

UNIVERSITY FOR DEVELOPMENT STUDIES

VALUE CHAIN ANALYSIS OF PIG PRODUCTION IN GHANA: A REVIEW

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VALUE CHAIN ANALYSIS OF PIG PRODUCTION IN GHANA: A REVIEW

BY

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**LONG ESSAY SUBMITTED TO THE DEPARTMENT OF ANIMAL SCIENCE,
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ABSTRACT

Value chain (VC) has been a useful concept in development of economies of which agriculture is a major sector, especially in Africa. The objective of the review was to explore the research works in the pig industry with regards to value chain actors from production to consumption and SWOT (strengths, weaknesses, opportunities and threats) analysis, encompassing Ghana pig production. The study covered Ghana pig industry, with much consideration of the northern and the southern divides. Secondary data was used and this comprised information from publications, student theses, websites, reports, online magazines, among others. The research design was mainly qualitative, with some quantitative inclusion. It was observed from the review that the Ghana pig value chain actors were not much different from many value chain actors in other economies. That is, it encompassed input suppliers, producers, processors, distributors, and consumers. The input suppliers include feed suppliers, drug and veterinary service providers, and breeding stock suppliers. These ensured that pig producers accessed necessary inputs. Their function in the chain was to ensure that pigs were managed to reach market weight. After producers, processors were the next to add value through slaughtering, packaging, etc. Distributors were the fourth actors in the chain. The distributors were retailers or wholesalers who transported pigs from point of processing to point of sales for consumption. All actors of the pig value chain were contributive; however, it is the three within the chain, namely producers, processors and distributors that added substantial amount of value along the chain. Some strengths of the chain include available good and disease resistant breeds from breeding stations and financial credit to pig farmers. More so, there were weaknesses including health misconception of pig products, high prevalence of infectious diseases, lack of highly decentralized breeding stations, etc. Opportunities include support from church



www.udsspace.uds.edu.gh organizations and gradual improvement of small and medium scale enterprises. With regards to threats, the review revealed public misinformation by media affects pig product patronage; negative effect of ethnic conflicts; poor pig farm waste management; among others. The Ghana pig value chain, according to the review, is also characterized by youthful age bracket of 20-50 years which gives the pig industry a good future prospect for youth employment. There is also increasing women empowerment or gender equality (with women pig producers nearly double the number of men in some pig production hubs). Welfare concerns are getting better as more producers and consumers continue to appreciate the associated benefits. The study recommends chain actor formalization, sustenance of Rearing for Food and Jobs (RFJ) programme and further research at the district levels to uncover deeper interactions of actors especially across the Ghana pig value chain.



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DEDICATION

To the glory of God Almighty who has been my source of direction, strength and light of the world.

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LIST OF ABBREVIATIONS

ABP	Ashanti Black Pig
AGREDS	Assemblies of God Relief Livestock Development Service
ASF	Africa Swine Fever
EU	European Union
FAO	Food and Agriculture Organisation
FIAS	Foreign Investment Advisory Service
GDP	Gross Domestic Product
GSS	Ghana Statistical Service
HPAI	Highly Pathogenic Avian Influenza
ICT	Information and Communications Technology
IFAD	International Fund for Agricultural Development
LMD	Livestock Market Development
MoFA	Ministry of Food and Agriculture
MTADP	Medium-Term Agricultural Development Plan
MTEF	Medium Term Expenditure Framework
NGOs	Non-Governmental Organisations
OIE	World Organisation for Animal Health
PVS	Performance of Veterinary Services
ROI	Return on Investment
SDA	Seventh Day Adventists
SDGs	Sustainable Development Goals
SMEs	Small and Medium-scale Enterprises
SRID	Statistics Research and information Directory
STOP AI	Stamping Out Pandemic and Avian Influenza



TAAP	www.udsspace.uds.edu.gh Tamale Arch-Dioocese Agricultural Programme
UBOS	Uganda Bureau of Statistics
UDSMU	University for Development Studies Meat Unit
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
VC	Value Chain
VSD	Veterinary Service Department
WBCSD	World Business Council for Sustainable Development
ZIDs	Zoonotic Infectious Diseases



CHAPTER ONE

INTRODUCTION

1.1 Background of study

According to the Ghana Statistical Service (GSS), employing almost 60% of the population, agriculture is the largest economic sector of Ghana, across the skilled and unskilled sectors and greater part are low-income earning subsistence farmers (GSS, 2012). With estimated population of 30 million as of the year 2020, the poor of Ghana dwellers, according to Ministry of Food and Agriculture (MoFA), are normally located in villages and food production is the foundation of the living standard of these people (MoFA, 2003). Over the past few decades, agriculture has remained a central means of poverty alleviation in Ghana. It is important to note that agriculture contributes approximately 20% of the national Gross Domestic Product (GDP) and production of animal make up an approximation of 9% of the agricultural fraction of the entire GDP (iTrade, 2020).

In Ghana, game meat is estimated as half of the meat production. With regards to the livestock industry, farming of poultry has developed appreciably with 50,000 tons as production volume in the year 2013, being more than double that of cattle product. Promar Consulting (2016) reports that in 2012, there were approximately 5.5 million goats, 4.0 million sheep, 1.5 million cattle, 600,000 tons of pigs and 58 million domestic poultry birds. Animal products including poultry, as well as milk products, are usually supplied from outside the country and introductions into the country have enlarged exponentially to meet the increasing local needs. Basically, ruminants reared in Ghana are cattle, sheep and goats and non-ruminants comprising pigs and poultry such as domestic fowl, guinea fowl and ducks (Adzitey, 2013). Pigs



are largely known for their high feed conversion efficiency. It is recognised that, apart from broilers they yield more live weight from a given feed quantity than any other group of meat-producing livestock.

It is expected that the knowledge acquired from studying the pig value chain and the industry at large should culminate in yielding the following advantages of pig production as listed by Holness *et al.* (2005) to the resource-poor farmer in the developing world, such as Ghana, compared to other forms of livestock production:

- (i) Pigs could be restricted and managed in relatively small space. Consequently, they are not subject to the same challenges which confront cattle, sheep and goat management in many regions where communal land tenure is usual practice.
- (ii) For the same reason that they require a small area, pig production especially suitable in densely inhabited communities.
- (iii) If pigs are managed in pens, they do not contribute to soil erosion and degradation of land, a system which remains a major challenge in developing world as result of grazing lands.
- (iv) Pigs would convert a diverse crop wastes, kitchen wastes and by-products from agriculture-based industries into excellent meat.
- (v) Pigs are more efficient in conversion of concentrate feeds to meat in comparison with ruminants. However, when feed quality is poor and there is high fibre they are less efficient than the ruminants.



(vi) Pigs give a comparatively quicker return on investment as even on low planes of feeding; a pig is ready for slaughter within a year age.

(vii) Pigs are usually considered as ‘living banks’ which could be slaughtered in periods of difficult financial need, for instance for taking care of health bills or academic fees.

(viii) Pigs have a greater dressing fraction than any other animal species produced that is, the carcass forms a higher proportion of the body at slaughter.

(ix) The size of pigs in relation to cattle makes dressing and distribution more flexible and a less cumbersome process.

(ix) Pigs yield relatively rich droppings which turn out to be a very significant resource to crop farming when the price of inorganic fertilizer is exorbitant.

Globally the production of pigs is a source of bristles for industrial raw material and also manure used in soil fertilization in crop production. The course for Ghana to achieve its food as well as nutritional security in livestock industry in a fast-growing population has long been established to require an integrated approach in livestock farming. Nutritionally, pork has excellent nutritive qualities with a protein content of 19.1– 23.4% in lean tissue (Skobrak *et al.*, 2011). Economically, among many others, pig farming and trade has created jobs, increased income, and consequently has been a means of poverty alleviation in many developing countries of Africa. Strange enough, with all these benefits, it is only in the last two decades that acceptance for pork and other pig products such as sausage in Ghana has increased significantly and motivated increased pig production (MoFA, 2016). For instance,



by way of inferring production from population, MoFA (2016) reports the national pig population of 2007 and 2016 as 152, 000 and 240, 000 respectively, showing 57.89% increase. The livestock sub-sector of Ghana is saturated by SME operators who normally produce crops and keep farm animals to supplement their household incomes and/or for food production. However, there are some well-established large-scale pig operative companies in the country (MoFA, 2010).

Meanwhile, in the midst of these nation building agriculture potentials, the pig industry in Ghana faces important challenges that need to be addressed. For example, historically, the production of livestock increased from 1995 for a decade with the exception of pigs whose numbers gently reduced because of the incidence of Africa Swine Fever (ASF) pestilence of 1995 and 2004 years of production (Sarpong, 2009). It is established that majority of the animals were killed not excluding their breeding stocks as a result of the outbreak. According to the Veterinary Service Department (VSD), the pig numbers however begun to rise in 2006 (VSD, 2007). According to Sarpong (2009), the recovery and later rise in the pig numbers may be associated with re-introduction of new pigs to replace those that were affected through the intervention support of FAO. Secondly, there is the challenge of pig product storage and preservation. According to Prescott *et al.* (2002), meat food, are in addition to high nutritive benefit to the consumer, perfect and conducive environment for the growth of microbes. This is one of the easiest means by which many different bacteria that cause spoilage grow (Mayr *et al.*, 2003). These are but few of the gaps found in the pig industry hindering its progress towards achieving global production levels like many others.



In order to pursue this development agenda, there is the need to mark out the major factors that play role in stagnation of the piggery industry and plans needful for progress. Accordingly, Giamalva (2014) important factors in pig management are farm size, the number of piglets that survived per litter and the number of litters per sow in a year.

For a long time, China has been both the world's largest in production and consumption of pork, same associated with about half of both production and consumption of outputs, with next being the European Union (EU) and the United States of America (Zhang, 2017). The European Union (EU) is the second in quantity of pork producer and the largest net exporter of pork, globally. The EU accrued just over 20 % of global pork production in the years from 2008 to 2013. The United States is the world's third-largest producer of pork, and the largest exporter (Zhang, 2017). U.S. pork production accounted for approximately 10 % of global production from 2008 to 2013 (Zhang, 2017). U.S. pig production is mostly by large-scale commercial operations. Largely, U.S. pigs are raised by producers with over 5,000 pigs and most are owned by farms that each own over 50,000 pigs (Zhang, 2017). The pork processing sector of U.S is also very concentrated, and has been throughout the period (Giamalva, 2014). Thus, on the global front, China butchers over half the number of pigs. Records show that between the year 2000 and 2015, pork yield in China rose from about 40 to approximately 55 million metric tons, with growth rate of a little above 2% every year (Zhang, 2017).





Figure 1.1: An image of a typical backyard pig farm in Ghana

Source: Author

To achieve significant development in the pig industry, Ghana can follow the example of these global masters of pig production namely China, US and the European Union, who started from backyard farming (backyard pig shown in Figure 1.1) to highly commercialized system (backyard pig shown in Figure 1.2), through appropriate research and interventions, and the current government Rearing for Food and Job (RFJ) programme is worth-noting. Even in the presence of such programme, there is the need for increased researches to define policies and intervention to further accelerate livestock production. It is against this background that the value chain analysis of pig production is essential. Value chain has played instrumental role in the development of livestock industry. For example, according to Afari (2012), despite the role that pigs play in the income of Ghanaians and its protein



supply, food-borne diseases may spring from pork if conditions of handling, such as slaughtering, processing, transportation and marketing. are unhygienic.



