COST EFFICIENCY AND ECONOMIES OF SCALE IN BROILER PRODUCTION IN GHANA. A CASE STUDY OF THE ASHANTI REGION.

By

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DECLARATION

I, Seth Etuah, do hereby declare that this submission is entirely my own work towards the MPhil. (Agricultural Economics) and that, to the best of my knowledge, it contains no material previously published by another person or material which has been accepted for the award of any other degree of the University except where due acknowledgement has been made in the text.

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ABSTRACT

The steep decline in broiler production in Ghana is largely attributed to high cost of production. However, empirical evidence from other African countries suggests that low cost efficiency levels among the broiler farms/farmers could be a contributory factor to this soaring production cost. This study, therefore, measured the economies of scale and cost efficiency levels of the broiler farms in the Ashanti region of Ghana. Through multi-stage sampling technique, 114 broiler farms/farmers were selected as respondents for this study. Stochastic cost frontier model was then used in estimating the cost efficiency levels. The empirical result of this study showed that the cost efficiency levels of the broiler farms in the study area ranged from 1.03 to 1.43 with the mean of 1.14. This implies that an average broiler farm in the study area spent about 14% above the frontier cost (minimum cost). Farm size, Farmers' level of education and technical advice from veterinary services were identified as factors that significantly improved cost efficiency in the study area. On the other hand, economies of scale was computed to be 1.513. Since the value of the economies of scale is greater than one, it implies that there is presence of positive scale economies among the farms. This is an indication that most of the broiler farms in the study area could reduce their production cost by further increasing their scale of production. It is, therefore, recommended that the Government should support the broiler farmers with funds to increase their scale of production in order to benefit from the cost advantage associated with scale. The farm owners should recruit farm managers who have at least acquired formal education up to the Senior High School (S.H.S) standard or at best use them on part-time basis. In addition, more veterinarians should be trained by the government and assigned to

the various poultry/broiler farming communities to enable the broiler farmers receive technical advice from a professional source instead of relying hugely on their fellow farmers.

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DEDICATION

I do dedicate this work to my parents; Mr. Kofi Etuah and Ms. Comfort Andoh. Again, I dedicate it to my lovely wife (Mrs Joyce Boakyewaa Etuah) as well as my brother and sisters; Frank Etuah, Regina Etuah, Esther Etuah and Gloria Essuman.

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LIST OF ACRONYMS AND ABBREVIATIONS

AGOA	African Growth and Opportunity Act
ERF	Economic Revision Focus
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Statistics
FASDEP	Food and Agriculture Sector Development Policy
GNP	Gross National Product
GDP	Gross Domestic Product
MoFA	Ministry of Food and Agriculture
NGO	Non-Governmental Organizations
USA	United States of American
USDA	United States Department of Agriculture

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Broiler production is of considerable significance to the rural, urban as well as the national economy and is an important source of animal protein. The poultry industry in Ghana grew rapidly during the 1980s and 1990s, developing into a vibrant agricultural sub-sector and supplying about 95 percent of chicken meat and eggs in the country. This growth was due to the Government of Ghana's initiative in the 1960s to promote commercial poultry production as the greatest potential for addressing the acute shortfall in the supply of animal protein (Aning *et al*, 2008). Since 2000/2001, however, Ghana's poultry sector has been experiencing a steep decline in output (USDA, 2008). The decline in domestic poultry output has resulted in an increase in poultry imports to Ghana.

Ghana's poultry imports have more than tripled in the past few years as the domestic poultry sector continues to decline and can only supply below 50 percent of poultry demand in the country (Flake and Ashitey, 2008). According to USDA (2008), post forecasts poultry imports for Ghana in 2008/2009 was as high as 80,000 MT, up from 66,000MT in 2007/2008 due to increasing demand and the continued decline in domestic commercial poultry meat (chicken) production.

This steep decline in the local poultry industry is due to the very high cost of inputs (feed, medication and energy) coupled with lack of credit for expansion culminating in low profits (Flake and Ashitey, 2008). The Ghana government's policy objective for the poultry sub-sector is to encourage increased production so that selfsufficiency and food security can be achieved. Nonetheless, production of poultry meat, especially chicken, has continued to decline over the years, partly due to factors enumerated above and policy constraints. According to Kibaara (2005), in the absence of price supports and with the competition from imports, one way of reducing the cost of production is by being efficient.

Udoh and Akintola (2008) stated that farming in general has to use available inputs as efficiently as possible to maximize production. Inefficiency of resource utilization can seriously jeopardize and hamper food production, availability and security. According to Udoh and Etim (2009), to optimize production and ensure sustainability there is need for judicious management of the resources employed in the broiler enterprise.

There have been Government and Non-Governmental programmes/policies in recent years to provide support for the poultry industry to increase production and bridge the gap between the increasing demand and the low supply of poultry products, especially chicken. More often than not, the commercial and development banks are urged to provide loans for the farmers to expand their production (FAO, 2006). However, there is no empirical evidence to justify whether or not an increase in the scale of production will be profitable to the farmers since the production cost is known to be high in the country. There is, therefore, the need to conduct a systematic study to assess the cost efficiency and economies of scale of the broiler farms in the country.

1.2 Problem Statement

In recent times, the poultry industry in Ghana has been experiencing a steep decline in output which is attributed to soaring cost of production, and hence significantly reduced net returns from the business. This has culminated in the exit of many poultry farms especially the broiler farms, with prospective investors becoming increasingly unwilling to invest in the industry (USDA, 2011). The situation does not only threaten existence and survival of the broiler industry but also calls for a conjunctive effort to save the industry from total collapse. By 2005, domestic poultry meat production was only able to meet 34 percent of demand as most poultry producers stopped producing broilers for meat altogether and started concentrating solely on the production of eggs. Both government and industry sources have indicated that poultry meat (broiler) production for 2008 fell to below 11 percent of demand (USDA, 2008). This steep decline in the local poultry industry has been attributed to the very high cost of production.

Time and time again, farmers attribute the high cost associated with poultry and for that matter broiler production to the cost of feeding the birds, and the cost of other inputs ignoring the crucial role that cost management can play. Efficient cost management or otherwise by the farmers has direct bearing on their cost of production. If farmers were efficient in allocation of inputs, this would minimize wastage of production resources resulting in minimization of cost and maximization of profit and, hence encouraging them to produce more. This presupposes that low cost efficiency (high cost inefficiency) could be a contributory factor to the high broiler production cost and for that matter low poultry meat (broiler) production in Ghana.

Studies from other African countries suggest that cost efficiency or inefficiency levels of broiler farms are determined by the socioeconomic and demographic characteristics of the farmers/production managers (Oji and Chukwuma, 2007; Udo and Etim, 2009; Ng'eno *et al*., 2010 ; Ashagidigbi *et al*., 2011). These characteristics include the information status and management skills measured by the level of education, farming experience, and source and frequency of technical advice. The level of farmers' formal education determines their readiness to accept new ideas and innovations, and hence promote proper cost management practices. Farmers who are more educated are, therefore, more likely to be cost efficient as compared to their less educated counterparts, probably due to their better skills, access to information and good farm planning.

Also, the continuous practice of an occupation for a long period presumably makes a person more experienced and more productive in practice. Years of experience in broiler production could result in acquisition of more knowledge on the production processes and practices culminating in efficient utilization of production inputs. However, there are instances where some very experienced farmers become adamant and unwilling to adopt new practices resulting in low cost efficiencies (high cost inefficiencies).

In addition, technical advice is very crucial or important for cost management. However, the quality of advice and its impact depend largely on the source. Broiler farmers receive technical advice from variety of sources. The differences in the content and quality of advice from these sources could lead to differences in the production practices among the broiler farms.

Besides the farmer characteristics, average cost of production could be reduced through an increase in the scale of production (indication of positive scale economies). Lower average costs represent an improvement in productive efficiency and can feed through to consumers as lower prices in the event of market competition. However, not all increases in output or scale of production lead to reductions in average production cost. There are instances where an increase in the scale of production lead to a rise in an average cost per unit. In some cases, an increase in production scale does not have any impact on the average production cost per unit. These occur when there are so many inefficiencies within the farm resulting in rising average costs. This study, therefore, addressed the following central research question: *what are the cost efficiency levels and the economies of scale among the broiler farms in the Ashanti region of Ghana?*

1.3 Specific Research Questions

The following specific research questions were addressed in the study:

(i) What are the cost efficiency levels of the broiler farms in the study area?

(ii) What are the factors that influence the cost efficiency levels of the broiler farms in the study area?

(iii) Is there a presence of positive scale economies among the broiler farms?

These questions formed the focus of this research using Ashanti region as a case study.

1.4 Objectives of the Study

This study is generally designed to analyse the cost efficiency in broiler production as well as determine the economies of scale of the broiler farms in the Ashanti region of Ghana.

1.4.1 Specific Objectives: The specific objectives are to:

(i) determine the levels of cost efficiency among the broiler farms in the study area.

(ii) identify and examine the factors influencing cost efficiency of the said farms and disentangle their individual effects.

(iii) determine the economies of scale of the farms.

(iv) draw policy implications based on the empirical results.

1.5 Statement of Hypotheses

The major hypotheses tested in this study included:

(i) **H_0: $\gamma = 0$,** the null hypothesis specifies that the boiler farms in the study area are cost efficient in their production and, hence, there are no inefficiency effects (γ) on their production cost.

$H_{1:}$ $\gamma \neq 0$, the broiler farms in the study area are not cost efficient in their production and, hence, there are inefficiency effects (γ) on their production cost.

(ii) **H_0: $y = 0$,** the null hypothesis specifies that production level/scale (y) has no effect on broiler production cost in the study area.

$H_{1:}$ $y \neq 0$, the production level/scale (y) has effect on broiler production cost in the study area.

1.6 Justification

The main concern of any production activity has been described as that of achieving maximum possible efficiency in the transformation of inputs into outputs. In agriculture, measurement of cost efficiency is an important step in a process that might lead to substantial resource saving which has important implications for both policy formulation and farm management. Efficiency measures can have important implications for issues related to economic survival, the technological adoption and innovations and the overall input use in the poultry subsector of agriculture. They can provide important insights to managers when making operational decisions and to policy makers in the debate on regulatory issues. Furthermore, for individual broiler farms, gains in efficiency are of great substance in periods of financial stress since efficient farms are more likely to generate higher incomes and thus, stand a better chance of surviving and prospering. It also helps to determine the under-utilization or over-utilization of factor inputs.

Moreover, measurement of the extent and determinants of cost efficiency indicates which aspects of broiler farms' characteristics can be addressed by public investment to improve efficiency. It also introduces a new dimension to farmers and policy makers on how to increase broiler production by determining the extent to which it is possible to raise the cost efficiency of the farms with the existing resources base and the available technology in order to meet the increasing demand of poultry products such as chicken in Ghana. An improvement in the understanding of the levels of cost efficiency and its relationship with a host of farm level factors can greatly aid policy makers in developing efficiency enhancing measures as well as in judging the efficacy of present and past reforms.

Moreover, the result of the economies of scale determination is a very useful decision making tool when considering an expansion in a farm's scale of production. The result is crucial not only for the broiler farmers but also for those who intend to invest in the broiler industry since it enables them to ascertain whether or not an increase in the present scale of production could translate into reduction in an average cost of production and eventually increase farmers' profit. That is, it enables the other stakeholders (private investors, government) to find out whether a possible increase in the present scale of broiler production in the study area and in Ghana as a whole would not disadvantage the farmers in terms cost/profit. Therefore, an empirical study to determine the cost efficiency levels of the broiler farms and the presence of economics of scale among the farms are the necessary first step in our national effort to reduce broiler production cost and boost local production.

1.7 Scope of the Study

This thesis covers the commercial broiler farms in Ashanti region of Ghana. To avoid inconsistencies in the data and ensure high level of accuracy of the results, information on a particular production period had to be considered. Therefore, this study considered information from farmers who received their day-old chicks between January and April, 2011 for production towards Easter season. According to USDA (2008), most of the commercial poultry farmers produce broiler birds for sale only during the festive seasons (Christmas and Easter), a period in which most Ghanaians prefer live chicken.

