8	32

Marketing

Market for pork, during the study period, was very good and expanding rapidly beyond supply. The major concern however, was the relatively lower price of pork vis-à-vis chicken, mutton and beef. The market was not stable periodically due to frequent outbreaks of African swine fever in certain parts of the country. The weight and beauty of the animal and its fat to muscle ratio affected the pricing of the pig and pork. Fatty pigs were hardly bought and farmers tried to choose their feed carefully to avoid fat build up and subsequent losses. Strong, heavy and good looking pigs with less fat had good markets and prices. A good looking 40 kilogram boar was sold for 500 cedis or $131.60.

Discussion

The numerous benefits afforded famers for adopting intensive pig farming far outweighed the challenges they faced. Free range farmers or semi intensive farmers were forced out of business due to expanding human population in the towns with increasing demand for residential land. Otherwise, they had to buy

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land to relocate their animals in appropriate infrastructure. Adoption of intensive farming, whilst generally accepted as the effective means to erode the dislike for pork in Ghanaian markets, made farmers responsible for providing better housing, healthcare, security, water and feed to their animals. Nevertheless, most investors looking for faster returns on their investments chose to adopt intensive commercial pig farming to protect their animals from disease outbreaks, malnutrition and fat build-up from unregulated feeding, bad weather, land insecurity, wild animals and thieves (Okai *et al.*, 2001).

The single most influential factor affecting the conditions of pig farms and their drive towards commercialization happened to be financial capital that determined farm, staff and herd size, water source, type and quantity of feed, farm hygiene, disease management and housing. Educational level, though hypothetically conceived as a possible factor in determining the conditions in a farm, could not be practically proved due to the great disparity in the number of farmers with a tertiary education vis-à-vis those with basic and secondary education. There were also negligible differences in farm practice and conditions among farms managed by persons of all educational backgrounds. The major effect of education in shaping farm practice was seen in disease management where educated farmers kept and used more types and brands of antibiotics.

In order to run intensive pig farming within their means and make huge economic investments unnecessary, small scale farmers kept small herds, which made additional farm hands, expensive stys, wells and commercial feed uneconomical. The situation on small scale farms reflected the conditions of many beginners and/or farmers with financial limitations. These farmers used the farm as a secondary source of employment and income; consequently, they had to divide their income between family and farm. Hence, small scale farmers only attended to their animals personally after work, or when their children closed from school and were free to help. It is therefore not surprising to see their animals emaciated in untidy stys, suffering from diarrhoea and other diseases. A larger herd would be unbearable under such a small and part-time labour force. These factors could affect the growth rate and weight of the pigs and subsequently, the price at which they were sold. With consistency and economy however, such farmers were able to increase their capital and become medium scale and even large scale pig farmers.

The relatively better financial capacity of medium-scale and large scale pig farms enabled them to employ more hands. Moreover, the larger herd size in these farms made it impossible for the proprietors to run the farms without employed labour. The larger animal numbers made wells and boreholes a necessity to ensure the constant supply of water on these farms. Permanent security on medium and large scale farms were provided by the permanent staff employed on the farms. Though these farms usually had good looking and well-fed animals with tidy stys, there were few with dilapidated infrastructure, diseased animals and dirty stys due to little supervision of the employed staff and the proprietors. The larger herd size of these farms were also made possible by the constant presence of employed labour who were present during parturition to prevent the mother from eating or sleeping on the newly born piglets; such incidences were common in farms without employed labour who stayed on the farms to oversee parturition during late hours. Furthermore, sick animals were easily noticed by the permanent staff and treated to prevent losses in the herds.

Farms made huge income by selling pigs in batches of tens and hundreds. These periodic incomes depended on the farms' ability to schedule the mating of the pigs to obtain piglets of the same age that would grow together for marketing. These bulk sales earned farmers large sums to feed the remaining herd, pay labour and expand the farm. Disease outbreaks and malnutrition, which respectively reduced herd size and slowed growth rate together with unstable markets resulting from swine flu scares dwindled the farmers' financial fortunes. The larger income obtained by the farms from bulk sales and the natural fecundity of pigs may suggest that farms will allow uncontrolled mating and reproduction. However, the financial challenges faced in providing additional stys and feed to a large herd kept most farms from such an endeavour. Subsequently, mating and reproduction were controlled according to the farms' financial ability.

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Cooperative societies enabled the farmers to get easy access to credit. Efforts from the government to aid the industry however, have largely been towards providing technical assistance and parent stock through district veterinarians and research institutions instead of the provision of credit and feed subsidies. Besides the pork show organized by the government in 1980 to encourage pork consumption (Okai and Boateng, 2010), little has been done by the government to increase pork prices and stabilize the pig market. These interventions, though important, have been largely misplaced as they are not the pressing needs of the industry. Poor pork prices have been demonstrated as a cause for reduced investment in the industry and subsequent migration towards poultry (Okai *et al.*, 2001). Many farms close down annually due to financial incapability and scarcity of feed. The locations of the farms (Table 4) and the presence of wells does not make access to water a necessity. Providing credit to pig farmers and subsidizing feed would boost the industry, provide employment, increase food security and reduce the meat deficit.

The farmers who adopted the simpler housing system argued that the wooden walls and palmed roof was better suited to the pigs in tropical conditions as it allowed greater circulation of air and better reduction of heat and odour. However, wealthier farmers moved towards improved and modern infrastructure with a different reason that the latter provided better security from harsher environmental conditions and thieves. Wooden infrastructure required cheaper initial capital but were nondurable. Pigs tend to break through wooden walls and gates to fight each other or escape into the farm's environment.

The proximity of pig farms makes control of swine flus difficult. The nearness of farms to water bodies (Table 4) and improper waste management practices pose health hazards to nearby communities (OseiSekyere, 2014). Birds and flies scavenging through the pig waste could transmit diseases to neighbouring residences. These environmental concerns will increase with increasing commercialization of the pig industry. Educating farmers on better waste disposal practices and using the farm waste as compost and manure could reduce these hazards. Furthermore, adopting insecticide-treated nets and improved hygiene in the farms could reduce disease outbreaks and their attendant effects on the farms and public health.

The lower number of tertiary students engaged in pig farming is very concerning. The relatively poor quality and quantity of research data among pig farms is also shared in the poultry sector (Sumberg *et al.*, 2013) and appears to be a problem of livestock farmers in the country; a natural result of the relatively lower educational level and the unprofessional/informal training of most livestock farmers. Implementing policies to subsidize livestock feed, stabilize pork markets and provide incentives to attract many educated young people would engender an elite farming society who would easily keep accurate data to provide useful information on the livestock production in the country.

Though the study was carried out only in the Ashanti region and may not be representative of the whole country, the problems encountered and factors observed gives an indication of the present state, challenges and factors influencing the adoption of intensive commercial pig farming in Ghana.

Conclusion

The desire for better prices and acceptance on the local markets, improved growth rate with minor disease transmission and urbanization are factors driving the shift towards intensive commercial pig farming in Ashanti region, Ghana. Absence of favourable credit facilities, high costs and scarcity of pig feed and frequent outbreaks of African swine fever are stifling the growth of intensive commercial pig farms. Providing feed subsidies and credit to farmers and stabilizing the market will attract more investors and young people, provide employment and reduce Ghana's meat deficit.

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Competing Interests

The authors declare that they have no competing interests and the sponsors had no role or whatsoever in the preparation of the manuscript, data collection and analysis and decision to publish.

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