Figure 1.2: An image of a typical commercial farm

Source: (<https://pig-farming.net/blog/pig-breeding/design-of-modern-pig-farms/>)

Value chain according to Kaplinsky (2000) is “the full range of activities which are required to bring a product or service from conception, through the intermediary phases of production, delivery to final consumers, and final disposal after use.” Agri-food value chain systems are reformed, from old traditional channels of marketing to a more organised system and value chain governance schemes in countries developing in their development phase. The classified forms normally have a feature of being fully integrated and activities of all value chains converged within one lawful entity or ownership. Also, co-ordinations, both horizontal and vertical are placed within such structures. Ouma *et al.* (2017) states that vertical coordination is



established between players who have unlike functions whereas horizontal coordination is found between the value chain players that have same function.

According to Livestock Market Development (LMD), market opportunity would lead to the deepening of value chain, enhancement of the value chain relations both vertically and horizontally, and investment in the main Value Chain (VC) activities and the necessary inputs and services (LMD, 2013). The research further states that all main actors will, in addition to learning to appreciate market trends and implications, help convert that evidence into better business models and relations that motivate ambitious dealers to offer higher quality pork products and other standards that yields efficient pricing and profitability. It is observed that this is necessary for market needs to be responded by value chains, for access to data such as traceability and prices, opportunity creation to engender new Information and Communications Technologies (ICTs) such as mobile applications for pig information sharing, business, among others.

1.2 Problem statement

Historically, Pietrobelli and Saliola (2008) realize that development experts and researchers have used value chain methods to spot the connections of ever-mutating markets in developing economies and to study the connections between assorted actors involved in all points of the marketing channel. There is therefore the need to mark out the various actors, linkages and dynamics of the pig industry, in the country. Ouma *et al.* (2016) realized that the knowledge of the value chain hierarchy is important in supplying information on the nature of improvement programmes to benefit Small and Medium scale Enterprise (SME) actors to raise their position in



the chain. And this is key: knowing the exact needs of the pig industry through value chain analysis leads to knowing the appropriate intervention to provide. Otherwise, many interventions may be provided but they may not fulfil the needed objectives.

It is noted that, the operation of agricultural food value chain is highly centralised particularly with regards to small and medium sized enterprises (SMEs) for enhanced function and stronger management of their roles in value chains. Meanwhile, in the course of meeting the new trends in consumption, there is the danger that SMEs may leave the chain as the entire value chain gets more developed and organised. It is realised that the entry of SMEs into chains and proceeding to compete fairly is a major difficulty for the majority of developing country. This is due to unequal influence in the chain that impact profitability (Ouma *et al.*, 2017).

Rich *et al.* (2009) state that livestock systems represent a possible poverty alleviation for many smallholders in the emerging economies. As a nation with high level of poverty especially in rural areas, pig production and trading could be a major means to improve standard of living. Moreover, the greater part of the world's poor living in rural communities, and a substantial percentage of the urban poor, manage livestock and use them diversely that go far beyond revenue generation (Randolph *et al.*, 2007). In brief, value chains form essential part of planned arrangement for many industries (World Business Council for Sustainable Development, 2011). The potential of pig production, if well tapped following strengthened value chain, will help contribute to food production, economic empowerment and other benefits towards the 2015 established global Sustainable Development Goals (SDGs).



1.3 Research questions

The research work pursues to answer the following questions:

1. What are the profiles of the major participants, their functions and the existing linkages in the pig value chain of Ghana?
2. What are the strengths, weaknesses, opportunities and threats associated with pig industry in Ghana? (SWOT analysis).
3. What are the measures to improve the pig value chain in Ghana.

1.4 Research objectives

The main research objective is to examine the value chain pig production in Ghana.

Specifically, the study seeks to;

1. Identify the main actors, their respective functions and also to assess the existing associations in the pig value chain.
2. Analyse the strengths, weaknesses, opportunities and threats (SWOT Analysis) of the Ghana pig industry.
3. Identify measures to improve the pig value chain in Ghana.

1.5 Relevance of the study

The significance of value chain analysis of pig is extensive: such as programme intervention, increased production, poverty alleviation, job creation, dietary and health benefit, among others. Pig is unarguably an important source of animal protein across the globe and its production is gaining grounds in Ghana.



Identifying the value actors, their roles and the existing linkages will ensure that actors work jointly in the pig industry and understand their community duties and how their roles affect each other horizontally in the chain system. By way of collaboration, the total competition and rising of the ultimate pig product will be enhanced in the country. This will provide many actors, as would be identified, with an added value addition advantage at every stage of the chain leading to poverty reduction.

Secondly, the knowledge of cost and returns at each stage of the value chain, for example, production, wholesaling and retailing to final consumption will give clear idea as to what kind of decision and interventions policy makers and government agencies as well as NGOs should take to elevate the division to assist the actors of the VC along the chain.

Thirdly, the knowledge of the extent of relationship in the pig value chain is relevant considering it will broaden the information and knowledge base of the industry in the nation for the actors to formulate policies that will improve the activities of the diverse actors. This will consequently lead to a more appropriation and distribution of resources along the chain and reduce unfair competition.

Finally, awareness of the strengths, constraints, opportunities and weaknesses of the various levels of the pig value chain will help actors of the value chain to formulate unitary target to augment performance. Identifying constraints gives a space for the actors of the value chain and other researchers to develop strategies to overcome the weakness in the chain leading to overall success in the industry. Moreover, the opportunities that will be identified in the value chain will encourage more



investment and maximum utilisation of such untapped prospects of the pig industry. Eventually, knowledge from the research will ensure that there is value addition across the value chain.

1.6 Organisation of the study

The study has been structured into five (5) major divisions. Chapter one (1) is introduction and it consists of the contextual knowledge, the problem statement of pig industry leading to the research questions, research objectives, as well as the relevance of the study. Review of relevant literature on value-addition, linkages and relationship in a value chain and on the various works done by other researchers relevant to the study are presented in chapter two (2). Chapter three (3) focuses on the methodology and describes the methods used to answer the research questions raised for the study. These include study area description. The synthesis and discussion of the literature are presented in chapter four (4). Finally, chapter five (5) presents the summary of major findings, conclusions and recommendations of the study.



CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter systematically reviews works done to provide a vivid overview to the study. It is an extensive review and it covers important areas such as: background of pig production, information on input for pig production, and other sections of value chain such as pig processing, marketing and distribution, and consumption. Also, it contains the concept of value chain, SWOT analysis examining the Ghanaian pig industry with regards to strengths, weaknesses, opportunities and threats are reviewed.

2.2 Stages of production chain

This section reviews the major stages of pig production, from input supply to consumption. These comprises acquisition of input, production, processing, marketing and distribution, and consumption.

2.2.1 Input information

Feed is noted to be the major section of the cost of producing pigs. It is therefore a major part of the livestock value chain and requires critical review. It implies that the inability for the pigs to efficiently use the feed will lead to production losses. Like any other feeding system or feed preparation, pigs may be fed with single nutritive material or be fed with mixture. Economically and geographically, these vary depending on the production culture of the production community or the available feed resources.



In Ghana, there has been significant number of researches into possible feed inputs for pigs. It all aims at yielding economic benefit for the farmer or for increased productivity of individual pigs. A notable one is the recent work by Bumbie (2017) which recommends corn cobs as substitute in diet preparation for Ghana pig producers and therefore, globally, available cobs, can be added up to one-fourth in feed preparation without any adverse health implication to pigs.”

Due to high cost of commercial pig feed, farmers usually prepared their own feed. Even though that meant slow rate of growth for individual animals, it was enough to help sustain the industry to some manageable level. The prepared feed includes leftovers from home and food joints. Other feed ingredients are soybean, maize, rice bran, among others. They prepared this feed according to their formulations and fed their livestock with it. Certain farmers sometimes fed their pigs with plant residues (Osei-Sekyere and Adu, 2015). Additionally, pigs are given feed twice every day and due to the gluttonous nature, the farm size depends on the farmers’ capacity to provide feed.

Many pig establishments, especially both the subsistence and commercial ones provide multivitamin for pigs that express signs of weakness or loss of appetite. Consequently, dewormers like ivermectin® and/or levamisole® were occasionally used for the fighting of internal and on-skin parasite infestations. Many kinds of antibacterial medicines were stored for the handling of numerous pig sicknesses apart from Africa Swine Fever. Medications were dispensed by keepers or their friends who had experience. Veterinarians are called in on special occasions (Osei-Sekyere and Adu, 2015).



2.2.2 Pig Production

Pigs (*Sus scrofa domesticus*) are livestock with single stomach, viviparous mammals that weigh between 400 and 600 pounds at maturity, depending on breed and gender of breeding stock (LMD, 2013). On the average a sow litters nine (9) piglets for every farrow after a period of 114-day gestation. Thus, if the sow litters 20 young pigs *per annum*; considering the pigs reach market weight very early and will equally become source of animal protein quicker (Koney, 2004; Awuku *et al.*, 1991). Pig production in Ghana is recorded to have developed at a degree of about 10% yearly for the past one and half decades, both across intensive and extensive production systems (Banson *et al.*, 2014; Sutton and Kpentey, 2012). However, national production is not able to meet the high demand of the national market, with short of 20% (Banson *et al.*, 2014; Sutton and Kpentey, 2012). Generally, it is agreed that a great fraction of agricultural production is embarked on at the rural level in developing economies. Pig production and pork consumption are known to gradually being accepted in many parts of Ghana (Koney, 2004).

For example, a survey by Dodua *et al.* (2019) among four major pig production regions, namely Brong-Ahafo, Upper East, Volta and Western reveals great strides in the sector. The research realised persons of various age groups, genders and educational levels involved in the production. For instance, there were 29 women and 16 men in production as against 10 women and 8 males in Brong Ahafo and Upper East regions, respectively. This indicates males were ahead of female counterparts in the pig industry. But the gender distribution was not the same between Volta (male: 12, female: 13) and Western regions (male: 6, female: 41). These show how gender is distributed in the production of pig, and auger well for



the future of the industry. Also, the survey realised majority of farmers within the age bracket of 20 to 50, giving the industry more potential for long years of production and experience. On the educational level, Dodua *et al.* (2019) realised that generally a great chunk of the farmers never went through formal education and few had primary education, with much fewer having secondary and tertiary education.

The population of the world is estimated to be seven (7) billion and again expected to reach nine (9) billion by the year 2030 and is likely to remain increasing for many years, mostly in developing countries according to the United Nations Development Programme (UNDP) (UNDP, 2008). This will mean an increased demand for animal products. The livestock sector, encompassing piggery continues to be significant for lots of developing country dwellers including people in Ghana. Growths within this sector are vital to achieve no poverty of the Sustainable Development Goals (SDGs) (UNDP-Sustainable Development Goals, 2018; Banson *et al.*, 2016). Again, it contributes to goal number two (2) which aims to achieve zero hunger and goal eight (8) which seeks to attain decent work and economic growth.

2.2.3 Pig processing

Pork processing consists of two main steps of procedures; pig slaughter and businesses which proceed processing into meat (LMD, 2013). These further processing may be sausage, or any other. It is expected that the piggery sector will significantly improve household economy in the coming decades of the pig industry. Moreover, consumers are progressively demanding quality food and pork is vital component (World Bank, 2014). And this demands that pig processing shifts from



informal system (an informal pork chain processing shown in Figure 2.1) to a more presentable formal system (a formal pork chain processing shown in Figure 2.2).

A classical study by Teye (1994) shows the extent to which technology is being utilised in pig and other meat processing throughout Ghana. The result revealed that twenty-three (23) operatives were available. Central and key sources of livestock for processing, according to the research, were noted as following:

1. The processor's own farm
2. The local livestock market
3. Commercial farm



Figure 2.1: An informal pork value chain processing

Source: <http://www.pigfarmghana.com/2014/01/two-years-into-pig-farming-part-4.html>



Figure 2.2: Formal pig processing at the University for Development Studies

Meat Unit

Source: Afari (2012)

2.2.4 Marketing and distribution

In developing countries, agri-food value chain organizations are shifting from the usual traditional models to more organised relations and controlled value chain systems. This is motivated by increased consumption of higher food and food service standards (Ouma *et al.*, 2017). In some nations the main supplier of pork to meat joints has been the pig slaughterhouse. The processors aim at the consumers to offer their processed pig products such as sausages. This is achieved by the demand for high quality pork and other pig products for consumption through the shop and trade distribution of the processors. The coordination established between the pig



abattoir and processors of the pig products on one hand and the shop and the processors chains on the other hand is sometimes well organised.