1.8 Organisation of the Thesis

The remainder of the thesis is structured as follows: Chapter two provides the literature or the theoretical underpinning for the study while in chapter three a description of the study area and the technique employed in data collection are presented. The theoretical considerations for this research as well as the methods used in the empirical analysis are also discussed in chapter three. Empirical results/findings of the study are discussed in chapter four. Chapter five contains general conclusions and recommendations based on the empirical results of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter, relevant literature on the study is reviewed. The review begins with the role of the poultry sub-sector in the Ghanaian economy. That is, its contribution to domestic meat and egg production, agricultural GNP and employment creation. Poultry production trends, constraints, cost and cost trend are also discussed. In addition, the role of efficiency in poultry production, levels of inefficiency in Ghana and other developing countries are discussed. The review concludes with the discussion on factors influencing efficiency including scale of production.

2.2 The role of the poultry sub-sector in the Ghanaian economy

GDP estimates released by the Ghana Statistical Service in 2010 indicate that the Ghanaian economy has undergone a significant structural change (Duffuor, 2010). The agricultural sector which has for long dominated economic activity has given way to the services sector (Duffuor, 2010). However, the role of the various sub-sectors of agriculture in the Ghanaian economy is still significant. As is the case in most African countries, the role of the livestock sub-sector in the Ghanaian economy cannot be underestimated. Poultry contributes 25% of the total domestic meat production and, together with other livestock, contributes 7% to the agricultural GNP (Aning *et al.* 2008). It can be deduced from a study by Killebrew and Plotnick (2010), that unlike domestic broiler meat production which is very low, Ghana's domestic egg production level is high.

According to Aning *et al* (2008), the exact number of people employed in the poultry sub-sector in Ghana is not known. However, it is estimated that nearly 2.5 million households benefit from village poultry production (Aning, 2006). The number of commercial poultry workers was estimated at about 7000 in the year 2007/2008 (Aning et al., 2008). Nonetheless, soaring cost of production in recent years has culminated in the exit of many poultry farms and for that matter the employees in the sub-sector.

The poultry industry is either directly or indirectly linked with the other sectors of the economy such as industry. Many industries provide inputs required in poultry production such as feed, day old chicks, drugs, chemicals and vaccines. There are other factories/industries that manufacture poultry equipments such as feeders, drinkers, brooders among others (Aning, 2006). This implies that the poultry industry indirectly offers employment to several people thereby contributing tremendously to economic development of the country.

2.3 Trends and Composition/ Structure of Domestic Poultry Production

In the 1960's, the government of Ghana identified commercial poultry production as the greatest possible way of resolving the acute shortfall in the supply of animal protein and consumption challenge in the country. This necessitated the establishment of an integrated poultry project in Accra. The growth of the industry was slow initially, as supplies of day-old chicks and other inputs were irregular (FAO, 2006). Frequent outbreaks of Newcastle disease during the period worsened the situation and deterred many potential farmers and investors from investing in the poultry industry.

According to Aning (2006), these constraints were overcome, and by the 1970s poultry production, supported by removal of custom duties on poultry inputs (feed additives, drugs and vaccines) and improved veterinary services was undertaken by many farmers either full-time or on part-time basis, especially in the urban areas of Accra and Kumasi. However, in the early 1980s the Ghanaian economy experienced sharp downturn which severely affected the availability of feed ingredients and other inputs and poultry production declined (FAO, 2006).

From the late 1980s to the 1990s, the poultry industry developed into a vibrant agricultural sub-sector, supplying about 95 percent of chicken meat and eggs in the country (Aning *et al.*, 2006). However, according to USDA (2008), since 2000/2001, Ghana's poultry sector has been experiencing a steep decline. This severe decline in the local poultry industry is due to the very high cost of production (USDA, 2008). By 2005, domestic poultry production was only able to meet 34 percent of demand for poultry meat as most poultry producers stopped producing broilers for meat altogether and started concentrating solely on the production of eggs. Both government and industry sources have indicated that poultry meat (broiler) production for 2007 fell to below 11 percent of demand (Aning *et al.*, 2008). Most of the small and medium-scale commercial broiler producers have completely closed down (USDA, 2011)

Due to low domestic poultry production and for that matter inability to meet increasing demand, imports of poultry products have increased almost 400 percent since 2000, growing at an annual average rate of 57 percent (USDA, 2008).

Poultry production in Ghana includes local and exotic breeds of chicken, turkey, guinea fowl, duck, quail, pigeon, and ostrich. Nonetheless, broilers and layers (including the local breeds of chicken) account for 70 to 80 percent of the country's total poultry population (USDA, 2011). Almost all rural households raise local chicken breeds as a source of meat, eggs, and emergency cash. Local breeds of Guinea fowl are also kept in rural areas, particularly in the country's poorer northern regions (Aning, 2006). This presupposes that keeping poultry for commercial purposes is not widespread in rural areas. A small percentage of the rural poultry population is comprised of exotic chickens raised for sale during festive occasions. Small-scale commercial layer units have also expanded in rural areas in recent years, aided by NGOs working to reduce rural poverty.

Commercial poultry operations are found mostly in the urban areas of Greater Accra, Brong Ahafo and Ashanti administrative regions (USDA,2008). Three hundred and eighty large-scale operations exist in the country, each with stocks of over 10,000 birds. Most large-scale operations are egg producers, with some raising exotic breeds of broiler chickens, Guinea fowl, and turkeys for meat. These operations manage their own feed mills. Some maintain hatcheries and parent stocks. Almost 1,000 small- to medium-scale (50 to 10,000 birds) facilities operate in the country (FAO, 2006). They rely on external suppliers for day-old chicks and feed. According to Killebrew and Plotnick (2010), the country has seven hatcheries (four in Ashanti, two in Greater Accra, and one in the Eastern region) which produce day-old chicks and guinea fowl keets for commercial production. Four of the seven facilities rely on imported fertile eggs. The country has 12 feed milling companies.

All hatcheries and feed mills operate below capacity (about 25 percent and 42 percent of capacity respectively) due to limited demand. In Ghana, local processing of poultry into cut portions to facilitate quick and easy use by consumers is nonexistent. There are two poultry enterprises that have the facility for processing poultry into dressed whole birds but has not been sustained(USDA,2008). Since 2000/2001, various governmental and non-governmental interventions have been introduced. Private sector initiatives were also encouraged. However, the local poultry production has always lagged behind demand because of high cost of production (Aning *et al*, 2008). The Food and Agriculture Sector Development Policies (FASDEP) estimates the annual poultry production to be 14,000 mt. of meat and 200 million eggs respectively (Aning, 2006).

2.4 The Nature of the Poultry Industry in the Ashanti Region

As stated earlier, Ashanti region is one of the three main commercial poultry production regions (aside Brong Ahafo and Greater Accra regions) in Ghana (Aning 2006). All the six major breeding farms in Ghana are found in the Ashanti region. Namely; Akate Farms, Topman Farms, Mfum Farms, Besease Farms, Dobbmags Farms and Jokas Farms (FAO, 2013). In addition, seven out of the nine hatcheries in Ghana that produce day old chicks are found in the Ashanti region. The local hatcheries that produce these day old chicks include Darko Farms, Akate Farms, Mfum farms, Jerusalem Farms, Asayam Farms, Besease farms, Akropong Farms (all in Ashanti Region) as well as Africo and Afariwa Farms (in Greater Accra Region) (FAO,2008). However, all these hatcheries now operate below their capacity due to high production cost and low demand (FAO, 2013).

Moreover, large-scale commercial feed producers are located in the region. Nonetheless, as is the case in the hatcheries, all the feed mill operators in the region now produce below their installed capacity due to low demand for poultry feed (FAO,2006). The low demand for poultry feed and day old chicks in this region, which supplied over 50% of poultry meat and eggs in the country during the 1990s, is mainly due to the collapse of many poultry farms. Most of the poultry farms presently operating in the region are concentrating on layers citing high cost associated with broiler production as their reason for the shift (FAO, 2006). This reflects the decline in poultry meat (broiler) production in the region and in Ghana as a whole. According to FAO (2008), the number of poultry operators in Ghana as whole has reduced from 5000 to less than 1000 and most of them are only focusing on layers and egg production with the broiler production almost scrapped off due to high cost of boiler production and lack of credit for expansion (FAO,2013).

2.5 Constraints to Poultry Production

According to Darko (2010), the poultry industry in Ghana is being constrained by uncompetitive interest rates, high cost of maize for feed formulation resulting in high cost of poultry production and low productivity. Asare-Boadu (2010) also identified high prices of poultry feed as the major cause of farm failure and stressed the need for the government to intervene to control feed prices. According to Asare-Boadu (2010) having heavy subsidies for maize production, will mean the cost of poultry production is being effectively subsidized because it has an impact on the cost of feed, which is a major part of the cost of poultry. Otoo (2009) explained that the Ghanaian poultry farmers put in everything to buy feed and pay duties at the ports as well. He also stressed that while the average Ghanaian farm yields 10 bags of maize per acre, the same land in Brazil, for example, yields 36 bags. This underlines why there is a vast difference between poultry production cost in Ghana and that of other developed countries.

Otoo (2009) also identified lack of affordable credit as a constraint to commercial poultry production in Ghana. According to Otoo (2009), the cost of the commercial loans is so high that it would not be viable using loan to finance poultry production activities. This presupposes that lack of finance is another major cause of failure or lack of progress in the poultry industry. Darko (2010) emphasized that interest rates in Ghana far exceed the international norm. A farmer in the United State of America borrows at 4 percent interest, while his Ghanaian counterpart pays anything up to 28 percent. Asare-Boadu (2010) also stated that, even with the high interest rates, loans are not easy to come by because banks see agriculture as high-risk. Darko(2010) stated that there used to be something like an agricultural loan in the past and the interest rate was good but it is no longer there and as a result of the high interest rate, poultry farmers can hardly borrow to improve their operations.

There is lack of policy initiative to focus attention on developing local poultry industry to meet the increasing local demand for poultry product especially meat (Owusu-Afari, 2010). According to Killebrew and Plotnick (2010), the policy and organizational environment is least favorable for poultry sector development in Ghana due to the lack of successful government support, infrastructure, or organization among producers. Owusu-Afari(2010) stated that there is a failure of legislators to recognize the need of passing laws that draw sufficient attention of government agencies responsible for agricultural development to the need of channeling adequate support to efforts being made to improve poultry production. This implies that there is lack of definite government policy on developing the poultry sector. Darko(2010) added that governments keep repeating policies on poultry whenever a national budget is read and yet none of these policies has been implemented. For instance, budget statement of Ghana (2009) indicated that government would help poultry farmers to increase production to meet the domestic demand of the country by the year 2012. However, according to Owusu-Afari(2010) , no development has been seen yet in the poultry sector.

According to Owusu-Afari(2010) there is also inadequate capacity-building programmes to equip poultry farmers with proven techniques for efficient and rewarding poultry production culminating from optimal utilisation of resources.

2.6 Cost and Cost Trend of Domestic Broiler Production

The fact that total poultry production costs vary from farm to farm makes it somewhat complicated in an attempt to make accurate generalizations. However, in all cases, the major cost item is feed. Though there is little official data available on local production costs, it is very evident that stakeholders are concerned about eroding competitiveness in the context of high and rising input costs. According to Aning (2006), production costs of 1kg of poultry meat(chicken) in Ghana from the year 2001 to 2005 were GH¢1.0526, GH¢1.1850, GH¢ 1.3430, GH¢ 1.6277 and GH¢ 1.7376 respectively. This represents an overall increase of 65.1% in poultry meat (1kg) production cost over the period with yearly increases between 6.8% and 21.2%

(Aning, 2006). Furthermore, there is some evidence that poultry production costs in Ghana are well above international levels. For instance, FAO (2008), reported the broiler production cost in Ghana in 2006 to be GH¢4.09 per bird (around 1.5 kg) or GH¢2.07 per kg live weight with feed cost making up over 60 percent of the total cost. Local sales prices were quoted at US$ 5.50(then equivalent of GH¢5.50) per bird, well above the price of an imported broiler. Major suppliers of chicken products, such as the US and Brazil, reported costs of US$0.52 and US$0.55 per kg live weight respectively (USDA, 2008). A study by USDA (2011) reported the broiler production cost in Brazil between January to June, 2011 to be US$1.12(then equivalent of GH¢1.64) per kg live weight. According to USDA (2008), the average cost of producing broiler in Ghana (live wt 2-2.5kg/dressed weight of 1.5-1.9kg) as of the year 2008 was estimated as GHC10.00 for large scale producers and it could be more for small-scale producers.