According to Osei-Sekyere and Adu (2015) demand for pork is very high and rapidly increasing past supply. The lower price of pork compared to meat of chicken, sheep and cattle is however of major concern. Moreover, as result of frequent African Swine Fever outbreak, cost of purchase was not stable from time to time across the country. In addition to the weight of the animal, the presentability of the pig, that is with regards to its beauty also affect pricing due to high fat to muscle ratio. Robust, weighty and good-looking pigs with less fat have ready markets.

2.2.5 Consumption

The piggery sector is a major subdivision which provides income for livelihood in Ghana, and is part of fast-developing sectors of the livestock industry due to increased consumption of pork (Banson *et al.*, 2014; Adzitey, 2013). Pigs hold the urgent and even short-term key to overcome the protein deficiency in animals (Annor-Frempong and Segbor, 1994) considering the fact that they are efficient feed (agro-industrial by-products) converters into edible meat (Annor-Frempong and Segbor, 1994; Barnes, 1994 Morrison, 1961). In the developing economies, pig product consumption has shown a gentle rise at the expense of cattle products in part as result of its lower fat content and healthier image of pig meat (Holness *et al.*, 2005).

2.3 The Concept of value chain

Value chain is the processes or the pathway that a product goes through from the primary production level and makes it to the ultimate consumption level



(diagrammatic illustration of value chain concept shown in Figure 2.3. In principle, it emphasizes that there is addition of at least some amount of value at every section of the chain, therefore the phrase “value chain”. The amount of value added, according to International Fund for Agricultural Development (IFAD), is defined or identified by the product market and is not augmented by default through processing or mere modification of its physical nature (IFAD, 2016). Full relationship is usually in products that are produced at scale, economically, and those that have higher quality of production standards (Minot, 2011). Vertical relationship is found in between chain actors with different operational function; meanwhile, horizontal relationship exists among the actors who have equal functionality in the VC (Ouma *et al.*, 2017). Value chains are termed “meso-level” structures because they are found between the lower micro-level of individual livestock producers and the higher macro-level of the economy (IFAD, 2016).

In addition, value chain governance is about the ability of actors of the whole system to exercise control at any section in the chain through influencing production or processing parameters of the other actors in the chain (Value chain quality control measures shown in Table 2.1).

According Gereffi *et al.* (2005), the main parameters of interest as shown in VC governance literature include;

1. What is to be produced; comprising design and specifications of product,
2. How it is to be produced; encompassing production processes, made up of factors including utilisable technology, labour standards, quality control and environmental standards,



3. How much to produce, and
4. When to produce; dealing with production schedules and logistical measures.



Figure 2.3: Diagrammatic illustration of value chain concept

Source: Will (2007)

Considering the diagrammatic representation of the value chain concept of Will (2007), the following are the steps or processes a pig, like any other agricultural commodity (good or service), goes through:

1. Input supplier for the provision of pig production resources
2. Farmers for breeding or prime production of pig
3. Intermediary trade or marketing of pig by middlemen
4. Converting carcasses into pork and other pig products by processing agents
5. Retailers for final marketing to pig consumers, and
6. Consumers to consume the final pig product

Foreign Investment Advisory Service states (FIAS) that value chain analysis is an approach to evaluate and show the generated value in the production of a good or offering of service as it converts from raw material to product for end user consumption (FIAS, 2007). At least there are two research suggestions, regarding



value chain analysis and its inclusion. Kaplinsky and Morris (2000) points out the following six (6) components as important in value chain analysis:

1. Value chain system entry point
2. Value chains mapping
3. Access to final markets
4. Production efficiency standardization
5. Value chains power structure
6. Value chains upgrading

In a different context, FIAS (2007) suggests that the analysis must include;

1. Identification of market segment to assess
2. Analysis of the channel
3. Framework mapping of the value chain
4. Quantification and establishment of the standard performance
5. Analysis of performance gap



Table 2.1: Value chain quality control measures

Level	Control measures	Observation
Farm	<ul style="list-style-type: none"> - Pig diseases control - Disposal of mortalities -Disposal of waste 	<ul style="list-style-type: none"> - Done by Vets but seldom - Bury -Use for cropping
Transport	<ul style="list-style-type: none"> - Pigs movement beyond border requires permit from the VSD. - Use of meat van to transport pork 	<ul style="list-style-type: none"> - Permit from veterinary office -Never
UDSMU (University for Development Studies Meat Unit)	<ul style="list-style-type: none"> - Holding pens for pre-slaughter checks - Proper disposal of waste - Use of right gear for processing - Right processing tools - Approved cold storage - Regular inspection of facility by authority 	<ul style="list-style-type: none"> -Veterinary checks - Always done - Available - Available
Retail joint (market)	Pork inspection by Vets	Undertaken by Vet officers

Source: Dade (2012)



2.4 SWOT analysis of Ghana's pig industry

SWOT analysis entails outlining the goals of a programme and finding the features that are conducive and unconducive, both internal and external, to ensure realisation of those goals. SWOT analysis comprises the strength, weaknesses, opportunities and threats analysis and may be utilised in any organisational plan to achieve defined goals.

1. Strengths encompass the innate abilities that an organisation already has and gives it the competence in its present production.
2. Weaknesses entails the capabilities that it does not have.
3. Opportunities are the abilities for development of the pig industry
4. Threats are factors that inhibits development but not directly controllable.

SWOT analysis is important to uncover opportunities that are available for higher productivity and knowing the weaknesses can help to manage and overcome some challenges.

2.4.1 Strengths

2.4.1.1 Breeding stations with strong improvement programmes

The Government of Ghana through its Animal Production Directorate (APD) under the MoFA has made available nucleus breeding centres for indigenous pigs and other livestock to ensure their improvement, as an ex-situ conservation policy (Livestock breeding and conservation centres of Animal Production Directorate are shown in Table 2.2).

This was during the National Livestock Services Project (NLSP) year under the Medium-Term Agricultural Development Plan (MTADP) of Ghana 1992-1999. One



of such centres which mandate is the improvement of the Ashanti Black Pig (ABP), an indigenous pig breed, is the Babile Pig Breeding Station. The main objective of the project was to use this indigenous breed in production to increase pork consumption and, thereby increase protein in-take by the populace which has been declining (Sarpong, 2009).

Table 2.2: Livestock breeding and conservation centres of Animal

Production Directorate

Livestock breeding and conservation centre	Species kept
Babile	Ashanti Black Pig
Amrahia	Dairy cattle (Friesian Crossbred)
Ejura	Sheep (Djallonke)
Kintampo	West African Dwarf Goat
Nungua	Large White Pig

Source: Sumah (2015).

2.4.1.2 Feed subsidy and credit to farmers

The Ghana pig industry is recognised to be much promising. Governments have the opportunity to provide feed subsidies and credit to support internal food production and also help stabilize the market prices through appropriate regulations to develop the industry, and increase employment and meat importation (Osei-Sekyere and Adu, 2015).



2.4.1.3 Strong disease resistant breed

Better-quality waste management on farms decreases disease outbreaks and animal-to-human transmission (Osei-Sekyere and Adu, 2015). According to Bumbie (2017), traditional beliefs and other health challenges which discourage consumers from pork have mostly been overcome due to the observance of high husbandry and hygiene practices on pig meat in the pig industry.

On the issues of litter size, resistance of disease and deaths experienced on farm, even though these pig producers have no farm records, they establish that even though local pigs had smaller size of young ones at birth, they were less likely to be attacked by endemic diseases (Dodua *et al.*, 2019).

2.4.2 Weaknesses

The Ghanaian pig industry has since its inception been plagued by many challenges, from production through trading to processing and distribution. Some of the challenges are systemic, while others are seasonal.

The survey of Ayizanga *et al.* (2018) realises various challenges and grade of the pig industry. One of the aims of the same survey was to find out and rank the constraints faced by pig farmers in the chosen communities. It indicates farmers were asked to show their most demanding constraints and a pairwise comparison of the constraints listed was conducted. The result of the pairwise comparison made was then used to determine the ranking of the various listed constraints or challenges. According to the research, of the farmers interviewed;

- 41.9% of the farmers ranked diseases as their biggest constraint.



- 41.9% of the farmers ranked inadequate feed as the second constraint.
- 37.8% of the farmers asserted poor housing as the third most demanding constraint.

This suggests that any intervention programme aimed at helping pig farmers should target finding workable solutions to these three constraints (Ayizanga *et al.*, 2018). Aforementioned are generalised output or result of a survey. However, the following are specific constraints to the pig industry in Ghana.

2.4.2.1 Poor level of available information

System classification of pig production offers valuable data necessary to improve their enhancement and protection. Data on the of local pig production practices is scarce which otherwise is essential for building breeding-oriented programmes to improve production capacities (Ayizanga *et al.*, 2018; Adjei *et al.*, 2015). Reviewed journals have insufficient data on pig farming in Ghana; researches and studies on pig have basically concentrated on nutrition and fail to provide historical background of the industry or elaborate conditions of its recent status and difficulties (Okai and Boateng, 2010; Okai, 2007; Okai *et al.*, 2001). Moreover, research on cause of production decline is insufficient, leading to difficulty in organisations implementing appropriate intervention (Osei-Sekyere and Adu, 2015).

2.4.2.2 Misconception on pig products

A major misconception among many Ghanaians on pigs is the belief that their products are full of fat, endoparasites and diseases. This view, directly or indirectly, has anti-marketing effect on the pig product and hinders the progress of the entire industry. This challenge leading to low patronage and profit has made many



investors opt rather for the poultry industry over the pig industry (Osei, 2013; Okai and Boateng, 2010).

3.4.2.3 Inadequate research

In the face of ever-changing human and institutional needs, Governments and Researchers are under influence to establish the right administrative decisions (Banson *et al.*, 2016; Banson *et al.*, 2015). Their work and findings go on to state that research gap is likely to perpetuate for the following many reasons:

1. insufficient support for broader research,
2. high inflation,
3. management incompetence, and
4. old fashioned approach and technology

2.4.2.4 Increased financial cost

In pursuit of evaluating the strength and weakness of the Ghana pig industry and the core influencing factors affecting the pig business, Osei-Sekyere and Adu (2015) studied one hundred and ten (110) piggeries in five (5) Ashanti region Districts which is a prominent pig hub of the nation. The results are shown in Table 2.3.



Table 2.3: Factors that increase financial burden of pig farmers

Factor	Increased pressure on land	Poor marketing	Threats by disease
Percent of survey (%)	77.27	87.27	91.82

Source: Osei-Sekyere and Adu (2015).

2.4.2.5 Scarce and high cost of feed and nutritional provision

Osei-Sekyere and Adu (2015) established that among other factors such as endemic disease outbreaks, a major problem that affects farmers who are into intensive pig production system include unavailable feed and high feed cost. These factors, they realised, are so powerful to cause farms and other actors to exit the industry.