Furthermore, nominal maize prices in US$ terms in Ghana have fluctuated between US$151 per tonne and US$256 per tonne far above that of the major suppliers such as United States of America and Brazil (FAO,2006). Similarly the prices of all categories of poultry feed rose by 96.4 to 106.7% between 2001 to 2005 (Aning, 2006). According to USDA(2008), the price of maize per 50kg bag in July 2008 was GH¢45.00 (then US$45), nearly double the cost of GH¢24.70 (then US$24.70) in the same period in 2007 whereas that of the major suppliers of chicken products to Ghana, such as the United States of America and Brazil, reported prices of US$10.77 and US$10.93 per 50kg bag respectively (USDA,2008).This implies that the increases in feed costs generally reflected the market price of maize, locally produced but often supplemented with imports(FAO, 2008). According to Aning (2006), the price of day-old chicks in Ghana also increased steeply between 2001 and 2005 from GH¢0.40 to GHC0.70. This implies that feed cost, cost of day old chicks, costs of energy among others account for the high poultry production cost in the country (FAO, 2008).

2.7. Role of Efficiency in Commercial Poultry Production

Efficiency can be defined as the ability to produce a given level of output at the lowest cost (Farrell, 1957). The role of efficiency in increasing poultry and for that matter agricultural output has been widely recognized in both developed and the developing countries of the world (Tran *et al*, 1993). The main concern of any production activity has been described as that of achieving maximum possible efficiency in the transformation of inputs into outputs. According to Lawal (2007), in agriculture, measurement of efficiency is an important step in a process that might lead to substantial cost saving which has important implications for both policy formulation and farm management. The general observation therefore is that local farmers, especially in the developing countries, are not efficient in the allocation of available resources in agricultural production (Abdullai and Huffman, 2000). Efficiency in production is a way to ensure that products of firms are produced in the best and most profitable way. To prevent waste of resources and for that matter high cost of production, efficiency is of great importance for every sector of the economy (Alrwis and Francis, 2008). Efficiency measurement is very important because it is a factor for productivity growth. It also helps to determine the under utilization or over utilization of factor inputs (Yusuf and Malomo, 2007).

According to Lawal (2007), gains in agricultural output through the improvement of efficiency levels are becoming particularly important nowadays since the opportunities to increase farm production by increasing the utilization of the physical resources have been diminishing. According to Kibaara (2005), cost of production is related to productivity and efficiency of production. Therefore, high costs could be as a result of cost inefficiency.

In addition, eliminating existing inefficiency among farmers can prove to be more cost effective than introducing new technologies as a means of increasing agricultural output and farm household income (Lawal, 2007). Furthermore, for individual farms, gains in efficiency are of great substance in periods of financial stress since efficient farms are more likely to generate higher incomes and thus, stand a better chance of surviving and prospering (Tijani *et al*.2006). As was pointed out by Giroh *et al*. (2010), efficiency level of the farmers has direct bearing on cost of production which consequently translates to more profit to the farmers. If the poultry farmers are efficient in the allocation of inputs, this would lead to minimization of cost resulting in maximization of profit and encourage them to produce more leading to food security (Nge'o *et al*.,2010). This implies that improvement in cost efficiency would cause a reduction or fall in total cost of broiler production.

Alrwis and Francis(2008) concluded that the cost of production may be relatively high, due to cost inefficiencies in production that may be the result of inexperienced management. If it were determined that the relatively high production costs are due to inefficiencies, then a policy of improving efficiency could be implemented. Available evidence suggests that mean efficiency levels for the agricultural sector in Ghana is lower than that of other sectors (Al-Hassan, 2008). This presupposes that the Ghana government's objectives of increasing supply of domestic poultry products is unlikely to materialize unless positive steps are taken to adequately improve upon farmers' efficiency. Again, Udoh and Etlm (2009) concluded that about 35.4% of cost saving was possible if commercial broiler farmers in Nigeria were cost efficient in their production. Udoh and Etim (2009), stated that reducing inefficiencies in commercial broiler production could result in over 30% cost savings. Giroh *et al* (2010), confirmed that greater reduction in the cost of production can be achieved through reduction in inefficiencies (efficiency improvement).

Ng'eno *et al*, (2010) determined the resource use efficiency of poultry farms in Bureti District of Kenya. The results showed that most of the resources were being used inefficiently culminating in high poultry production cost. The efficiency indicator for poultry feed (0.0603) showed that poultry feed was being used inefficiently. This is because according to Ng'eno *et al*, (2010), when the resource-use efficiency (RUE) =1, it implies that resources are optimally utilized and that the farmers are efficient, when RUE < 1, resources are over utilized (there is inefficiency) and when RUE > 1, it means resources are underutilized which also translates into inefficiencies. Labour efficiency indicator (-0.091) showed that farmers were not only grossly inefficient in the use of the resource but also over utilized it while the efficiency indicator for poultry equipment (60.86) implied poultry equipment was underutilized resulting in cost inefficiency. These inefficiencies directly translate into low productivity and high unit costs in poultry production.

According to Ashagidigbi *et al*. (2011), about 27% of the variation in the cost efficiency of the poultry farms in Nigeria is due to inefficiency. This implies that cost inefficiency contributes tremendously to poultry production cost in Nigeria. Also, a study by Alrwis and Francis (2008) on the technical, allocative, and cost/economic efficiencies of broiler farms in the central region of Saudi Arabia revealed that the cost of production could be reduced by over 30% if all the farms produced on the efficient cost frontier. This indicates that cost inefficiency accounts for over 30% of the broiler production cost in the region.

Achieving economies of scale is a possible means of minimizing production cost. The presence of scale economies shows that the average cost falls when the output or the size of poultry farms increases. Cost efficiency is the ability to minimize cost for a given output (Weill, 2009). Thus, both economies of scale and cost efficiency measures are indicators of cost savings. According to Ogundari *et al.(*2006), only economies greater than one indicates cost savings. This implies that the presence of economies of scale (scale economies greater than one) ensures full utilization of resources. Also, according to Alrwis and Francis (2008), to prevent wastage of resources in production, efficiency is of great importance for every sector of the economy. Yusuf and Malomo (2007) confirmed that cost efficiency also helps to determine the under utilization or over utilization of factor inputs just like economies of scale. However, whereas economies of scale explores the possibilities of minimizing production cost by increasing output level, cost efficiency is concerned with the possibilities of minimizing cost of production through prudent cost management and utilization of resources.

Coelli *et al* (2005), also confirmed that economies of scale gives the change in the marginal cost of producing a given output with respect to a change in the production level of that output. That is, the advantage of large scale production that results in lower average cost per unit. According to Ogundari *et al.* (2006), Coelli *et al* (2005), mathematically, economies of scale (***Es***) is determined as the inverse of the sum of all the elasticities of total production cost with respect to all outputs. Economies of scale (***Es***) prevail, if ***Es*** is greater than 1 and, accordingly diseconomies of scale exist if ***Es*** is below 1. In the case of ***Es***=1 no economies of scale or diseconomies of scale exist. According to Allen and Liu (2004), in general, most studies find only small economies of scale in a firm's cost structure. In those studies that find evidence of increasing returns to scale, the measured economies of scale seem to be stronger in small to medium sized farms than for large farms.

According to Filippini and Farsi (2004), if a given firm's output is less than the optimal level, there are unexploited scale economies, whilst for firms larger than the optimal size there are diseconomies of scale. The optimal size of a firm is defined as the amount of output that minimizes the average cost of producing a unit of output. The unexploited scale economies could translate into inefficiencies and eventually high production cost. Yusuf and Malomo (2007) stated that efficiency measures can have important implications for issues related to the size distribution of farms and the overall input use in the poultry sub-sector.

2.8 Levels of Cost Efficiency in Poultry Production in Ghana and Other Developing Countries

There is no empirical evidence on the level of cost efficiency in poultry production in Ghana. However, Seidu (2008) conducted a study on technical efficiency of broiler farms in Brong Ahafo region of Ghana and concluded that the efficiency level of the farms was quite low. Findings revealed a mean efficiency index of 0.71 with a range of 0.43-0.79 indicating that output from broiler production could be increased by 29 percent using the same inputs and the available technology.

A few studies available on cost efficiency level of poultry production in some developing countries concluded that the farms were relatively cost inefficient. A study by Ashagidigbi *et al*. (2011) on technical and allocative efficiency of poultry producers in Nigeria concluded that the farms were about 27% cost inefficient indicating that the production cost could be reduced by 27% if the farms were efficient.

Begum *et al.* (2009) determined cost/economic efficiency of poultry farms in Bangladesh .The estimated mean value/level of cost efficiency was 0.66 indicating substantial inefficiencies in poultry production in the study area. The authors concluded that there was a scope for reducing cost of poultry production and hence obtaining higher profit through efficiency improvement. Also, a study by Alrwis and Francis (2008) on technical, allocative, and cost efficiencies of broiler farms in the central region of Saudi Arabia concluded that inspite of the subsidies on inputs the farms were relatively inefficient. The estimated cost efficiency level was 0.664 indicating the possibility of reducing production cost by 33.6% if the farm were cost efficient.

2.9. Factors Influencing Cost Efficiency in Poultry Production

Different authors have identified a number of factors influencing cost efficiency especially in a developing country's agriculture. According to Al-hassan (2008), inefficiency can result from socioeconomic, demographic or environmental factors. However, some of the environmental/exogenous factors such as weather, government policies among others are outside the scope or the control of the farmers, and hence their impact cannot be considered as farmers' inefficiency. Ali and Byerlee (1991), stated that farm-specific efficiency or inefficiency is influenced by farmers' characteristics (socioeconomic and demographic factors) which encompass information status and managerial skills, such as level of education, farming experience, extension contacts, farm size, gender , age as well as system effects exogenous to the farm, such as access to credit .

A study by Battese and Coelli (1995) identified age and schooling (level of education) as factors influencing efficiency. The result indicated that the younger farmers were more efficient than the older ones. The researchers concluded that the farmers with more years of schooling were also more efficient than their counterparts with fewer years.

Oji and Chukwuma (2007) also determined technical efficiency of small scale poultry-egg production in Imo State, Nigeria and concluded that farm size has a significant positive effect on efficiency at 1% level of significance. The authors concluded that the farmers were not operating at full capacity and would increase output by increasing the number of birds reared. Extension contact and education level were identified to have positive impact on efficiency at 5% level of significance. Furthermore, the farmers' access to credit was also identified to have a positive effect on efficiency. This implies that farmers who use credit in production are more efficient than those who do not receive credit. This could be due to the fact that those who receive credit are able to increase their level of production and benefit from cost advantage that are, in some cases, associated with scale.

Ng'eno *et al.*(2010) revealed that level of education and experience had significant and positive effect on efficiency of poultry farmers in Bureti District of Kenya. This findings stem from the fact that farmers with more years of experience and education are likely to be more dynamic and, therefore more willing to adopt new practices, thus leading to low inefficiencies in production. Udoh and Etim (2009) determined the farm level efficiency of broiler production in Uyo, Akwa Ibom State, Nigeria and concluded that higher experience and level of education reduce inefficiency. This confirmed the results by other researchers that experience and level of education increase the efficiency of the farmers. Also, the effect of age on inefficiency was positive confirming that the older farmers were inefficient as reported by other researchers.

Similarly, a study by Ashagidigbi *et al*. (2011) on technical and allocative efficiency of poultry producers in Nigeria identified farming experience, educational level, access to extension service and credit as well as gender of the farmers as factors that influence their level of cost efficiency. Farming experience, and access to credit were significant at 1%; educational level was significant at 5% while access to extension service and gender were not statistically significant. The result shows that farming experience and access to credit facilities have significant impact on cost inefficiency. The negative value and significant coefficient of farming experience and access to credit facilities , as pointed out by several researchers , indicate that increase in years of experience and access to credit facilities reduce cost inefficiency. Experience farmers have in-depth knowledge on their resources and practices resulting in proper utilization of inputs.