2.4.2.6 High prevalence of infectious diseases

The outbreak of human pathogenic diseases on the world front continues to rise and zoonotic infectious diseases (ZIDs) account for the greatest portion (about 60%) of infectious diseases recorded, and 75% of infectious diseases that are emerging (WHO, 2011). Additionally, these zoonotic diseases are of agro-economic concerns, as they diminish livestock health, minimize production efficiency, reduce revenue and minimize food availability of farm products (Ayim-Akonor, 2020). The loss of revenue as result of trade restrictions, low consumer patronage and high costs of marketing to establish confidence among consumers may unfavorably affect growth of national economies, where zoonotic infectious disease outbreaks are frequent (Halliday *et al.*, 2015; McDermott & Arimi, 2002; WHO, 2006). Until recently, the



system by which pigs were managed are extensive or semi-intensive with some supplement of domestic and institutional food and foodstuff leftovers. Pigs were usually allowed to scavenge for food on garbage sites, eat human fecal matter and wallow in gutters and swamps, though unhealthy. The sharp increase in the pig-trade in Ghana has signaled interests about increased transmission of zoonotic diseases that usually accompany it. A survey on pig-based zoonoses along the pork value chain was steered in Upper East and Greater Accra regions of Ghana (Okai and Boateng, 2011). Results showed significant seroprevalence of taenia and trichinella, representing 60% and 8%, respectively in pigs in Upper East with little signs of movement to humans. Sero-prevalence of HEV was high in both humans (37%) and pigs (85%). Sero-prevalence rates were greatly higher in Upper East than Greater Accra. Pig managers in Accra had significantly higher sero-prevalence rates (58%) than other community members (18%) but there was no such association in the Upper East. Given the high rates of deaths, miscarriage and stillbirth associated with HEV in gestation, it is a cause for concern that 31% women of child-bearing age tested sero-positive for HEV.

2.4.2.7 Religious beliefs affecting patronage of pig products

The pig industry which contributes to Ghanaian microeconomies, is a rapidly growing segment of the livestock industry as result of rise in pork consumption (Banson and Josephine, 2014; Adzitey, 2013). Meanwhile, according to Okai *et al.* (2001) and Okai and Boateng (2010), faith groups in Ghana that prohibit the keeping and consumption of pork on religious grounds, possesses negative effect on the industry. This is as a result of the lack of patronage and dislike of pig products.



2.4.2.8 Lack of highly decentralised breeding station system (proximity challenge)

The closeness of the farms to each other describes why the breeding stocks of pig farmers are obtained from relatives. It is on record that very few producers acquire their breeding stock from official breeding stations (Sources of breeding stock are shown in Table 2.4). The breeds are further circulated to other relatives by mating them with other traditional breeds in their communities. As a result, potential of unregulated crossbreeding is high potentially, in pigs in the communities that were studied (Dodua *et al.*, 2019).

Table 2.4: Sources of pig breeding stock

<i>Source</i>	<i>Frequency</i>	<i>Percentage (approximation)</i>
Family and friends	86	64
Breeding stations	15	11
Open market	34	26

Source: Dodua *et al.* (2019).

2.4.3 Opportunities

2.4.3.1 Improvement of small and medium scale farmers

The continual change of human population demands high agricultural production to provide food, and considering that arable land is scarce, the general method has been to promote increasing production levels. However, increasing production is not an appropriate choice due to the prevalence of the many SME farmers all over the world and the consequent limited resources. In effect, small scale agriculture is going to be the order of the day for now and the foreseeable future. It is therefore of great



necessity to improve on the productivity levels of small-scale agricultural production. One way of contributing towards bettering the traditional small-scale agricultural system is to study it and thereby find ways of improving it (Ayizanga, 2016).

Essentially, the Rearing for Food and Jobs (RFJ) programme by the Government of Ghana implemented through MoFA is one that is expected to yield great impact. The goal of the project is to raise the production of particular livestock of which piggery is listed to be promoted (MoFA- Medium Term Expenditure Framework (MTEF), 2019). Under pig production, the programme states that “38,000 breeding stock of pigs would be procured (6,000 for the 1st year and 8,000 for subsequent years) and supplied to 7,600 farmers for breeding. The progeny of these animals will be supplied further to other farmers to increase the stock base. This will involve 30 districts in Ashanti, Bono, Bono East, Ahafo, Western, Volta, Greater Accra and Central regions under a Credit-In-Kind (C.I.K) scheme where each animal will attract an interest of two (2) animals within a period of five (5) years. It is expected that the roll over progeny (repayment) for the five-year project period will yield 662,640 animals, which will be given to other farmers over the years” (MoFA, 2019).

Table 2.5 shows the key outputs, its pointers and estimates by which MoFA evaluates the mini-programme. The previous years’ information shows their real performance while the future ones are estimates of the Ministry.



Table 2.5: Years and their respective pig farmer support

Year	Budget year 2019	2020 Indicative Year	2021 Indicative Year	2022 Indicative Year
Number of pig Farmers Supported	335	368	404	444

Source: MoFA-MTEF (2019).

The Babile Pig Breeding Station is in Lawra District in the Upper West Region of the nation. It is about 72 kilometers from Wa, the regional capital. In 1995 it was upgraded into the pig breeding station from general agriculture station, with the mandate to improve the Ashanti Black Forest Pig breed (APD, 2014). The production of pigs has a high possibility to enhance productivity due to its rapid rate of development, minimum generational interval, excellent feed conversion efficiency, and high litter sizes in relation to cattle (Mbuthia *et al.*, 2015).



2.4.3.2 The committed contribution of church organisations

Church organisations in seeking the welfare of members and communities at large have, over the years, helped in livestock programmes. These supports are clear opportunities for expansion and intensification of the Ghanaian pig industry. Many times, these organisations provide supports in different forms such as breeding stock, finance, or even capacity building. Classical examples are shown in Table 2.6.

Table 2.6: Some church organisations and their reasons of intervention

Church	Name of Organisation	Reason of intervention
1. Catholic Church	Tamale Arch-Dioocese Agricultural Programme (TAAP)	<ul style="list-style-type: none">• To improve upon the living condition of the people.• Food Security
2. Presbyterian Church of Ghana	Presby Farmers Training Programme	<ul style="list-style-type: none">• To improve upon the living conditions of the people.• Food Security.
3. Assemblies of God	Assemblies of God Relief livestock Development Service (AGREDS)	<ul style="list-style-type: none">• To re-stock and that were lost during the 1994 conflict between the people of Konkomba and Nanumba in the northern region• To help facilitate peace talks after the conflict.• Food security.

Source: Ansah *et al.* (2004).



2.4.3.3 Credit financing

There is evidence that some pig farmers received credit support from financial institutions beside extended family and self-sponsorship (Osei-Sekyere and Adu, 2015). A survey across some districts in the Ashanti Region, a major hub of the Ghana pig industry shows that generally, pig farmers financed their farms from their own savings. However, some small numbers of farmers gained the support of families or financial loans in commencing their farms. Many farmers during the production period especially sought to get loans towards feeding their pigs. However, these loans were difficult to come by due to absence of collateral and high interest on loans (Osei-Sekyere and Adu, 2015). More so, farmers who belonged to associations were better off, as there was association administrative support, though not reliable always due to high numbers of loan applicants. Details of the survey with regards to credit financing can be found in Table 2.7.

Table 2.7: Sources of funding for pig farmers

Source of Funding	Ejisu Juaben (n=43)	Bosomtwe & Akwanwoma (n=24)	Kwabre East (n=21)	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

Source: Osei-Sekyere and Adu (2015).



2.4.4 Threats

2.4.4.1 The threat of misinformation by media

It is recorded that unregulated media coverage on diseases such as African swine fever and H1N1 pandemics (Osei, 2013; Okai and Boateng, 2010) have been a challenge in some regions of Ghana. As a result, negative tags and misinformation, coupled with fear of sickness are proven to have caused downward effect on production and consumption of pig products.

2.4.4.2 The negative effect of ethnic conflicts

The many pockets of tribal conflict across the nation have their drawback threats on piggery production. For example, the perennial conflicts in some part of northern Ghana have affected economic activities and the animal production industry. The losses of livestock in Bawku Municipality during 2000-2001 conflict were attributed to starvation (2%), poisoning (2%), indiscriminate killing (13%) and 83% as result of stealing (Bariyam, 2018). The effect of conflict is also on maiming of humans who are key in the management of livestock, leading to high decrement of the animal population.

2.4.4.3 Poor farm waste management

Improper disposal of waste is established as a common practice of pig farms that poses potential health hazards to the public as farm locations were close to human residence. It therefore recognised that improved farm hygiene has the potential to reduce zoonotic disease outbreak and transmission (Osei-Sekyere and Adu, 2015). If manure is not disposed properly, it generates a pile of flies and bad odour but the droppings can be gainfully used as fertilizer or in bio-gas plants to solve this problem



(Bumbie, 2017). Eventually, pigs can still be produced even within residential areas, enhancing productivity.

2.4.4.4 Rampant open defecation

There is concern that the rapid increase in smallholder pig production across Ghana may aggravate the risk to human health of pig-associated zoonoses such as *Taenia solium*, *Trichinella spiralis* and *hepatitis E virus*. The transmission of these viruses is strongly linked to poor sanitary practices in meat processing (Knopp *et al.*, 2012; Van der Poel *et al.*, 2017). Ghana has a particularly poor sanitation record, with just 19% sanitation coverage and high open defecation rates (UNICEF-WHO, 2015).

2.4.4.5 Poor human resource system

According to Adzitey (2013) and Anane (2006), the development of Ghana's pig industry has various impediments such as poor breeding stock, inaccessible land and water insufficiency, growing urbanisation and its challenges, and environmental pollution. The same authors report that poor human resource or managerial inputs is a major challenging factor. In line with this challenge, Banson *et al.* (2018) emphasised that historically it is recommended that livestock problems, and for that matter pig production, be solved with multi-dimensional expertise and tools. Converse to this recommendation, Moya (2016) observed that chief and primary challenge for farmer entrepreneurs in Ghana that led to business failure on the short and long run is the issue of poor attitude to control all units of the business. This is noted to be unproductive and that it is best if separate experts were sought for administration, comprising human resources (management), accounting, comprising bookkeeping systems, and marketing, comprising of sales and decision making. This



would mean that for human resource to be effective in the pig industry there should be individuals for specific roles and expertise rather than pig keepers becoming jacks of all trades. In that, separation of role system enhances absolute responsibility of every sector.

2.4.4.6 Anti-production climate

Climate has long been noted to have direct effect on piggery, just like any other livestock production. In Ghana there is a wide range of environmental temperatures across the south and the north. Ouma *et al.* (2013) indicated that husbandry systems and production goals are highly determined by immediate factors and these factors highly differ in terms of their effect on limiting production needs for example poor water and shortage of feed supply systems, parasites and diseases and many others. Furthermore, Roessler *et al.* (2008) reported that the local ecological conditions, in addition with social, economic and cultural factors largely determine the suitability of breeds or specific genotypes and helps to refine farmers' breeding objectives both overtly and covertly. Eventually, the species and breeds of animals kept by local farmers and their breeding objectives are very diverse and directly proportional to the highly diverse climatic, social, economic and cultural factors within which the producers exist.

2.5 Model chain map of pig value chain: the case of Tamale Metropolis

University for Development Studies Meat Unit (UDSMU) utilized the concept of value chain evaluate the pork value chain condition. This was recognized by the analysis of the actors involved and projecting them on the value chain maps. The outline involved examining the pig product value chain and evaluating its market.



The supply of input commences the chain and ends with the consumption and the research also considered the functions of the chain. The category for evaluation were flow of information and system of quality control. The study was by the use of analysis of actors, five forces of Porter's, concept of sustainability, marketing mix (4P's) and analysis of strength, weakness, opportunity and threat (SWOT). Model chain map of pork value chains of Tamale Metropolitan Area is shown in Figure 2.4.

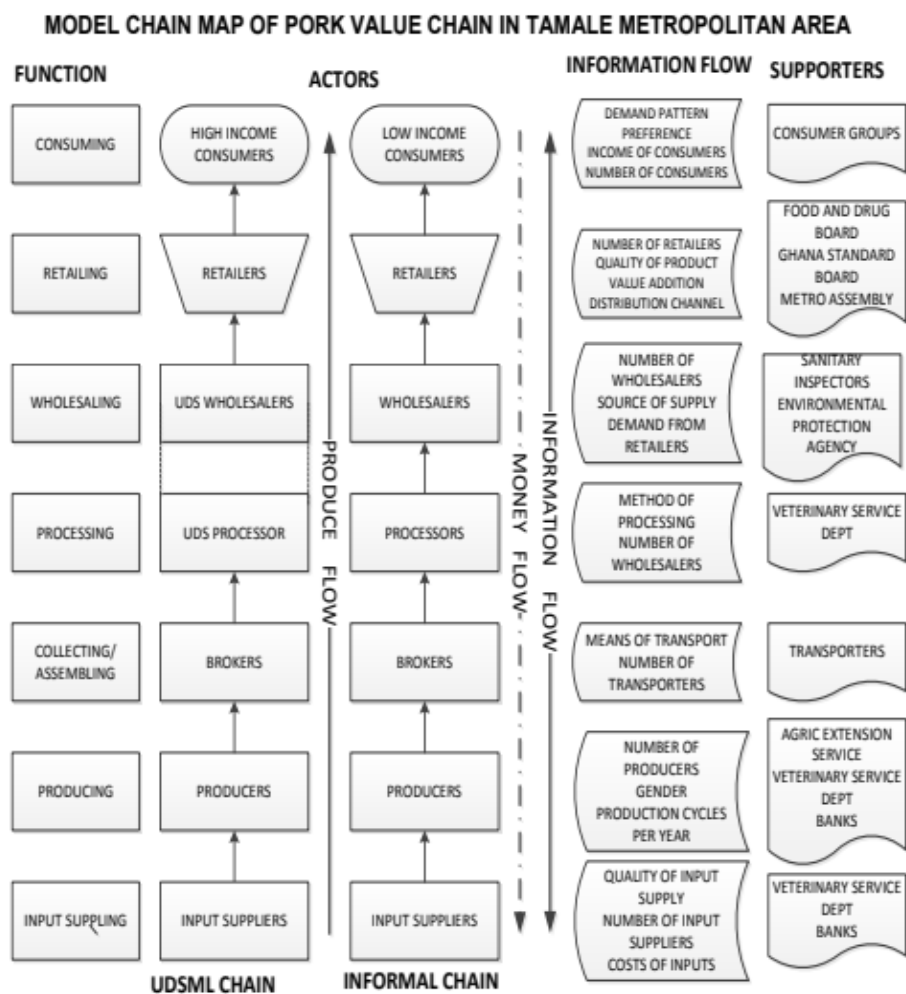


Figure 2.4: Model chain map of pork value chains of Tamale Metropolitan Area

Source: Afari (2012)



2.6 Model chain map of pig value chain: the case of Ejisu District

The Ejisu district is one of the main pig-producing areas in the Ashanti Region Ghana. Previously, sales and management were executed informally. But, to ensure satisfactory and ethical standards of hygiene in the pig industry, the Ejisu Pig Farmers Association (EJPFA) was formed in the year 2001 with ten (10) members and presently has about 200 processors and producers (producers 50%, processors 30% and 20% being both producer and processor). The mission of the association is clearly to produce, process and market good pork and also enhance existing know-hows. The group helps its members to acquire production and other inputs materials at cheaper prices. Membership advantages also include higher sales negotiation power and support in seeking credit. Pigs are obtained from members without the burden of purchasing from non-registered members to ensure quality of pork. The members undertake slaughtering and processing in the 6 abattoirs where there is a veterinary station. The means of value addition is the further step of processing pork into products such as ham, sausage and bacon for consumers (Ofori, 2012). The Ejisu Pig Value Chain is detailed in Figure 2.5.



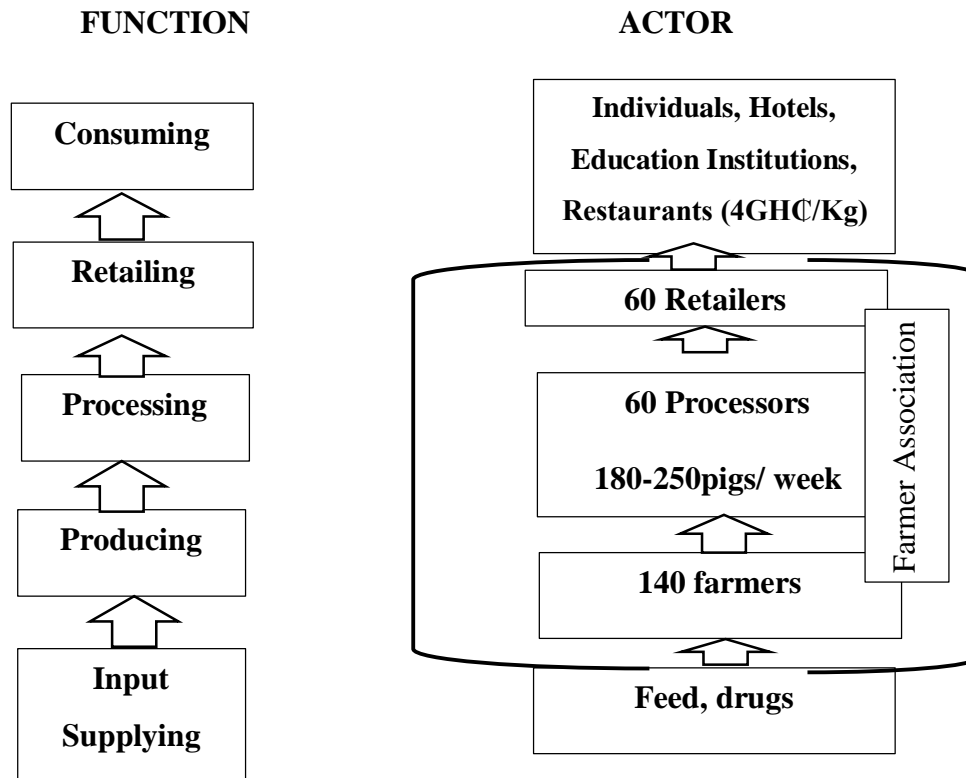


Figure 2.5: The Ejisu Pig Value Chain

Source: Ofori (2012)

2.7 Growing welfare concerns

Animal welfare is defined as the state of healthy condition as result of meeting the bodily, environmental, dietary, and social requirements of either an individual animal or group of animals under the management of people (Appleby, 1996).

Animal welfare concerns have become necessary because animals are considered as sentient beings in some cultures. Intensification of animal production has heightened the interest in animal welfare and animal ethics. This phenomenon dates as far back as 1950, after the World War II, due to the emergence and shift of animal confinement system which replaced traditional free movement of livestock in



industrialised countries. Confinement of pig in cage, an issue of welfare concern is shown in Figure 2.6.

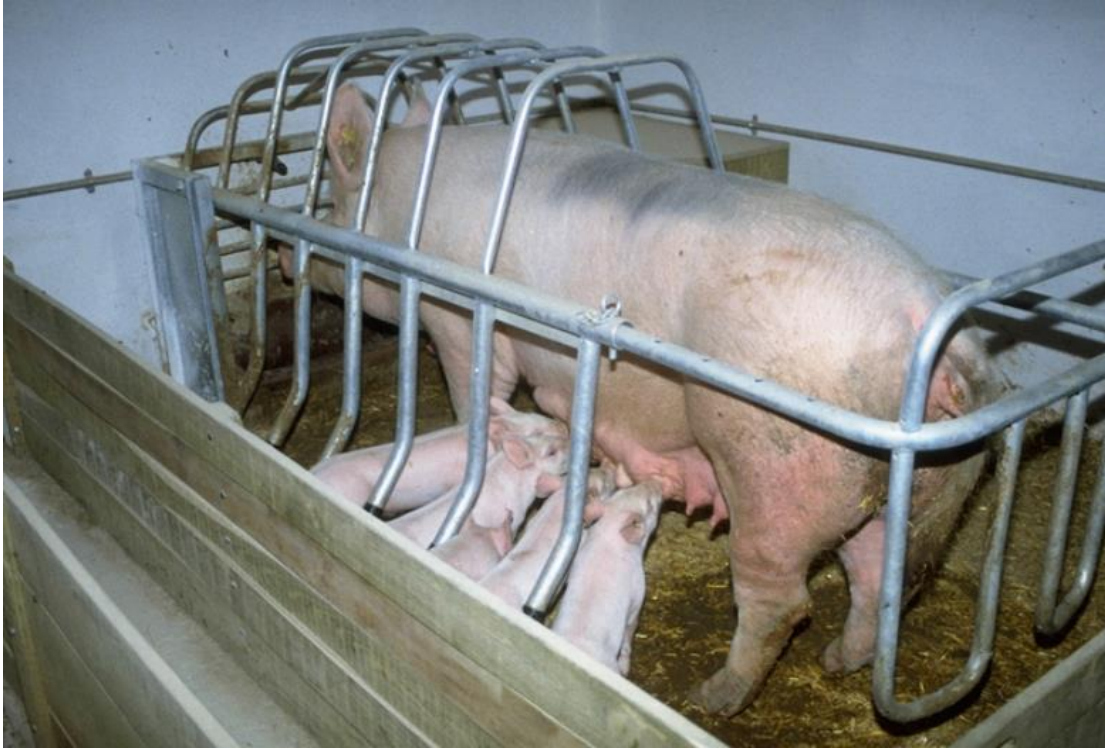


Figure 2.6: A pig in cage

Source: Leeb (2011).

This confinement system dominated the production of livestock that fed on grains and other concentrate feed, including the production of pigs, poultry and veal (Fraser *et al.*, 2001). It happened that as confinement increased on many farms over this period, attitudes towards these animals which hitherto had been gentle, shifted to cruelty for agricultural gain (Preece and Fraser, 2003).

Welfare is also the provision of animal requirements with regards to the respect of the “five freedoms” as postulated in the Brambell Report (1965), and adopted in the



Farm Animal Welfare Council (1993), which are important and considered in every scientific work on animal welfare. These freedoms of animal welfare are as follows.

1. Freedom to express normal behaviour
2. Freedom from thirst, hunger and malnutrition
3. Freedom from discomfort
4. Freedom from pain, injury and disease
5. Freedom from fear and distress

2.7.1 Behaviour as an indicator of pig welfare

The behaviour of pigs

Unlike other species intensively managed, it is normally challenging to differentiate the pig's acquired behaviours as result of intensive management conditions from its innate species-related behaviours (Scipioni *et al.*, 2009). The behaviour of domestic pigs is affected by bio-rhythms which influences the sleeping cycle and other significant instants of its life: e.g., time of farrowing which, likewise to man and horse, normally happens during the evening, when the highest serenity is achieved (Friend *et al.*, 1962). The social behaviours, such as sexual and gestation activities, are the most vital aspect of research with regards to evaluation of pig welfare, considering the fact that pigs normally show abnormal behaviours expressing a state of pain (Scipioni *et al.*, 2009). Two concepts affecting physical and mental welfare are shown in Figure 2.7.

- **Stereotypic behaviours** (bar biting, restlessness, continuous scratching against the floor and wall, floor scraping, rooting in the empty feeder, head shaking, drinker playing, polydipsia)



Main causes: absence of stimuli, scarce food availability, food characteristics (fibre, energy, feeding system, particle size), lack of enrichment materials

- **Dog-sitting posture**

Cause: absence of stimuli

- **Piglet crushing** (sow; in farrowing cage it is considered a “technological incident”)

Causes: farrowing cage design piglet’s and hypothermia genetics

- **Piglet savaging** (sow)

Main causes: milk production decrease, precocious, post farrow oestrus, and genetics

- **Aggressiveness** (group housed growing-fattening pigs/pregnant sows)

Causes: lack of space, lack of feed, and lack of enrichment materials

- **Tail biting, ear biting and cannibalism** (growing-fattening phase)

Causes: multifactorial

- **Dirtying out of the proper areas** (growing-fattening phase)

Causes: lack of space and pen design

Scipioni *et al.* (2009).