A study by Taru *et al.*(2010) on economics of broiler production in Meme Division of Cameroon confirmed that farmers' age, experience and stock/farm size influence cost efficiency. Therefore increases in these factors have the potential of reducing cost inefficiency. Furthermore, a study by Alrwis and Francis (2008) on technical, allocative, and cost efficiencies of broiler farms in the central region of Saudi Arabia confirmed that farm size influence cost efficiency. The result indicated that the large broiler farms were more efficient than the small farms.

Begum *et al.* (2009) determined cost/economic efficiency of poultry farms in Bangladesh and emphasized that efficiency is significantly influenced by some of the farm's socioeconomic factors such as farmer's age, education, experience, and poultry farm size. The results indicate that education is positively and significantly related to farm's efficiency as indicated several researchers. This is expected because the more educated farmers are more likely to be efficient as compared to their less educated counterparts, perhaps as a result of their better skills, access to information and good farm planning. The result also confirmed that efficiency is not related to age under all circumstances. Farming experience was confirmed as one of the factors that reduce cost inefficiency. The authors concluded that large farms were more efficient than small farms due to economic advantages concerning the organization and economic knowledge.

Output size has been identified by several researchers as one of the factors that influence efficiency. A study by Oji and Chukwuma (2007), confirmed that an increase in production capacity (number of birds produced) could increase efficiency and ensure full utilization of available resources. However, Lipsey (2000) stated that effect of output size on cost efficiency can be positive, negative or neutral. This is due to the fact that not all increases in output size result in reduction in cost per unit. There is, therefore, the need to determine the optimal output size to produce so as to avoid inefficiencies associated with cost and increase farm profit. ERF (2004) stated that to be able to know the optimum output size, there is the need for determination of scale effect (economies of scale). Alrwis and Francis (2008) determined the technical, allocative, and cost efficiencies of broiler farms in the central region of Saudi Arabia. The result indicated that twenty-three out of the forty farms or more than 57% of the sample data exhibited presence of economies of scale (positive scale effect), which implies that the farms should produce larger output than they are presently in order to reduce inefficiencies, production cost and increase their profit .

A study by Ollinger *et al.* (2005) on technological change and economies of scale in U.S. poultry processing concluded that plants producing larger outputs were more cost efficient than the smaller plants. Average costs at the largest poultry processing plants were about 8% lower than costs at plants that were half that size, and about 20% lower than costs at plants one-eighth that size. Cost advantages of these magnitudes help explain the near disappearance of small plants and the dramatic shift of production to large plants, whose share of output rose from less than 30% in 1967 to over 80% in 1992. Expanding poultry plant sizes reduced costs substantially during that period through the realization of scale economies. According to the authors, by 1992, wholesale chicken costs were 12% below what they would have been had plant sizes not changed between 1972 and 1992.

A study by Udoh and Etim (2009) on the farm level efficiency of broiler production in Uyo, Akwa Ibom State, Nigeria confirmed that effect of an increase in output size on efficiency could be neutral (constant economies of scale). This implies that the benefits of an increase in output size might not be realized at that level of broiler production in the study area.

Canbäck (2006) stated that if all increases in output sizes result in high efficiency or cost advantage then there should be no limits to firm's growth and size. This indicates that an increase in output size beyond certain limits could result in over-utilization of fixed production resources and result in inefficiencies.

2.10 Summary of Main Findings of Studies Reviewed and Knowledge Gap(s)

All the reviewed studies related to poultry production in Ghana pointed out the important role that broiler production plays in meeting the animal protein need of the populace. In addition, the studies confirmed that broiler production and, for that matter, the poultry industry in Ghana contributed significantly to employment creation and the Gross National Product (GNP) in the past. However, the studies revealed that the broiler industry in Ghana is now on the verge of collapse due to high cost of domestic production.

The studies reviewed on efficiency from other countries indicated that low cost efficiency (cost inefficiency) contribute greatly to the cost of broiler production. The studies also identified farmers' level of education, farming experience, scale of production (farm size), access to credit, age, extension contact and gender as factors that influenced the efficiency levels of the sampled farms in their study areas. Surprisingly, as it is evident from the review, studies on efficiency in broiler/poultry production in Ghana are virtually nonexistent. This study will therefore bridge that gap by providing empirical evidence on the cost efficiency levels and economies of scale of the broiler farms in the Ashanti region, which will be a unique and significant contribution to the body of literature on the poultry industry in Ghana.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The purpose of this chapter is to introduce the study area and report on the data sources and collection techniques employed in this study. In addition, it describes the survey instrument and how it was administered. It further describes the analytical framework and the specification of the empirical model.

3.2 Description of the Study Area

The study was conducted in the Ashanti region, one of Ghana's ten administrative regions. The region is centrally located in the middle belt of Ghana. It lies between longitudes 0.15W and 2.25W, and latitudes 5.50N and 7.46N. The region shares boundaries with four of the ten political regions, Brong-Ahafo Region in the north, Eastern region in the east, Central region in the south and Western region in the Southwest. It covers an area of 24,390 square kilometres representing 10.2% of the land area of Ghana with an annual rainfall range of 1098mm to 1637mm. The centre of population of the Ashanti Region is located in the Kumasi Metropolitan District. According to the 2010 population and housing census results, the region has a population of 4,839,100 making it the most populous region; however, its density (148.1 per square km) is lower than those of the Greater Accra (895.5/sq km) and Central (162.2/sq km) Region. The region is divided into 27 districts. Each District, Municipal or Metropolitan Area, is administered by a Chief Executive, representing the central government but deriving authority from an Assembly headed by a presiding member elected from among the members themselves. Ashanti region has a total labour force of 1,612,467 (Ages between 15-49).

In many of the districts, the main occupation of a very high proportion of the predominantly rural population is agriculture. Major activity within the agricultural sector in this region that is worth mentioning is poultry production. Ashanti region is among the few regions in the country with large number of poultry farms. Though the high cost associated with poultry production in Ghana has culminated in the exit of many poultry farms, the Region has the potential to feed the whole country and the sub region with poultry products.

Feed mill operations in Ghana are concentrated in the Greater Accra, Brong-Ahafo and Ashanti regions where almost all commercial poultry production occurs. Since large-scale commercial feed producers are located in Ashanti region, this region is considered as home of large poultry feed mills. As sated earlier, almost all the feed mill operators in the region now produce below their installed capacity due to high production cost, which has affected the demand for poultry feed. Low level operations, also reflects the levels of local poultry production in the country. Ashanti Region also has quite a number of hatchery companies, which make day old chicks readily available to most of the poultry farmers. This prevents long distance transportation in an attempt to obtain day old chicks. It, therefore, reduces the cost of acquiring day old chicks in the region.

The Ashanti Region has a number of highways that connect it to the other regional capitals making transportation and marketing of poultry products easier. This is because the large-scale commercial farms in this region have vehicles for transportation of feed, birds and other items. Poultry farmers in the region have formed a vibrant association. All that is required is for the Government to source funding under the AGOA initiative from the African Development Bank to support the poultry industry in the region.

3.3 Methods of Data Collection

This covers discussions on types and sources of data, sample size and sampling technique as well as survey instrument and administration.

3.3.1 Types and Sources of Data

Both primary and secondary data were collected in this study. Primary data were sourced from broiler farmers (production managers). Secondary data / information were obtained from publications of individual researchers as well as the reports/bulletins of various governmental (example, MoFA) and non- governmental organizations (such as Poultry Farmers Associations).

3.3.2 Sample Size and Sampling Technique

Multi-Stage sampling technique was employed in the selection of the respondents. That is, the respondents were chosen through a process of defined stages. A multi-stage sample is often more precise than a simple random sample of the same cost, and usually more accurate than cluster sample of the same total size. This sampling technique is much more flexible, economical and efficient than one-stage sampling. It employs combinations of different sampling methods.

The first stage involved purposive selection of eight (8) districts taking into consideration the prevalence of commercial broiler production in those districts. The districts were Atwima Nwabiagya, Atwima Mponua, Atwima Kwanwoma, Kwabre East, Ahafo Ano South, Sekyere South, Ejisu-Juaben Municipal and Kumasi Metropolis.

The second stage involved purposive selection of six (6) villages each from the Atwima Nwabiagya, Atwima Mponua, Atwima Kwanwoma, and Kwabre East districts, five (5) villages each from Ahafo Ano South and Sekyere South districts and four (4) suburbs from each of the last two districts (Ejisu-Juaben Municipal and Kumasi Metropolis) respectively. In all, there were 42 villages/suburbs as shown in table 3.1. The selection was based on preponderance of commercial broiler farms in those villages/suburbs.

Thirdly, the population of farms that produced broilers between January and June 2011 from the forty-two (42) selected villages/suburbs (in the 8 selected districts) were identified. The number of broiler farms in the districts ranged from a low of 12 in the Kumasi Metropolis and Ejisu-Juaben Municipal to a high of 26 in the Atwima Nwabiagya district (Table 3.1).

The number of farms for each district in the study sample was determined using quota sampling. That means that the number of farms to be included from each district was determined using their proportional representation in the population of broiler farms in all selected districts during the period under consideration. The following formula was employed: That is $\left(\frac{\text{Number of farms in a district}}{\text{Total number of farms in all districts}} X \text{ Sample size} \right)$.

The same procedure was employed to determine the number of farms to be included for each of the selected villages/suburbs in the study sample. In this case, the formula employed was:

$$\left(\frac{\text{Number of farms in village}}{\text{Total number of farms in district}} X \text{ Number of farms from district included in sample} \right)$$

Finally, the individual farms from each village or suburb were then chosen through simple random sampling. The simple random sampling was done by writing the names of each identified farm in each selected village or suburb on a chit of paper. The chits bearing the names of the farms were folded and then mixed together thoroughly. The chits were then picked one after the other without replacement till the required number for each village or suburb was obtained. The names appearing on each of the randomly picked chits of papers were then included in the study sample.

Last column of Table 3.1 shows the number of farms selected from each district. The production manager for each of the 114 selected farms was then included in the study as a respondent.

Table 3.1 Summary of the sampled areas and the distribution of the sampled farms

District	Number of villages/ suburbs selected	Population of broiler farms in the district	Number of farms included in study
Atwima Nwabiagya	6	26	18
Atwima Mponua	6	24	16
Atwima Kwanwoma	6	25	17
Kwabre East	6	25	17
Ahafo Ano South	5	22	15
Sekyere South	5	21	15
Ejisu – Juaben	4	12	8
Kumasi Metropolis	4	12	8
Total	42	167	114

Source: Researchers own computation, 2011

3.3.3 Survey Instrument and Administration

The instrument used was a questionnaire developed and tested in Kumasi Metropolis on 10 commercial broiler farmers. The questionnaire had 4 broad questions with 15 sub-questions and was designed to collect information on output, input, some major socio-economic characteristics of the farmers and production constraints. The input data included the costs of feed, human labour, day old chicks, medication , transportation and other running costs required in broiler production. Since input costs/prices vary by time, data were collected on the cost of the various inputs used during a particular production period/cycle. As stated earlier, data from the farmers who produced between January and June 2011 or better still, farmers who received day old chicks between

January and April 2011 were considered. That is, data on production towards the Easter season where most broiler farms engage in active production just like the Christmas period. The output data included the quantity of broilers produced at the end of the production cycle under consideration.

Data were collected on socio-economic variables such as educational level, farming experience, frequency of technical advice, accessibility to credit and farm size of the sampled farmers to explore their influence on the estimated cost efficiencies of the broiler farms. Data were also sought on the constraints faced by the broiler farms and the severity of each constraint. The data on the severity of the constraints were sought by asking the respondents to rank the constraints on the scale of 1 to 12 in order to test the agreement of the various respondents to their constraints. The 12 represents the number of constraints listed for the respondents to rank. The constraint ranked 1 by a respondent represents that respondent's severe or topmost constraint and 12 represents the least severe constraint.

All the 114 respondents were visited on their farms and interviewed based on the questionnaire. In order to avoid improper filling of the questionnaire by some of the respondents, the questionnaires were filled by the researcher as the respondents were providing the answers. The questionnaires were administered in English but in the local language (Twi) for those with difficulties in the English language.