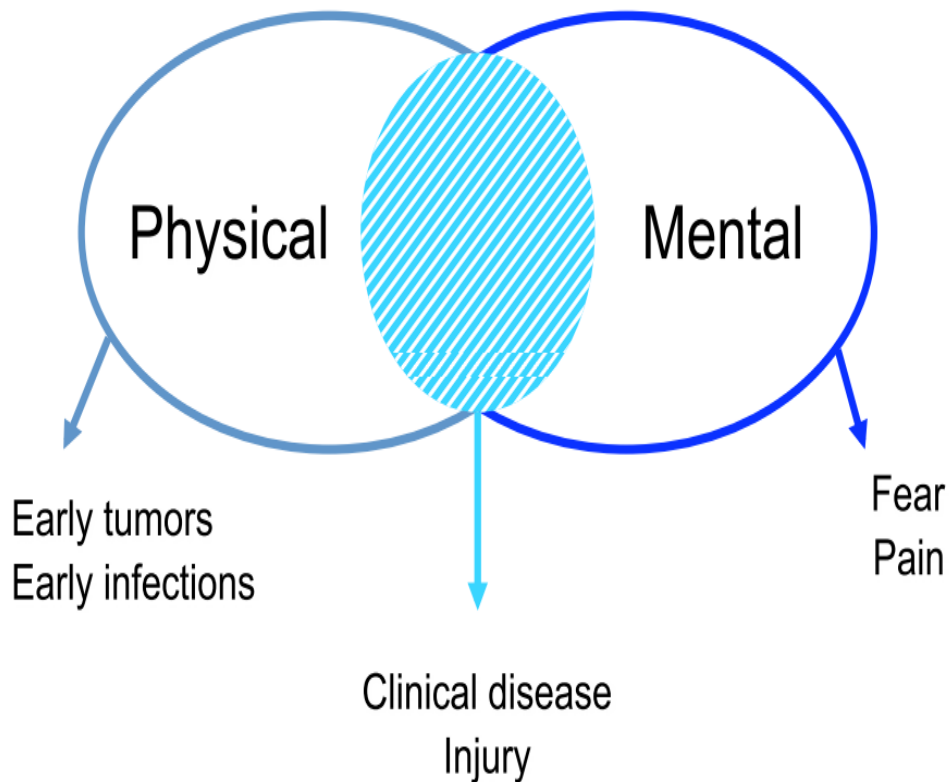


Figure 2.7: Two concepts affecting physical and mental welfare

Source: Leeb (2011)

2.7.2 Criteria (or measurables) for the welfare of pigs by World Organisation for Animal Health (OIE)

The following result-oriented characterization, precisely based on animals, can be vital animal welfare pointers. These pointers, if used at right levels, should be utilized in various methods of pig management such as herd fitness, location difference, pig breed, and climate. Sources given and model of the system should also be considered. These standards can be taken as instruments to regulate management and design efficiency, considering they have capacity to affect animal welfare.



1. Behaviour

How pigs play and their exact vocalizations appear to be certain behaviours that indicate good animal welfare and health in pigs. Some other actions could portray health challenges and animal welfare. They comprise sudden mobility inadequacy, attempts to escape, changes in feed and water consumption, changed behaviour of movement or posture, altered sleeping time, panting and change in rate of respiration, cough, huddling and shivering, high-pitched vocalisations, increased agonistic (including aggression), stereotypic, apathetic or other behaviours that are not normal.

Surroundings or activities that cause stereotypies (repetition of gestures) naturally also diminishes animal welfare. Even though stereotypies are generally considered to indicate poor welfare. There are some instances where there is a poor linkage between stereotypies and stress. For instance, pressure-based stress may be corrected if the result of the stress itself reduces the stress. Within a group, individual pigs that make stereotypies may therefore be successfully managing than their counterparts that do not. Nonetheless, stereotypies show either a recent problem for the animal or a previous problem that has resolved. It is advised that, as with many indicators, carefulness is considered when using stereotypies as a measure of welfare in isolation from other indicators.

2. Morbidity rates

Above certain limits, some forms of morbidity may be indirect or direct pointers of welfare of animals in group. These may include infection rates and metabolic illnesses, limping, peripartum and surgery complications, wound and other forms of



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morbidity. Understanding the etiology of the disease is vital for predicting likely problems affecting animal welfare. Inflammation of udder and metritis, problems of hoof, leg, shoulder, ulcers in mothers, lesions, diseases of the respiratory, digestive and reproductive systems are also very vital pig health problems. Scoring systems, including body condition, lameness and injuries, and slaughter data, can give added information. Both pre- and post mortem pathologic examination should be utilised as indicators of disease, injuries and other problems that may inhibit animal welfare in pigs.

3. Mortality and culling rates

Deaths and rates of sick bird removal affect the length of productive life and, like morbidity rates, may directly or indirectly indicate animal welfare at the group level. Depending on the system of production, evaluations of mortality and rates of culling can be obtained by analyzing the causes of death and culling and their temporal and spatial patterns of occurrence. Mortality and culling rates, and their causes, when known, should be recorded regularly. These may be done for instance on daily, monthly, or annually and used for monitoring. For example, necropsy is useful in establishing the cause of death.

4. Changes in body weight and body condition

In growing animals, body weight changes outside the expected growth rate, especially excessive sudden weight loss, are indicators of poor animal welfare and health. Body condition outside an acceptable range or large variation amongst individual animals in the group may be an indicator of compromised animal welfare and health, and reproductive efficiency in mature animals.



5. Reproductive efficiency

Reproductive efficiency can be a pointer of animal welfare and health condition.

Poor efficiency in regards to reproduction, can show animal welfare problems in relation with the expected gain from a particular breed of pig.

For example:

- poor potential of conceiving,
- excessive levels of aborted pregnancies,
- metritis and inflammation of the udder
- few litters at birth
- high levels of stillbirths

6. Physical appearance

How the pig looks from the outside (physically) may equally be a pointer of compromised welfare and inadequate healthcare. Signs or indicators of poor welfare as viewed from the outside may include:

- poor body condition,
- infestation of ectoparasites,
- poor hair growth and texture,
- pigs soiling themselves with feces,
- sunburn and loss of skin color,
- enlargements, wounds or scratches,
- discharges (e.g. from nose or eyes, including tear staining),
- feet and leg irregularities,
- abnormal posture (e.g. rounded back, head low), and
- emaciation or dehydration.



Figures 2.8 and 2.9 show using rightly measured floor to avoid physical injury to the pig hooves and a pig showing lesions a typical poor physical welfare, respectively.

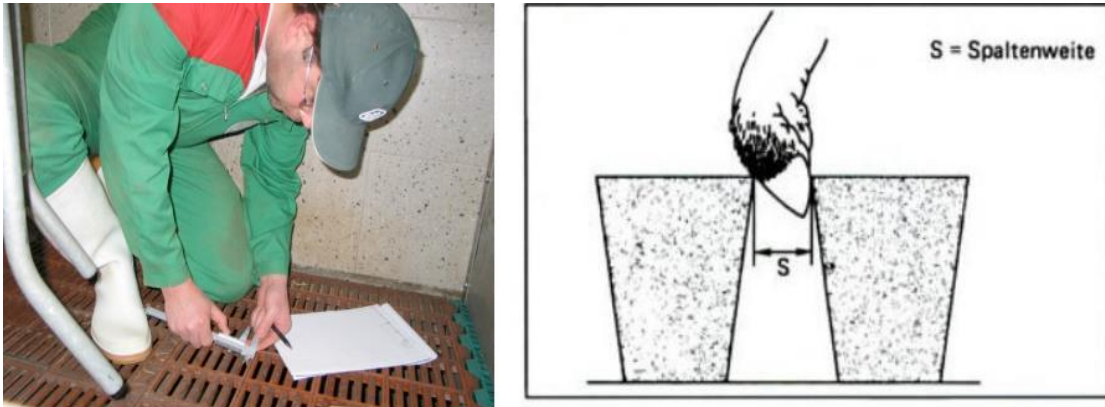


Figure 2.8: Using rightly measured floor to avoid physical injury to pig hooves.

Source: Leeb (2011).



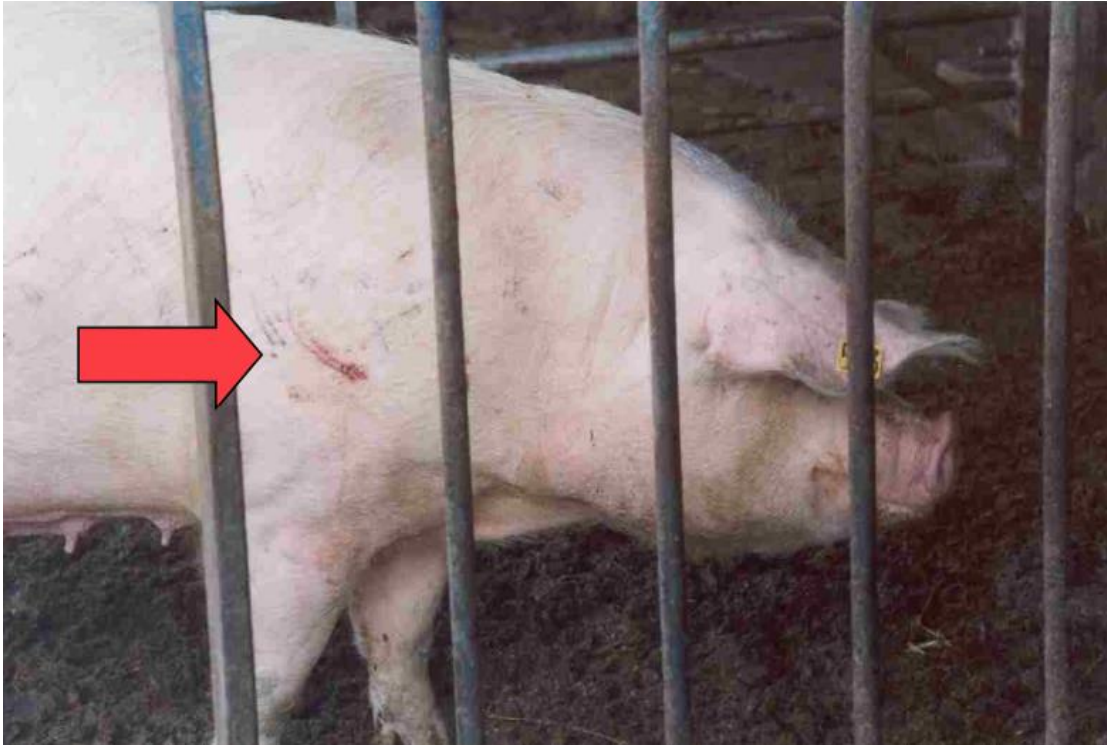


Figure 2.9: A pig showing lesion from poor handling

Source: Leeb (2011).

7. Handling response

Distress and fear in pigs may result from improper management or lack of human. An expression of fear of humans by pigs may be a sign of animal welfare system that is compromised. For example:

- signs of poor animal-human coexistence, e.g. high-level dissociation from handlers or too much noise making when forced to move or in situations when pig keepers handle them.
- animals slipping while handling, and
- sustaining wounds during handling.



8. Lameness

Pigs are prone to a wide range of muscle and bone related diseases and disorders. These ailments may lead to limping and abnormal walking postures. Mainly, pigs that have these muscle and bone related disorders may have challenges getting access to the source of feed and water, leading to aching and pain. Genetic, nutrition, sanitation, floor quality, and other environmental and management factors are associated with causes of these musculoskeletal difficulties. There are numerous gaits marking systems available.