3.4 Theoretical/Conceptual Framework

Empirical measurement and analysis of efficiency date back to the pioneering work of Farrell (1957) who distinguished between technical and allocative efficiency (or price efficiency). He defined technical efficiency as the ability of a firm to produce maximum output from a given set of inputs and allocative efficiency as ability of a firm to use inputs in optimal proportions given their prices and the technology available. According to Farrell's framework, the product of technical and allocative efficiencies is equal to overall economic efficiency. However, Farrell's methodology has been widely applied over the years, while it undergoes many refinement and improvement.

Presently, two approaches adopted for efficiency measurement are the classical and the frontier approaches. According to Oji and Chukwuma (2007), the classical approach compares the ratio of output (for example, number of eggs laid in a poultry farm daily) to a particular input (for example, quantity and cost of feed given to the laying birds). Classical approach will not be used for this study because it does not consider other factors which affect output as well as production cost, namely; quality of feed, ambient temperature and humidity among others. This implies that classical approach does not take into account other environmental/exogenous factors that influence the cost of production and efficiency of the farmers.

The frontier approach measures the difference between the inefficient units and the frontier through the residuals. The essence of frontier analysis is to construct a best practice frontier against which to evaluate the performance of individual producers (Lovell, 2008). The performance implies the ability to minimize expenditure required to provide a given output in light of input cost/price vector and other exogenous variables whose elements characterize the operating environment. The frontier measure of cost efficiency implies that efficient firms are those operating on the cost frontier. Therefore, the amount by which a farm /firm lies above its cost frontier is taken as the measure of its cost inefficiency (Lovell, 2008). That is, cost frontier analysis assumes that each farm/firm potentially spends more than it might due to the degree of inefficiency. This study will, therefore, employ the frontier approach.

According to Khumbakar and Lovell (2000), unlike the production frontier analysis, which is concerned with technical efficiency only and does not impose any behavioral assumptions, cost frontier analysis implies cost minimization. The cost minimization assumption is appropriate in circumstances when input prices, rather than input quantities, are strictly exogenous.

In addition, according to Chirwa (2002), the frontier measurement of cost efficiency can be grouped into non-parametric frontiers and parametric frontiers. The non- parametric frontiers can be used where a farmer produces multiple outputs. The commonly used non- parametric frontiers are the Data envelopment analysis (DEA), Free disposable hull (FDH), Malmquist Index, Tornqvist Index, and Distance Functions. However, the most popular non- parametric method of frontier analysis is the Data envelopment analysis (DEA). Non-parametric approaches like the data envelopment analysis (DEA), apply linear programming techniques to construct an efficient cost/production frontier. Non-parametric frontiers do not impose a functional form on the cost/production frontiers and do not make any assumption about the error term.

According to Coelli *et al.* (2005), this property makes estimation of non-parametric frontiers relatively easier. Nonetheless, the major drawback of the non-parametric frontiers such as DEA is that all the deviations from the frontier are considered to be the result of the firm's inefficiency. Also, according to Bhasin (2002), another criticism of the non-parametric approach is that the maximum possible output is derived using only marginal data and not all observations in the sample which could affect the credibility of the outcome. This method is also criticized for not permitting hypothesis testing or statistical inference (since non-parametric frontiers do not impose a functional form on the cost frontiers and do not make assumptions about the error terms).

Unlike non-parametric approach, parametric approach involves modeling cost/production frontier using various econometric techniques. The underlying principle behind the parametric approaches such as Stochastic frontier approach is that it accounts for random error (factors outside the scope of the farmers which affect production cost) and disentangles the inefficiency component from it. The commonly used parametric approaches for efficiency analysis are the Stochastic frontier approach (SFA), Thick Frontier Approach (TFA),Distribution free approach (DFA) and the Fixed and Random effects models (FEM and REM). However, the most popular parametric method is the Stochastic frontier methodology. This parametric method/approach requires imposition of a given functional form for the relationship between inputs prices, output and cost of production and also makes assumptions about the data. According to Coelli *et al*, (2005), when the functional form is specified then the unknown parameters of the function can be estimated using econometric techniques. The parametric approach has not received any credible criticism since its introduction. Nevertheless, some researchers are of the view that the procedure involved in the determination of efficiency using parametric methods is quite complex compared to the non-parametric methods.

In this study, the parametric approach was chosen over non-parametric approach due to the following reasons. To begin with, according to Podpiera and Pruteanu (2005), parametric methods study technological as well as cost/allocative efficiency, whereas the non-parametric techniques focus on analyzing technological efficiency only. Also, in order to disentangle inefficiency effect from the environmental factors that affect production cost (random error) and make credible statistical inferences, the best option is the parametric approach. In recent years, according to Boshrabadia *et al.*, (2007), the stochastic frontier methodology/ analysis has proven to be the most popular parametric method due to its ability to take into account measurement error in the output/costs and stochastic elements of production/costs, thereby distinguishing the effect of noise from the effect of inefficiency. The stochastic frontier methodology, which is a parametric approach, was employed in this study since it is well established, widely used and recommended by several researches for efficiency analysis.

Aigner *et al* (1977), and Meeusen and van den Broeck (1977) independently introduced the stochastic production frontier model. This model has two error terms (composed error structure) and each was developed in context of a production frontier. However, upon research the model was extended to measure cost efficiency by changing the sign of the second error term of the stochastic production frontier from negative to positive (that is, $\exp\{v+u\}$) and changing the production function in the said model to cost function. In order to introduce the stochastic cost frontier, there is the need to define a cost function. Cost of production is defined as a function of output and input prices

According to Kumbhakar and Lovell (2000), implicit stochastic cost frontier can be written as; $C = f(y, w; \beta).\exp\{v + u\}$ ……………………………………………(1)

Where **C** is the total production cost/expenditure incurred by the farm/firm

y is the output level

w is a vector of input prices

β is a vector of parameters to be estimated.

$f(y, w; \beta)$ is the minimum cost frontier

v represents random effects outside the control of production unit including measurement errors and other statistical noise typical of empirical relationships

u represents the cost inefficiency.

The implication of the stochastic cost frontier regression model above is that actual total expenditure/cost (C_i) equals minimum required total expenditure/cost plus the product of two error components. Thus, the left hand side of the model represents the observed/actual total production cost whereas the right hand side represents the expected minimum total production cost (minimum frontier cost) .

The model cannot be estimated in implicit form. This, therefore, calls for the choice of a functional or algebraic form that can disentangle the two error terms and make estimation possible. Different functional or algebraic forms of function give rise to different models. According to Coelli *et al.* (2005), when choosing between these different forms, preference should be given to those that are flexible, linear in the parameters, and parsimonious (that is, the simplest functional form that "gets the job done adequately" with little or no difficulty). The most common functional or algebraic forms include the Cobb-Douglas(log-linear), Constant Elasticity of Substitution, Quadratic, Normalized - Quadratic, Generalized Leontief and Trans-log functions. This study will employ Cobb-Douglas (log-linear) functional form since according to Filippini and Farsi (2004), Cobb-Douglas (log-linear) model is one of the most commonly used functional forms. This functional form is employed due to its simplicity which gives it a practical advantage in statistical estimations over more complicated forms. Unlike the trans-log and other complex functional forms, the Cobb-Douglas (log-linear) form does not include any interaction terms and this makes the interpretation of the results much easier.

According to Kumbhakar and Lovell (2000), the stochastic cost frontier model is required to be estimated using maximum likelihood approach. However, to use the maximum likelihood principle to estimate the parameters of the model, there is the need to make assumptions concerning the distributions of the error terms. According to Lovell (2008), the most common assumptions about the error terms are:

(i) **v** ~ iid N $(0,\sigma_v^2)$, That is, **v** is assumed to be identically and independently normally distributed with mean zero and constant variance

(ii) **u** ~ iid N^+ $(0,\sigma_u^2)$, That is, **u** is distributed as the nonnegative half of a normal distribution having zero mean and constant variance σ_u^2

(iii) **v** and **u** are distributed independently of each other, and of the regressors.

These assumptions introduce two additional parameters, σ_v^2 and σ_u^2, to be estimated along with the elements of the parameter vector β (Lovell, 2008). The overall variance of the model is (σ^2) $= \sigma_v^2 + \sigma_u^2$. Also, in order to determine how much cost inefficiency contributes to total cost of production, there is the need to find gamma which is (γ) $= \dfrac{\sigma_u^2}{\sigma_v^2 + \sigma_u^2}$. The parameter γ must lie between 0 and 1 (Battase and Corra, 1977); Battase and Coelli(1995), and Ogundari *et al*.(2006). If gamma (γ) =0, it implies that there are no cost inefficiency effects and all deviations from the frontier are due to noise (factors outside the scope of the farmer). Thus, the gamma (γ) measures the variation of total production cost from the frontier cost which can be attributed to cost inefficiency.

It is also necessary to test whether any form of stochastic cost frontier is needed at all by conducting generalized likelihood-ratio tests(λ) of null hypotheses. That is, generalized likelihood-ratio test is conducted to accept or reject the null hypotheses that the farms are operating on their cost efficient frontier and that inefficiency effects are zero (that is, the inefficiencies are not statistically significant). If the null hypothesis that specifies that U_i is equals zero, is accepted, this would indicate that σ_u^2 is zero and hence the U_i term should be removed from the model. When that happened, the stochastic nature of the model would be lost (an indication of absence of inefficiency).

The generalized likelihood-ratio test (λ), according to Ogundari *et al*. (2006), is expressed as: λ= -2 In (H_0/Ha)

Where: H_0 is the value of the likelihood function for the frontier model in which parameters restriction is specified by the null hypothesis, Ha is the value of the likelihood function for general frontier model.

λ has mixed chi-squared distribution, with degrees of freedom equal to the number of restrictions imposed under the null hypothesis. Failure to carry out this hypothesis testing implies that the cost inefficiency level obtained from the estimation of the stochastic cost frontier model is imposed. That is, the research just assumed from the onset that the farmers were inefficient.

3.5 Empirical Framework

For data analysis, both econometric and statistical/tabular methods were employed. In order to carry out the econometric analysis, the stochastic cost frontier model as specified by Kumbhakar and Lovell (2000) was applied and all the parameters were estimated together in one-step maximum likelihood estimation. However, as pointed out earlier in the theory behind the stochastic frontier methodology, the first step in estimating the stochastic cost frontier model is to specify the functional or algebraic form of the function.

With the application of the Cobb-Douglas (log-linear) functional form, the implicit stochastic cost frontier model ($C = f(y, w_i; \beta).\exp\{v_i + u_i\}$) can be specified in an explicit form as;

$$\ln(C_i) = \beta_0 + \sum_{n=1}^{N} \beta_n \ln w_{ni} + \beta_m \ln y_i + v_i + u_i \text{..}(2)$$

As stated earlier, in other to make the Cobb-Douglas functional form linear in the parameters and proceed with the estimation (doing away with the exponent and splitting or disentangling the two error terms from the cost function of the implicit stochastic cost frontier model), there is the need to take logarithms/natural-log of both sides of the implicit model. Introduction of natural-log following the Cobb-Douglas functional form yielded the explicit stochastic cost frontier model numbered (2).

The right hand side of the model (2) gives the minimum cost of producing output y_i when the farm faces input prices $w_{1i}, w_{2i}, w_{3i} \ldots w_{ni}$. Model (2) implies that for a cost efficient farm, the observed cost is equal to this minimum cost of production. Under such condition, the u_i which represents cost inefficiency will be assumed to be zero. Thus, u_i=0 for a farm whose costs lie on the frontier and $u_i > 0$ for farms whose cost is above the frontier (the cost inefficient farm). The two error terms are proceeded by positive signs because inefficiencies are always assumed to increase cost.

On the other hand, according to Filippini and Farsi(2004), Coelli *et al*,(2005), Ogundari *et al* (2006), the economies of scale (***Es***) can be obtained from model (2) as the inverse of the sum of all the elasticities of total production cost with respect to all output. This can be mathematically written as:

$$Es = \left[\sum_{m=1}^{M} \frac{\partial \ln c(w_i, y_i)}{\partial \ln y_m} \right]^{-1} \qquad \text{...(3)}$$

However, for this study, output is only one (the kilogramme weights of broilers produced). Therefore, positive economies of scale (*Es*) prevail, if the ***Es*** is greater than 1. Thus, an increase in scale of production will result in cost advantage. Diseconomies of scale (DS) prevail when the ***Es*** is less than 1. Thus, an increase in scale of production is not necessary because it will not lead to any cost advantage. Constant economies of scale prevails when ***Es = 1***

3.5.1 Empirical Models Specification

This covers specification of the stochastic cost frontier model for the cost efficiency analysis as well as the inefficiency model that explains the effects of farmers' social-economic characteristics on their efficiency levels.

3.5.1.1 Specification of the Stochastic Cost Frontier Model

Following the adoption of Kumbhakar and Lovell (2000) framework for analysis of data with respect to cost efficiency, the stochastic cost frontier model for the broiler farms in the study area was explicitly specified employing Cobb-Douglas (log-linear) functional form as follows:

$$\ln C_i = \beta_0 + \beta_1 \ln P_L i + \beta_2 \ln P_{MD} i + \beta_3 \ln P_{DOC} i + \beta_4 \ln P_F i + \beta_5 \ln P_K i + \beta_6 \ln P_M i + \beta_7 \ln Y_i + (V_i + U_i) \quad \text{...}(4)$$

Where: $\mathbf{C_i}$ represents total production cost (GH¢/farm)

$\mathbf{P_L}$ represents labour price (GH¢/man-day)

$\mathbf{P_{MD}}$ represents average price of medicine/disinfectant (GH¢/unit)

$\mathbf{P_{DOC}}$ represents average price of day old chick (GH¢/chick)

$\mathbf{P_F}$ represents average feed price (GH¢/kg)

$\mathbf{P_K}$ represents average price of fixed capital assets (GH¢)

$\mathbf{P_M}$ represents average price of other miscellaneous items (GH¢)

$\mathbf{Y_i}$ represents output level (kilograms of broilers produced)

3.5.1.1.1 Description/Measurement of Variables in Stochastic Cost Frontier Model

This explains how the variables were measured for the analysis and the expected signs of the coefficients (a priori expectations). The main task is to explore which variables or factors potentially influence and how (the direction of the relationship) these factors relate with the dependent variables. Therefore, potential variables, which are supposed to influence broiler production cost/cost efficiency levels and how each of these variables was measured are explained below.

3.5.1.1.1.1 The Dependent Variable

The dependent variable in the model is the total cost of production, which is the summation of the farms fixed and variable costs. In the short-run, some of the input factors the farm uses in production are fixed. The costs of these fixed factors are the farm's fixed costs (including depreciation/leased cost of fixed capital assets). The farm's fixed costs do not vary with increase in output. The farm also employs a number of variable factors of production. The costs of these variable factors of production are the farm's variable costs (inputs and other running costs). According to Bhasin (2002), as the farm's output increases or the input prices increase, the farm's variable cost and for that matter total production cost is expected to increase. This explains why total cost of production is said to be a function of output and input prices. Total cost of production is, therefore, expected to have a positive relationship with the various independent variables.

3.5.1.1.1.2 Independent Variables

3.5.1.1.1.2.1 Average Feed Price: This is the average amount of money paid for a killogramme (kg) of broiler feed. The average was computed by dividing the total expenditure on feed by the killogrammes of feed used to obtain an average price per kg of feed. According to Leeson (2008), feed represents about 65% of total expenditure involved in poultry production. Average feed price was, therefore, expected to have a positive coefficient/ relationship with the dependent variable.

3.5.1.1.1.2.2 Labour Price: Family and hired labour plays an important role in agricultural production especially in developing economies. Labour price is the average amount of money paid for labour. This average was computed by dividing the total expenditure on labour by the man-days of labour usage per farm during the production period. Labour price was expected to have a direct or positive relationship with total production cost.

3.5.1.1.1.2.3 Average Price of Medicine/Disinfectant: A medicine is anything that treats, prevents, or alleviates the symptoms of disease (for instance, vaccines/drugs). Similarly, disinfectant is an agent (as a chemical) that destroys microorganisms that might carry disease. Price of medicine/disinfectant was measured as average amount of money paid for vaccine, drug and disinfectant used. This was computed by dividing the total expenditure on vaccines, drugs and disinfectants by the respective quantities (bottles) used before summing up their averages to obtain the average price of medicine/disinfectant. The price of medicine/disinfectants was expected to have a direct/positive relationship with the production cost.

3.5.1.1.1.2.4. **Price of Day Old Chick:** This is the average amount of money paid for a day old chick. It was computed by dividing the total expenditure on day old chicks by the number of day old chicks purchased. An increase in the market price of a day old chick is expected to have a significant effect on the total production cost. This implies that the price of a day old chick has a direct/positive relationship with the total cost of production.

3.5.1.1.1.2.5 Average Price of Fixed Capital Assets: In contrast to material inputs such as feed or medicines that are consumed or utilized during a given production period, capital assets are purchased in one period and used in the production process throughout the life of the asset or until it is replaced by a new asset. Capital assets can also be leased/rented and used for production yearly. The price component of capital assets that were leased/rented for production was measured using the leased/rental price of that particular asset. For the user cost of capital (cost of assets owned by the farmer),depreciation of fixed farm equipment/tools was used. To obtain the worth of each of the fixed cost items, the straight line method of depreciation was employed and the salvage value assumed to be zero. The formula for depreciation using straight-line method is given as: $\text{Depreciation} = \dfrac{\text{Purchase price}}{\text{No of years of useful life of the asset}}$

Since the broiler farmers carried out two productions in a year, the annual depreciation was divided by two to obtain the cost per period. The depreciated cost of the various inputs was then divided by their respective quantities to obtain the unit price of each fixed input for the analysis.

With regard to land price, for the leaseholders, the land was valued based on the annual leasing price. On the other hand, the land value for the freeholders (inherited lands) was based on leasing equivalence approach where price was imputed for the land using the leasing price of an equivalent land for the same period taking into account factors such as location and size. Since two productions were carried out in a year, the annual land price was divided by two to obtain the price for the production period. The land price for the production period was then added to the corresponding price of other fixed items to obtain the average price of fixed capital assets for the analysis. The average price of fixed capital assets was expected to have a positive relationship with the total cost of production.

3.5.1.1.1.2.6 Average Price of other Miscellaneous Items: This is the summation of average amount of money paid for energy, water, transportation and milling during the production period. It was, therefore, expected to have a direct/positive relationship with the dependent variable.

3.5.1.1.1.2.7 Output Level: The output level of a broiler farm was measured as the kilogramme weight of birds produced at the end of the production cycle in question (that is, between January and April 2011). An increase in output wass, therefore, expected to have significant effect on the total production cost. A positive coefficient was, therefore, expected.

3.5.1.2 Specification of the Inefficiency Model

Besides the general stochastic cost frontier model, there is the need for inefficiency model, which is designed to estimate the influence of some farmer's socio-economic variables on the cost efficiencies of the farmers. The inefficiency model (U_i) is specified as:

$$U_i = \phi_0 + \phi_1 Z_{1i} + \phi_2 Z_{2i} + \phi_3 Z_{3i} + \phi_4 Z_{4i} \quad (5)$$

Where: Z_1 represents educational level (years)

Z_2 represents farmer's years of experience in broiler production (years)

Z_3 represents farm size (quantity of birds)

Z_4 represents technical advice from veterinary services (Dummy; 1= technical advice from veterinary services and 0 = otherwise)

The ϕ_i 's are scalar parameters to be estimated

3.5.1.2.1 Description/Measurement of Variables in the Inefficiency Model

3.5.1.2.1.1 Farming Experience: It is a continuous variable measured as the number of years the farmer has been in broiler production. Literature reviews on farming experience on efficiency have given mixed results. Farming experience could have negative or positive effect on the cost efficiency of the farmer (Yusuf and Malomo, 2007). Ng'eno *et al* (2010) reported a positive relationship between the experience and the efficiency of poultry farmers in Kenya. This findings stem from the fact that farmers with more years of experience and are older are likely to be more conservative and, therefore less willing to adopt new practices, thus leading to low efficiencies in production. Battese and Coelli

(1995) reported negative production elasticity with respect to farming experience for farmers in two villages in India, thus suggesting that older farmers are relatively more efficient. Continuous practice of an occupation for a long period presumably makes a person more experienced and more productive in practice. This agrees with Adeoti (2004) that years of experience reduce farmers' inefficiency.

3.5.1.2.1.2 Level of Education: This was measured by the number of years of schooling completed by the farmer (production manager). Those farmers who have formal education tend to have a readiness to accept new ideas and innovations, and hence promote high efficiency in their cost. Therefore, level of education was hypothesized to positively influence efficiency. Ng'eno *et al* (2010) found that education had significant and positive effect on cost efficiency of poultry farmers in Bureti District of Kenya. Education is, therefore, expected to have a positive influence on the levels of efficiency of the poultry farmers in the study area. This implies a negative coefficient in the cost inefficiency model.

3.5.1.2.1.2 Farm Size: The farm size was measured as the quantity/number of broilers produced. According to Oji and Chukwuma (2007), farm size has a significant positive impact on efficiency in poultry production.

3.5.1.2.1.3 Technical Advice from Veterinary Services: This was measured as a dummy variable with 1 representing farmers/respondents who received technical advice from veterinary services, and 0 for otherwise. This enables the farmers to acquire new ideas from a professional source and improve upon their managerial skills, which eventually lead to efficiency improvement. A technical advice veterinary service was, therefore, expected to have negative coefficient in the inefficiency model and improve the cost efficiency level of the farmers.

The estimate for all the parameters of the stochastic frontier cost function and the inefficiency model were simultaneously obtained using the program FRONTIER version 4.1c. The summary statistics of the variables were obtained using STATA version 11.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

In this chapter, the relevant data collected on the study have been analysed and the results presented and discussed accordingly. The chapter commences with discussion on production process, which comprises the activities prior to the arrival of day old chicks, brooder stage, grower stage, finisher stage and marketing. Production resources such as land, labour, and other fixed capital assets/resources as well as the variable resources/inputs used by the sampled farms are also discussed. In addition, analysis/discussions are made on production cost, returns, and mortality rate of birds. This chapter concludes with discussions on the socioeconomic characteristics of respondents, regression results, generalized likelihood ratio test of hypotheses, cost efficiency levels, economies of scale and broiler farmers' production constraints.

4.2 The Production Process

This covers discussions on activities prior to the arrival of the day old chicks, brooder, grower and finisher stages as well as the marketing of the produce (birds).

4.2.1 Activities Prior to the Arrival of the Day Old Chicks

According to the respondents, the broiler houses/brooder pens and all the equipments are cleaned and disinfected. The floors of the pens are filled with fresh but dry wood shavings. A day before the arrival of the chicks, the brooder pens are pre-heated to ensure a uniform temperature throughout the brooder area. The drinkers and feeders are then placed at appropriate positions within the brooder house. An hour before the arrival of the chicks, feeders and drinkers are filled with feed and water respectively. Glucose is added to the water in order to give the day old chicks instant energy.

4.2.2 Brooder Stage

The survey showed that the duration of the brooder stage among the sampled broiler farms ranged from 2 to 3 weeks. During this period, the chicks are given first Gumboro and Newcastle diseases vaccines. The chicks are also served with broiler starter feed during this stage. According to the respondents, the brooder pens are visited 4 to 5 times daily to observe the condition (temperature) of the chicks. Excessive heat or low heat could be fatal to the chicks. The survey further showed that all the respondents gradually reduced the heat / temperature in the brooder houses as the chicks are growing.

4.2.3 Grower Stage

The duration of the grower stage among the sampled farms ranged from 4 to 5 weeks. According to the respondents, during this stage, the chicks are transferred from the brooder houses into the main pens. Second Gumboro and Newcastle vaccinations are carried out at this stage. The chicks were then fed on broiler grower feed.

4.2.4 Finisher Stage

The duration of the finisher stage across the sampled farms in the study area ranged from 2 to 3 weeks. During this stage, the birds are fed on broiler finisher feed. After this stage, the birds are considered matured/ready for market.

The survey showed that the duration of the entire broiler production processes among the respondents in the study area ranged from 8 to 11 weeks depending on the live-weight of birds the farmer wanted to produce.