9. Complications from common procedures

Some painful surgeries or those that are likely to bring pains such as surgical castration, docking of tail, clipping or grinding of teeth, nose ringing and hoof care are performed on pigs to enhance administration, satisfy market or environmental needs and improve human security or protect animal welfare. However, if these procedures are not performed according to regular steps or as expected, animal welfare and health can be pointlessly compromised. Problems linked with these procedures may contain:

- post-procedure contagion and inflammation,
- post-procedure lameness,
- behavior showing pain, distress fear, or suffering,
- enlarged disease rates, and increased deaths and rates of culling,
- reduced intake of feed and water, and
- post procedure body condition and weight loss (OIE, 2019).



The Diseases of Animals Act 1961 Act covers various aspects of animal welfare.

These are contained in sections of the law, such as the following:

1. Power of veterinary authority to inspect animals.
2. Power of veterinary authority to perform autopsies.
3. Power of veterinary authority to require disinfection or quarantine.
4. Power of veterinary authority with respect to disinfection and destruction.

The Veterinary Service Department (VSD) is tasked with animal welfare and the protection of the well-being of pets and other recreational animals. Laws regarding animal welfare in line with current global ideals need to be institutionalized by which such rules can be run as part of the Technical Authority and Capacity of VSD (OIE PVS-Ghana, 2009).

Nonetheless, the country has legislation for culling for the interest of controlling disease. This Diseases of Animals Act 83 law was enforced through the stamping out policy during the epidemics of HPAI and H5N1 in 2007 in the country. Even though there are industry ethics of practices or voluntary animal welfare schemes they do not show OIE standards. More so, some non-governmental organizations (NGOs) are included in animal welfare issue and standards communication, including: Heifer Project International, Kindness International USA and the Ghana Poultry Network. Some staff of veterinary, farmers and other experts were trained in humane slaughtering practices and handling during the training organized by USAID STOP AI in 2008. The transport of live poultry is the major animal welfare challenge likely to occur in the country. Normally, in Ghana transportation of live



pigs is done in the same vehicle as humans. Animal welfare problems may be resolved by the use of tools such as right legislation, voluntary structures of practices, education and training, communication approaches and the total consolidation of the veterinary services in the country (FAO, 2014). Meanwhile the increasing acceptance of welfare standards especially in the area of pig health and sanitation are opportunity to the pig industry as it will also increase.

2.7.3 Objective evaluation of pig welfare

The World Organisation for Animal Health (OIE, 2005) recently stated that welfare has strong relationship with animal health, and therefore enhancing welfare usually yields a better output and security of animal products. Humans make profit from animals, scientific research and for recreation, therefore developing his own welfare. In exchange, man has to assure, from view point of morality, the top level of welfare available to animals.

Among animal standards, some parts of the animal body are very significant to inspect, considering that they may have been affected by fighting or poor environmental conditions leading to injuries: shoulders, snout, ears, flanks, legs, distal joints, toes, perineum and tail (Boyle *et al.*, 2000; Anil *et al.*, 2005; Cagienard *et al.*, 2005; Scott *et al.*, 2006). The size and extent of the lesions may also be examined as measure of “body damage score”.



CHAPTER THREE

METHODOLOGY

3.1 Study area

Literature was collected on research works done and publications across Ghana. Ghana is located at the western part of Africa and it borders the Atlantic Ocean with total land area of 230,940 square kilometre. Geographically, the position of Ghana is between three (3) French-speaking countries of West Africa, and it shares boundary with Togo on the east and Cote d'Ivoire on the west side, and with Burkina Faso at the north (Adzitey, 2013). The population of Ghana according Ghana Statistical Service (G.S.S) (2012), is approximately 25 million of which 51% and 49% living in the cities and rural areas, respectively.

The climate is tropical in nature but temperatures fluctuate with time of year and elevation. The southern part of the country is characterized by two rainy seasons: one from April to July and the other from September to November. On the other hand, the rainy season of the northern part is unimodal and begins from mid-April and continues until September. Annual rainfall ranges from 1,100mm in the north to 2100mm in the South West. Notably, the climate gives rise to five major agro-ecological zones, namely:

- Sudan savannah
- Coastal savannah
- Forest
- Derived savannah, and
- Guinea savannah



3.2 Data collection and research framework

Data collection was desktop based. It involved extensive review of relevant literature on various topics of the pig industry. These topics cut across global and local production of pigs, marketing and consumption as well as the strength, weakness, opportunities and threats which define the state of the pig industry. This information was sourced from publications, student theses, websites, reports, online magazines, among others. The choice of sources was defined by the CRAAP Test, entailing currency of the publication; relevance of the information to the research; authority and credentials of the authors; accuracy of information; and purpose of the source as being objective rather than bias-oriented. Information was collected from various parts of the study area to ensure fair and balanced literature review. Primarily, there was inclusion of pig value chain of both northern and southern Ghana.

The research design used was mainly qualitative, and with some quantitative blend. This allowed for proper description of findings regarding the pig value chain of Ghana, and drawing of appropriate conclusions. Case studies of districts in the northern and southern sectors were used to further understand the social complexities of the pig value chain.



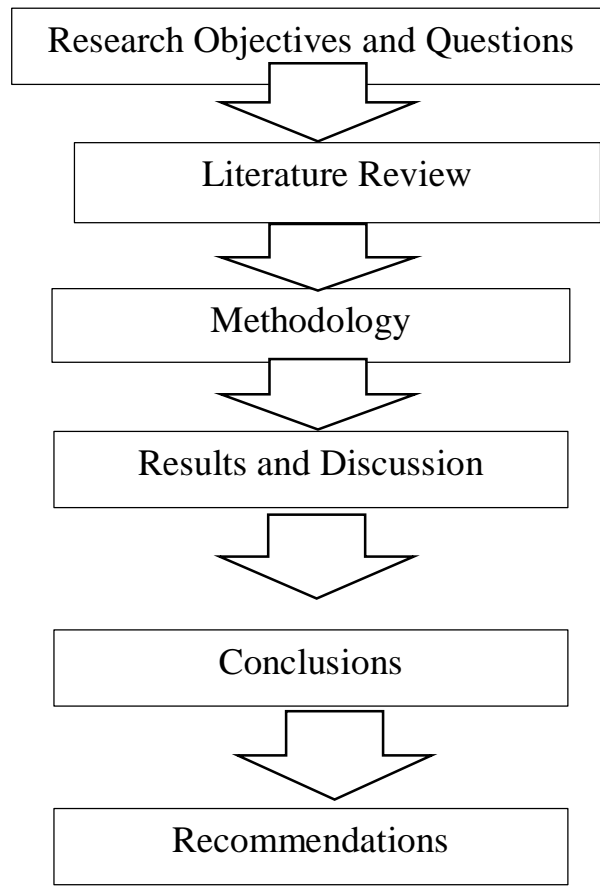


Figure 3.1: Research framework



CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

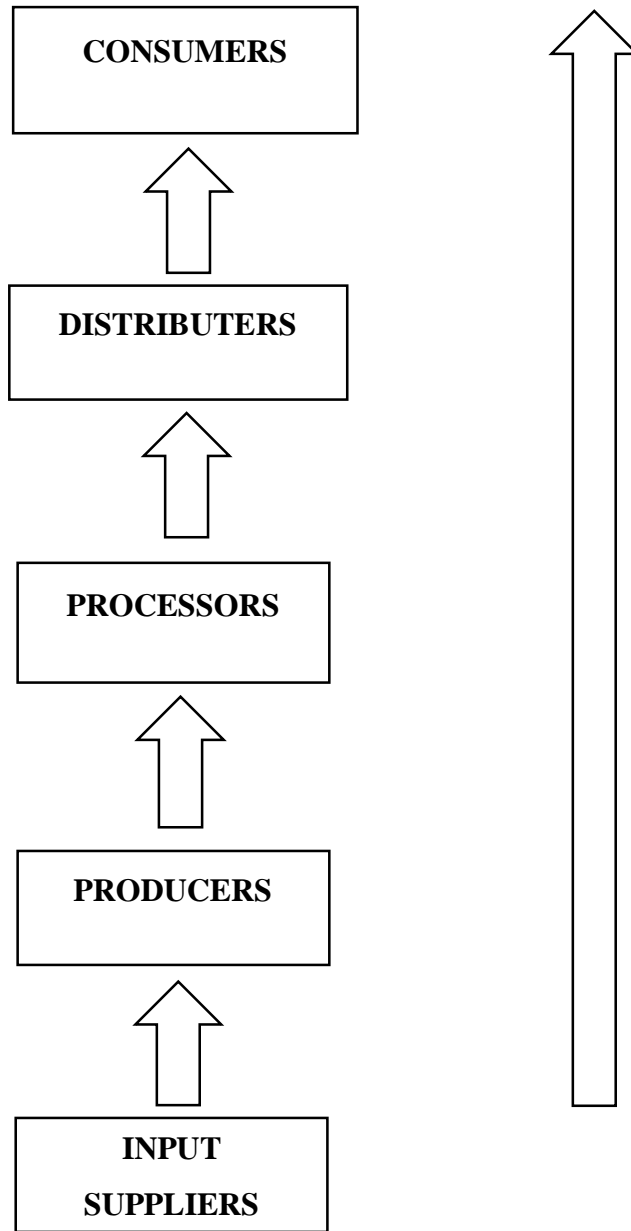
The value chain analysis of the Ghana pig industry showed many underpinning factors and complexities. The industry is underdeveloped and highly informal across production through processing and marketing. This underdevelopment agrees with the finding of Afari (2012) which states that most of the successes behind countries having formal value chain was strict safety issues and marketing networks and associations in the formal value chain and that there is always a means to formalise the informal chain. This long tradition of informal system accounts for the wide gap between Ghana pig industry and that of pig super power nations like China and the EU who are much advanced. From the analysis, the kinds of advancement lagging in the case of Ghana's pig industry mainly include policies, infrastructures and technology.

Also, due to the high informality nature of the pig industry, there is the shortcoming of poor market information flow especially at the production and marketing as there is hardly coordinated system to share information. This agrees with the findings of Livestock Market Development (2013) which realise that market opportunity lead to the deepening of value chain as well as the enhancement of horizontal and vertical relations with the value chain, and investment in the main value chain activities and the needed services and inputs.



ACTORS

VALUE ADDITION FLOW



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Figure 4.1: General value chain of Ghana pig production

4.2 Value chain actors and activities

4.2.1 Pig production input suppliers

The major input suppliers of the Ghanaian pig value chain include feed suppliers, veterinarians and general researchers at various sections of the chain, most especially at the bottom. This indicates that suppliers are very critical in the industry and any challenge in their activities can have massive negative impact on the performance of the other. Considering the present global outbreak of coronavirus (COVID-19), it is obvious that the implementation of various national and international restrictions such as on importation of production inputs has distracted the value chain of the Ghanaian pig industry. More so, the high cost of available input materials hinders the progress of the industry. For instance, many pig farmers are less interested in appropriate veterinary services and standard feed. Therefore, any increase in pricing or restriction is likely to intensify their disinterest.

4.2.2 Pig producers

The pig producers, which are also known as keepers or breeders, are right on top of the input suppliers and below the processors in the Ghanaian value chain framework. The research reveals that much of the production of pig in Ghana takes place in the rural areas. This may be due to the availability of land in rural areas and feeding ingredients to producers from local industries such as 'pito' mash, maize chaff, and rice bran which are major feed ingredients for pigs. Again, the high level of production in the rural centres may be due to less regulations with regards to bad odour that emanates from pig farms which is not tolerated in urban centres. In addition, the reported increasing production of pig in Ghana in much recent years may be due to the lucrative, nutritive and employment essence of the industry.



Gradually, Ghanaians are appreciating the health and nutritive essence of pork and the high demand of it has led to increase demand, even with deficit. Consequently, producers are rapidly increasing over the country.