4.2.5 Marketing

The respondents sold their produce (birds) to wholesalers, retailers, caterers and household consumers. The broilers were sold live (live birds) mainly at the farm-gate. The producers usually inform their customers when the birds are ready for market. The customers upon the information received from the producers come to the farms to buy the birds. However, some of the respondents transported some of their produce (broilers) outside their farms for sale. The survey showed that the birds were priced based on their live-weights.

4.3 The Production Resources

Discussion of production resources encompasses analyses of land, labour and capital assets/resources used by the respondents during the production process.

4.3.1 Land

This covers analysis on how the respondents acquired their farmlands for broiler production as well as analysis on the land and farm sizes of the respondents in the study area.

4.3.1.1 Land Acquisition

The survey showed that 62.28% of the respondents acquired the lands on which they had established their poultry farms through leasing agreement. That is, they (respondents) paid for the right to occupy the land for a specified term. The term of leasing agreement among the sampled farms ranged from 10 years to 99 years. Across the study area, a lease is granted either by the holder of the allodial title (stool lands) or by a customary freeholder (an individual who inherited family land).

The rest of the respondents (37.72%) acquired the land through freehold system of land ownership. Freehold simply means the land was acquired by an individual either through lineage/inheritance (customary law freeholders) or gift (common law freeholders). Table 4.1 shows the land ownership type(s) among the respondents in the study area.

Table 4.1 Land Ownership Type (s) Among The Respondents

Ownership Type	Frequency	Percentage (%)
Freehold	43	37.72
Leasehold	71	62.28
Total	114	100.00

Source: Survey Result from this study (2011).

4.3.1.2 Land and Farm Size

This covers analysis on the sizes of the farmlands used by the respondents as well as their farm sizes (birds produced).

4.3.1.2.1 Land Sizes of the Respondents

The land sizes of the respondents ranged from 0.05 to 0.48 hectares (ha) with the mean of 0.15 hectares. The survey data showed that the land sizes of the respondents in the Atwima Nwabiagya, Atwima Mponua, Atwima Kwanwoma, and Ahafo Ano South districts were larger than those of the respondents in Kwabre East district, Ejisu-Juaben Municipal and Kumasi Metropolis. This implies that the broiler farms located in the cities/towns had smaller land sizes. Most of the farms had greater portions of their lands unutilized even though 22.81% of the farms had fully utilized their lands.

The distribution of land sizes shows that 71.93% of the respondents used land size that ranged from 0.05 to 0.15 hectares. 21.93% of the respondents had land sizes ranging from 0.16 to 0.26 hectares. In addition, 4.39% had land sizes between 0.27 and 0.37 hectares. The rest of the respondents (1.75%) worked on land sizes that ranged from 0.0.38 to 0.48 hectares. Table 4.2 shows the distribution of the land sizes of the respondents.

Table 4.2 Land Sizes of the Respondents

Land Size (ha)	Frequency	Percentages
0.05 – 0.15	82	71.93
0.16 – 0.26	25	21.93
0.27 – 0.37	5	4.39
0.38 – 0.48	2	1.75
Total	114	100.00

Source: Survey Result from this study (2011)

4.3.1.2.2 Farm Sizes of the Respondents

The farm sizes of the respondents ranges from 144 to 1,175 birds with the mean of 545 birds. The distribution of farm sizes among the respondents is shown in table 4.3. The analysis shows that 51.75% of the respondents produced between 500 to 1000 broiler birds. 44.74% of the respondents had farm sizes less than 500 birds. The rest of the respondents representing 3.51% produced between 1001 and 1500 broilers. This result implies that the broiler farmers in the study are mainly into small-scale production.

Table 4.3 Farm Sizes of the Respondents

Farm Size	Frequency	Percentage (%)
< 500	51	44.74
500 - 1000	59	51.75
1001 - 1500	4	3.51
Total	114	100.00

Source: Survey result from this study (2011).

4.3.2 Labour Usage

The sampled farms in the study area employed both permanent and casual workers. The permanent workers included family labourers who were paid just like the hired ones.

Table 4.4 shows the distribution of the average labour usage (man- days) across the sampled broiler farms during the various production stages. The distribution indicates that the average labour usage for the entire production period among the respondents who produced less than 500 birds was 85 man- days. The producers of between 500 and 1000 birds recorded an average labour usage of 150 man-days for the entire duration of the production period. The rest of the respondents who produced between 1001 and 1500 birds recorded an average labour usage of 201 man-days. The result indicates that as the farm size increases the average labour usage or requirement per bird decreases.

Table 4.4 Average Labour Usage across the Sampled Broiler Farms (in Man-days)

Farm Size	Brooder Stage (2-3 weeks)	Grower Stage (4-5 weeks)	Finisher Stage (2-3 weeks)	Total Man-days	Man-days per bird
< 500	35	32	18	85	0.17
500 - 1000	53	62	35	150	0.15
1001 - 1500	53	95	53	201	0.13

Source: Survey Result from this study (2011)

The analysis indicates that though the brooder and the finisher stages lasted for 2-3 weeks each, the average labour usage at the former was higher than that of the latter across all the farm sizes. This implies that more man-days of labour are required at the brooder stage in order to alleviate the high mortality that is usually associated with the early stages of the production process than in the finisher stage.

4.3.3 Capital Resources

Capital as a resource consists of fixed and variable assets/resources used during the production period.

4.3.3.1 Fixed Capital Resources

The fixed capital resources/assets include the buildings, feeders, drinkers, brooding devices, buckets, shovels, water reservoirs, wells, wheelbarrow (s) and push trucks / vehicles owned or leased/rented by the farms and used during the production period under consideration.

4.3.3.1.1 Farm Buildings

The design and size of broiler houses/pens in the study area were influenced by the climatic conditions, the production capacity, and, most importantly, the cost involved in the construction. The broiler pens across the sampled farms were rectangular in shape and around 7 to 8 feet tall. Most of the pens consist of 2 to 4 feet cement block wall (foundation wall) with 3 to 5 feet wire mesh or wood strips sides (Figures 4.1,4.2 and 4.3). Some of the pens also had two sides (the widths) completely closed with 7 to 8 feet cement block walls to the eaves and the other sides (the lengths) made of wire mesh.

The pens had concrete/cemented floors that helped in controlling parasites such as mites, which usually hide in the soil. The pens were roofed with corrugated zinc/iron sheets. The doors of the pens are made of either wood or a combination of wood and wire mesh. The brooder pens had adjustable roll-down black/white plastic curtains for use during brooding/cold weather (Figure 4.4).

The survey showed that the broiler pens in the study area were of two different sizes. The normal (25 x 30feet) size and the large (50 x 60 feet) size. The normal size can accommodate between 300 to 350 broiler birds whereas the large size accommodates between 600 to 800 birds. According to the respondents, the normal/large size pens could even accommodate more number of birds than the range stated above. However, improper stocking density or overstocking could restrict birds' movement, decrease accessibility to feed/water and affect broiler performance as a whole. The number of broiler pens per farm by the respondents ranged from 1 to 4 pens depending on the number of birds kept and the size of the pens.

Table 4.5 shows the distribution of the type/sizes of the pens used by the respondents. The analysis shows that majority of the respondents (92.98%) used cement blocks and mesh pens. 7.02 % of the respondents used wooden pens.

Table 4.5 Distribution of the type of pens used by the respondents

Type of Pen Used	Frequency	Percentage
Cement Block and Mesh Pen	106	92.98
Wooden Pen	8	7.02
Total	114	100.00

Source: Survey Result from this study (2011).

The analysis indicates that a typical broiler farm in the study area has two normal size blocks and mesh pens accommodating about 300 birds each.

Figures 4.1, 4.2, 4.3 and 4.4 show the designs of broiler houses/pens across the study area.

Figure 4.1 Pen with 2 cement block walls and wire mesh sides

Figure 4.2 Pen with 2-4 feet foundation block and wire mesh sides

Figure 4.3 Wooden pen

Figure 4.4 Cement block and wire mesh pen with plastic curtains for brooding

In addition to the pens, each of the sampled broiler farms had a storeroom for storing farm equipments such as buckets, shovels as well as drugs and feedstuffs. Storerooms usually have a concrete/cemented floor and are roofed with corrugated zinc/iron sheets.

4.3.3.1.2 Feeders, Drinkers and Brooding Devices

According to the respondents, a normal size broiler pen (25 x 30 feet) used between 15 and 20 feeders depending on the type/size of the feeder and the number of birds kept. Similarly, a large size pen (50 x 60 feet) requires between 30 and 40 feeders. The analysis implies that an average or a typical farm in the study area with two normal size pens has between 30 and 40 feeders with an average of 36 feeders.

Figure 4.5, 4.6, 4.7 and 4.8 show the types of feeders used by the respondents in the study area.

Figure 4.5 Plastic Feeders

Figure 4.6 Metal Feeder

Figure 4.7 Wooden feeder

Figure 4.8 Feeders for day old chicks

The respondents used imported drinkers during the brooding stage. Thereafter, they relied on their own improvised drinkers such as ordinary plastic bowls in order to reduce cost (Figure 4.9). According to the respondents, during the brooding stage, the use of improvised drinkers could result in the chicks falling into the water or chicks not being able to reach the water level in the drinkers. In both cases, high mortalities are usually recorded. This reason informed their (respondents) decision to use the imported drinkers at that stage irrespective of the cost (Figure 4.10).

The survey shows that a normal size broiler pen (25 x 30 feet) used between 10 and 15 drinkers depending on the type/size of the drinker and the number of birds kept. This implies that an average farm that has two normal size pens requires between 20 and 30 drinkers just like a large size pen (50 x 60 feet) with the mean of 26 feeders.

Figure 4.9 and 4.10 show the types of drinkers used by the respondents.

Figure 4.9 Plastic bowl drinker

Figure 4.10 Drinkers for day old chicks

The distribution of the type(s) of brooder heating device(s) used by the respondents is shown in table 4.6. The analysis shows that 95.61% of the respondents used clay pot/charcoal as brooding heating device (Figure 4.11). 3.51% of the respondents used metal coal pot/charcoal to heat the broods (Figure 4.13). However, only one of the respondents representing 0.88% used hover as a heating device (Figures 4.14). The hover is adjustable, rotatable and capable of maintaining a constant temperature. However, most of the respondents (99.12%) did not use hover, not only because of the electricity outages or gas shortages that could occur during brooding, but also because of the cost involved in its acquisition.

Table 4.6 Type of Brooding Device(s) Used By The respondents

Type of Brooding Device(s) Used	Frequency	Percentage (%)
Electric/Gas Hover	1	0.88
Clay pot/charcoal	109	95.61
Metal Coal pot/charcoal	4	3.51
Total	114	100.00

Source: Survey Result from this study (2011).

The survey showed that the number of brooder heating devices (mainly clay pot) used by the respondents during the brooding period ranged from 1 to 8 with the mean of 4 depending on the number of chicks and the size of the brooder house.

Figures 4.11, 4.12, 4.13 and 4.14 show the types of brooding devices used by the respondents.

Figure4.11Large size clay pot brooder

Figure 4.12 Small size clay pot brooders

Figure 4.13 Metal coal pot used for brooding

Figure 4.14 Brooding hover

4.3.3.1.3 Buckets and Shovels

The respondents in the study area used rubber buckets to carry feed/water into the pens before pouring them into feeders/drinkers for the birds. The rubber buckets were also used to fetch water from the wells/reservoirs to wash other farm equipments. Moreover, pure vitamins and drugs such as cocciplus, cipcox that were used for preventing/treating coccidiosis are first mixed in the buckets. The number of buckets used by the respondents ranged from 2 to 10 buckets with the mean of 5 buckets depending on the farm size.

The survey showed that the respondents used shovel(s) to mix/prepare the broiler feeds, remove old litters (wood shavings) from the pens and stir litters to ensure complete dryness. The number of shovels used by the respondents ranged from 1 to 3 shovels with the mean of 2 shovels depending on the farm size.

4.3.3.1.4 Wells/Pipes and Water Reservoirs

The survey showed that 109 respondents representing 95.61% used water from wells constructed in their farms. Only 5 of the respondents representing 4.39% of the sample relied solely on pipe borne water. The respondents who depended on pipe-borne water had hoses connected from the pipes to reservoirs in the farm to enable them store water for use in times of water shortages. Table 4.7 shows the respondent source(s) of waters.