4.2.3 Pig processors

The two types of operations in relation to pig processing as found in research are namely, pig slaughter (also called packing) and further processing of meat from carcasses by other firms that engage in it (LMD, 2013). These two separate levels of activities may be associated to the financial constraint by many slaughterers who do not have the financial power to do the further processing. As noted, majority of the carcass after the slaughter is eaten as raw meat; only a very small portion is processed further into other products. The minor and less processing may include the financial constraint, unavailability of technology and infrastructures/facilities to many people in the slaughtering stage. Conversely, Teye (1994) reports that technologies are being utilised in pig and other meat processing throughout Ghana. Possibly, there is technology investment imbalance or bias towards the processing of non-pig animals such as cattle.

Due to increasing consumer demand for quality food and pork (World Bank, 2014), there is call for the Ghanaian pig industry to step up its structures and infrastructures to meet international processing standards.

4.2.4 Distributers and marketers

As the research reveals, pig value chain organisations in Ghana just like many developing countries, are shifting from the normal traditional models to more organised linkages and controlled value chain systems. This development, according



to Ouma *et al.* (2017), is motivated by increased consumption of higher food and food service standards.

Another observation in the Ghanaian pig value chain is the well organised coordination established between the pig slaughterhouse and the pig product processors on one hand and the processors and the shop chains on the other hand. This may be attributed to the growing concerns such as welfare and its associated economic benefits which have redefined marketing and distribution of pig products.

Again, according to the research, the lower price of pork per unit weight as compared to meat of chicken, sheep and cattle is of major marketing concern. This low pricing of pig products compared to other animal products may be due to fear of marketers losing if they insist on higher pricing. Moreover, due to low preservation facilities available, sellers of slaughtered animals are forced to sell them off with little bargaining power. This loss of marketing power is attributed to the frequent outbreak of African Swine Fever. The recent outbreak of Coronavirus Disease (COVID-19) and the prejudice associated with the consumption of pig products as being possible carriers of the virus.

4.3 SWOT analysis

4.3.1 Strengths

The establishment and presence of pig breeding stations such as that of Nungua and Babile shows a major strength of the pig industry in Ghana. Research shows that many farms, especially those close to the stations geographically have access to improved breeds for breeding stock and consequently increased productivity. The challenge for the majority of the many farms which are especially small to medium



enterprises (SMEs) is their inability to link to these stations. The inaccessibility may be due to limited knowledge of these stations by many SME farms, break in information access or difficulty in transporting live pigs over a long distance.

Also, the increasing level of formal chain system due to commercialisation and increasing welfare concerns gives it extra strength for survival and development. The expectation is that many other small and informal sections of the industry will follow suit, as commercialisation and formalisation through the chain will be the new normal.

4.3.2 Weaknesses

The Ghana pig industry is plagued with several weaknesses. Central among all these are health, financial and research-based issues. The seasonal epidemic of diseases such as African swine fever and H1N1 is antidevelopment to the industry and has the potential for loss of investment and interest in piggery. If this seasonal disease continues the target to meet global demands and make higher contribution will not be achieved. More so, this may collapse the industry at large as people have fear for contracting disease or even losing their lives. This supports the assertion by Ayizanga *et al.* (2018) that any intervention programme aimed at helping pig farmers should target finding workable solutions to these three constraints, namely health, feed and housing.

Also, the mishandling of information during such epidemics is recognised to be detrimental, and must be discouraged. In an age of swift and wide information spread and devastating effect of fake news, such weakness needs much to be desired as it



reduces the confidence that both local and international consumers may have in the national pig food chain.

Thirdly, the high cost of managing pigs as a result of increased cost of feed is a major weakness to the Ghanaian pig industry. This weakness has often necessitated from financial institutions is difficult too. Meanwhile, the system of accessing financial assistance from family and friends is not sustainable. It is obvious that such challenge in investment in the pig industry can discourage many youth and upcoming investors from venturing into and hinder the expansion of the existing small-scale pig enterprises in the chain.

4.3.3 Opportunities

The research indicates that the Ghana pig industry is open to enormous opportunities. Central to these opportunities is the facilitation and promotion of small and medium scale enterprises (SMEs) through the government's Rearing for Food and Jobs intervention. With expected supply of 8, 600 breeding stocks it is obvious that many pig farmers will be sustained and encouraged in production, affecting the overall industry. As a fact, the role of SMEs has been instrumental in the development of many pig industries including the world major pig industrialist countries such as China, United States of America (USA) and the European Union (EU). The strategy has been that development of the pockets of small farms and processing firms leads to the eventual aggregation of these products, therefore feeding the national demand and even exporting excesses. It is therefore in good fate that the Ghana pig industry has the opportunity of developing through the small and medium scale enterprises (composed of channels such as production, processing and



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marketing of products). The implication and resultant benefit will be increased household income and better standard of living for the beneficiaries, their dependents and the national economy at large.

Also, the support of church-based organisations is a great advantage and opportunity for the pig industry. As many church organisations support their members and communities through pig projects, national production is increased and jobs are created for the project beneficiaries. These projects may be due to the aim of the churches to not only develop the spiritual development but also their economic need. These projects are usually sustainable and come with good monitoring system and are likely to add much weight to the contribution of national pork demand. As a country of high Christian faith adherents (about 70%), such opportunity if encouraged and well supported can really relieve many farmers of their economic challenges.

Again, the developing pig industry presents itself with pig feed industry and credit facility opportunities. The cost of pig feeding has been estimated at around 70% of the production cost. Firstly, feed subsidies may be the aim of many governments to accelerate pig production. Again, it may be the chain of production that needs much assistance as the high cost and supply may be challenging and therefore the concentration of intervention by many governments. The high demand is opportunity for the development of the pig feed industry, as local feed and nutritional materials are costly and less productive to animal growth.

Lastly, there is the opportunity of disease resistant pigs. The existent of the breeding stations and breeding programmes auger for strong genetic foundation for piggery



production and this in turn gives the opportunity for massive production with little risk of losing investments. It is a fact that disease is a major threat to many national pig productions, especially in the era of corona virus where animal movement and animal product consumption are under strict surveillance to avoid disease outbreak. This resistance may be due to the long use and breeding of the local breeds such as the Ashanti Black and their adaption to the environment.

4.3.4 Threats

The spread of detrimental fake news by the media on animal products and its safety as a threat is of major interest. From the literature this threat is seasonal during the epidemic of diseases such as H1N1. This misinformation may be due to previous incidence of consumers suffering ill health from pig products during epidemics which is difficult to overlook even in the event of nondeadly ones. It could also be attributed to the misconception that pigs are more susceptible to diseases due to the poor management environment. The implication of this gross misinformation on product and disease is that it can cripple the pig industry at large. This may lead to increased demand of other animal protein sources such as beef and poultry, and fish to the dwindling consumption of pork. The reality is that many consumers may not be interested in pork and other pig products even after such disease outbreak due to unhealthy and unmeasured passage of information by the media.

Secondly, as a society the negative effect of community conflicts has been realised to equally affect welfare and development of pigs in Ghanaian communities. Pig management which is mainly extensive in Ghana therefore poses high risk of animal loss during conflicts. According to Bariyam (2018), there are many forms, namely



starvation, poisoning, indiscriminate killing and stealing by which livestock and for that matter pigs are lost during conflicts. These forms of loss may be attributed to the pursuit of the conflicting parties to inflict pain or destroy the economic reserves of their enemies. The degree of loss may be due to household or backyard management system which readily exposed the pigs to indiscriminate killing and stealing. Starvation and poisoning may have been due to absence of human management leading to unavailability of feed or ingestion of unhealthy materials.

Moreover, pig fecal matter from pig farming has been an issue of communal and health concern. This is because the bad odour from pig droppings has been a respiratory challenge and the material is a medium for microbial growth leading to environmental pollution. This threat may be of high significance due to urbanisation and nearing of human settlements or residence to pig farms and management area. As pigs roam within open markets, residential areas and streets, they become dirty with mud water in the surrounding leading to loss of aesthetic value and production of bad odour. Moreover, pig fecal matter is noted for making water bodies including rivers and dams unhygienic for household usage. Such health-related threat raises public health concerns, making extensive system of pig management which is less expensive, discouraged in communities as compared with other livestock such as small ruminant and poultry.

Similarly, open defecation which is a major practice in many Ghanaian communities, is a threat to the pig industry. The practice may be attributed to absence of decent toilet facilities in communities or inconvenient proximity, compelling people to use open fields. Moreover, open defecation may also be due to cultural reasons and



traditional attachment of people to use the open field rather than the modern toilet facilities. Agronomically, some farmers intentionally open up their crop fields for open defecation as the human excreta is supposed to increase soil fertility for crop production. Meanwhile, the very acts tend to become anti-promoting factors as people who see pigs roam in such open defecation surroundings get discouraged from patronising pork and other pig products. This change in consumer behaviour may be due to the perception that the product is consequently unhealthy.

Lastly, the varied nature of Ghana's climate, regarding the cool temperate south and arid north, affects the production and productivity of pig production and other chains of the industry and are constant threat. This may be attributed to inadequate water and feed, pest and disease that come with these harsh climatic conditions. Yet water supply is a major requirement across all chains of the pig business such as production and processing. For example, at production water is needed in feed preparation, cleaning and use in wallow for cooling body temperatures of pigs.



CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

From the study of works done across the nation and considering both southern and northern spaces, it is concluded that the pig industry of Ghana is mainly informal in its value chain structures, intertwined with many value chain actors and activities, among others. Generally, the main actors along the value chain are input suppliers, producers, processors, marketers and consumers. Input suppliers have the responsibility of empowering producers with the resources such as feed and veterinary service for the production of market weight pigs. After producers, processors were the next to add value to the product. Distributors were the connection between pig processors and consumers of pig product. The distributors were retailers or wholesalers who ensured that pigs were transported from their source of processing to point of sales for consumption. Some strengths of the chain include available good and disease resistant breeds from breeding stations and credit to pig farmers. Weaknesses include health misconception of pig products, high prevalence of infectious disease, lack of highly decentralized breeding stations affecting acquisition of good breeding stocks, among others. Opportunities of the Ghana pig industry include support from church organizations, credit financing, and gradual improvement of small and medium scale enterprises (SMEs). On the issue of threats, the research revealed that there is misinformation by media especially during disease outbreaks; negative effect of ethnic conflicts; poor pig farm waste management which is threat to production in residential areas; rampant open defecation which makes pigs and their product unattractive for consumption thereby impeding marketing.



5.2 Recommendations

Based on the findings and the study the following recommendations are made:

1. There is the need to restructure the informal chain. This will have massive advantage for all actors and food safety can be regulated. This may include comprehensive welfare components and will help to do away with tag and the misconception on pig industry with regards to hygienic standards and disease outbreak management.

2. Ensure strict continuity and execution of government's Rearing for Food and Job (RFJ) programme which aims at distributing breeding stock pigs to farmers. This will go a long way to encourage more pig production, include good breed into Ghanaian pig population, lead to job creation and consequently boost development.

3. Considering the financing challenge of various actors, it is recommended that Government and NGOs support farmers with inputs and financial credits. This should increase household and commercial productions and other chains, thereby feeding the national demand and even leading to exportation of the excess.

4. It is recommended that the personnel of the mainstream media houses should be trained on pig diseases such as African Swine Flu diseases so that they can communicate appropriately to the public during epidemics. This is necessary to avoid poor communication which makes pork and other pig products less patronized during (and after) outbreak, even when such diseases cannot affect human health. This should go a long way to reduce market risks and losses which would have



otherwise maximized as result of misinformation of the public by poor media during disease outbreak.

5. There is the need for investment for further research into the pig value chain as there is limited knowledge in this special area of pig in Ghana. Further studies, especially at the district or even regional levels and on economic areas such as return on investment (ROI) and value addition at each section of the chain will promote and reveal some other deep interactions of the actors necessary for programme interventions.



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