Table 4.7 Distribution of Respondents' Source(s) of Water

Source of Water	**Frequency**	**Percentage**
Pipe Borne Water	5	4.39
Well	109	95.61
Total	114	100.00

Source: Survey result from this study (2011).

Out of the 109 respondents who depended on well water, 67 of them representing 58.77% of the sample had water-pumping machines fixed to the wells that pumped water from the wells into the reservoirs through connected pipes/hoses. The remaining 42 of the respondents who used water from wells representing 36.84% of the sample did not have machines to pump water into reservoirs. However, the others (users of well water without pumping machines) had a rope tied to a small rubber bucket that was used in drawing water from the well to fill tanks/ small reservoirs placed close to the pens to save time whenever water was needed in the pen. The survey showed that one well would be enough to serve a whole farm. Table 4.8 shows the different categories of well water users among the respondents..

Table 4.8 Categories of Well Water Users

Categories of Well Water Users	Frequency	Percentage
Well With Water Pumping Machine	67	58.77
Well Without Water Pumping Machine	42	36.84
Total	109	95.61

Source: Survey result from this study(2011)..

4.3.3.1.5 Wheelbarrows and Push Trucks

The survey showed that 71.93% of the respondents had wheelbarrows. 7.89% of the respondents used push trucks. The wheelbarrows/push trucks were mainly used for carrying feed ingredients/items such as maize, copra cakes among others from a vehicle into a store room/feed mixing or preparation room. The wheelbarrows/push trucks were also used in carrying maize from the storeroom to corn mill centers and vice versa. The rest of the respondents (20.18%) relied solely on the strength of the workers in carrying loads/feed items in and around the farm. The number of wheelbarrows used by the respondents ranged from 1 to 3 with the mean of 1 wheel barrow.

Table 4.9 shows the distribution of the ownership of wheelbarrows and push trucks among the respondents.

Table 4.9 Distribution of the Ownership of Wheelbarrows and Push Trucks

Means of Carrying Feed/Farm Items	Frequency	Percentage
Wheelbarrow	82	71.93
Push Truck	9	7.89
Buckets	23	20.18
Total	114	100.00

Source: Survey result from this study(2011).

4.3.3.1.6 Vehicles

Since farm sizes are small, none of the respondents owned a vehicle for the sole use of the business (broiler production). All the respondents depended either on public commercial vehicles or on the use of the owner's private vehicle on part-time basis.

4.3.3.2 Variable Capital Resources

The variable capital resources/assets include production inputs such as day old chicks, medicines and disinfectants, feed, cash and credits used for the production.

4.3.3.2.1 Day Old Chicks

The survey showed that 32.46% of the respondents obtained their day old chicks from hatchery of Akate Farms. 18.42 % of the respondents purchased their day old chicks from Darko Farms. 15.79% of the respondents obtained their day old chicks from hatchery of Asamoah-Yamoah Farms. The respondents who purchased their day old chicks from the hatchery of Topman Farms were 16 representing 14.04% of the sample. 7.89% of the respondents also obtained their day old chicks from Nfum Farms hatchery.

On the other hand, 7.02% of the respondents purchased imported day old chicks from Rees and Co. Company. 2.63% of the respondents used imported day old chicks from a company called Frankhuson. The rest of the respondents (1.75%) used imported day old chiks from a company called Multivet. All the respondents claimed that, indeed, the imported day old chicks were hardier but more expensive than those from the local hatchery companies. Table 4.10 shows the respondents' source(s) of day old chicks.

Table 4.10 Respondents Source(s) of Day Old Chicks

Source(s) of Day Old Chick	Frequency	Percentage
Akate Farms	37	32.46
Darko Farms	21	18.42
Asamoah Yamoah Farms	18	15.79
Nfum Farms	9	7.89
Topman Farms	16	14.04
Rees and Co. *	8	7.02
Frankhuson *	3	2.63
Multivet *	2	1.75
Total	114	100

Source: Survey result from this study (2011) * importer of day old chicks

4.3.3.2.2 Medicines and Disinfectants

Before the arrival of the day old chicks, the broiler pens and the equipments were cleaned and disinfected using Omicide, Quincide, Izal, and Dettol among others. The survey showed that all the respondents gave their day old chicks a specially made type of glucose called Glucovit immediately the chicks arrived in the farm. The Glucovit gives the chicks instant energy. Table 4.11 shows the drugs, vaccines and disinfectants used.

Table 4.11 Medicines and Disinfectants used by the Respondents.

Production Period	**Treatment(s) Given**	**Medicine (s) and Disinfectant(s) Used**	**Quantity/ 1000 Birds**
Pre-production	Disinfection	Omicide, Quincide, Dettol	-
Week 1	Energy Supplement	Glucovit	0.5 kg
	Antibiotic Administration	T-Sian, Nodex	1kg
	1st Gumboro Vaccination	DM97, 228 Vaccine	1bottle (1000 dose)
Week 2	1st Newcastle Vaccination	HB1, NEWCAVAC	1bottle (1000 dose)
Week 3	2nd Gumboro Vaccination	DM97	1bottle (1000 dose)
Week 4	2nd Newcastle Vaccination	Lasota,	1bottle (1000 dose)
Week 5	Coccidiosis Prevention	Cipcox, Nacox, Cocciplus,	1kg
Week 6	Pure vitamin Supplement	Multiaminolyte	1kg

Source: Survey Result from this study (2011)

On the second day of the first week , the chicks are given antibiotics such as T-Sian, Nodex among others. The survey shows the chicks are given first Gumboro and Newcastle diseases vaccines on the first and the second weeks respectively. Second Gumboro and Newcastle diseases vaccination followed on the third and fourth week respectively. The Newcastle disease vaccines used are HB1 vaccine, Newcastle Activated Vaccine (NEWCAVAC) and Lasota. The NEWCAVAC is injected through the wings of the chicks whilst the HB1 and Lasota vaccines are mixed in drinking water for the chicks. The Gomboro vaccines used are DM97 vaccine and 228 vaccines. The DM97 vaccine is administered twice whilst the 228 vaccine is administered once. This implies that, unlike the DM97 vaccine, if a farmer administers 228 Gumboro vaccine to the chicks, there will be no need for second Gumboro vaccination. The mode of administration of the Gumboro vaccines is by mixing the vaccines in a given amount of water for the chicks. Every 1 bottle (1000 dose) of vaccine is to be administered to 1000 chicks.

Anti-coccidial drugs such as Cipcox, Nacox, Cocciplus and Coccivit were given to the birds through their drinking water in order to prevent coccidiosis. The birds are also given pure vitamins to boost their growth.

4.3.3.2.3 Feed

The type of feed the respondents gave to their broilers varied according to the age of the birds. Starter feed was given to the chicks between the age of 1 and 14 days. Grower feed was given to the broilers between the age of 15 and 28 days. Thereafter, the birds were served with finisher feed until they (birds) were sold out. According to the respondents, broiler starter feed needs to have smooth texture to avoid the feed choking the chicks to death and high amount of protein to promote faster growth. This implies that any mistake in the preparation of the starter feed could result in either the death of the chicks or retardation in the growth of the chicks. In view of this, all the respondents depended on commercial broiler starter feed. The survey showed that 35.59% of the respondents obtain their broiler starter feed from Agricare Company. 30.70% of the respondents purchased their feeds (starter) from Akate Farms. The respondents who obtained their starter feed from Kugis Company were 17.54% of the sample. The rest of the respondents (15.79%) obtained their starter feed from Topman Farms.

The survey indicated that 90.35% of the respondents depended on self-prepared grower/finisher feeds. 5.26 % of the respondents relied on commercial grower/finisher feeds from Agricare. 2.63 % of the respondents depended on grower/finisher feed from Kugis. The remaining respondents (1.75%) obtained their grower/finisher feeds from Akate Farms. The respondents who depended on commercial feed mill for grower/finisher feeds were mainly those who produced less than 250 birds. The respondents who produced less than 250 birds did not consider it necessary to engage in self-preparation of feed due to the small farm size. Table 4.12 shows the distribution of respondents' source(s) of feed.

Table4.12 Respondents' Source(s) of Feed

Starter	Frequency	Percentage	Grower/Finisher	Frequency	Percentage
Agricare	41	35.97	Agricare	6	5.26
Kugis	20	17.54	Kugis	3	2.63
Akate Farms	35	30.70	Akate Farms	2	1.75
Topman	18	15.79	Topman	0	0.00
Self-prepared	0	0.00	Self-prepared	103	90.35
Total	114	100.00	Total	114	100

Source: Survey result from this study (2011)

The survey further showed that the nutrient composition of the various feeds differed between the starter, grower, and finisher feeds. Nonetheless, the main ingredients in all the feeds used were maize, soybean/copra cake /palm-kernel cake/groundnut cake, fishmeal, wheat bran, oyster shell and broiler vitamin/mineral premixes. According to the respondents, 1 ton of broiler feed contains 600kg of maize. This implies that maize forms 60 percent by weight of the total broiler feed formulation in the study area. The composition of a typical broiler grower feed in study area is shown in table 4.13

Table 4.13 Feed Formula for Preparing 1 Ton (1000kg) of a Typical Broiler Grower Feed among the Sampled Farms

Feed Components	Quantity Used
Maize	600 kg
Soybean	250 kg
Wheat Bran	75 kg
Copra Cake	12.5 kg
Fishmeal/Herrings	50 kg
Oyster Shell	10kg
Broiler Premix	2.5 kg
Total	1000 kg

Source: Survey result from this study (2011).

Some of the respondents reduced the proportion or inclusion of soybean and fishmeal especially during the finisher stage and added low cost substitutes such as groundnut cake, palm-kernel cake among others in order to reduce feed cost.

The survey indicated that a broiler bird (1.5 kg live weight) from a day old to maturity consumed between 5.8kg and 8.7kg of feed with the mean of 6.9 kg. The distribution of feed consumption per bird (1.5 kg live weight) among the respondents is shown in table 4.14

The analysis shows that the quantity of feed consumed per bird (1.5kg weight) for 71.93% of the sampled farms ranged from 6.8 to 7.7kg. 16.67% of the respondent recorded between 7.8 and 8.7 kg as the quantity of feed consumed per bird. For the rest of the respondents (11.40%), the feed consumption per bird ranged from 5.8 to 6.7 kg.

Table 4.14 Feed Consumption per Bird (1.5kg live weight) across the Sampled Farms

Quantity of Feed Consumed (kg)	Frequency	Percentage of Farms Experiencing Consumption Level (%)
5.8 – 6.7	13	11.40
6.8 – 7.7	82	71.93
7.8 – 8.7	19	16.67
Total	114	100.00

Source: Survey result from this study (2011)

Table 4.15 shows the feed consumption per bird (1.5kg live weight) across the various farm sizes of the respondents. The analysis indicates that the feed usage or consumption per bird among the respondents who produced less than 500 birds ranged from 6.7kg to 8.7kg with the mean of 6.93kg per bird. Feed consumption per bird for the producers of between 500 and 1000 birds ranged from 6.5kg to 8.4kg with the mean of 6.88kg per bird. The feed consumption per bird among the respondents who produced between 1001 and 1500 birds ranged from 5.8kg to 7.9kg with the mean 6.47kg per bird. The analysis indicates that feed consumption per bird decreases with an increase in farm size.

Table 4.15 Feed Consumption per Bird (1.5kg live weight) across the Various Farm Sizes (kg)

Farm Size	Minimum	Mean	Maximum
< 500	6.70	6.93	8.70
500 - 1000	6.50	6.88	8.40
1001 - 1500	5.80	6.47	7.90
Sample	5.80	6.90	8.70

Source: Survey result from this study (2011).

4.3.3.2.4 Cash and Credits

The survey showed that 84.21% of the respondents depended solely on their personal savings during the production period under consideration. The rest of the respondents (15.79%) relied on both their personal savings and financial support from friends/families. None of the respondents depended on bank loans for their production.

However, 49 out of the 114 respondents representing 42.98% of the sample were able to purchase maize on credit as they, paid 50% of the cost and paid the rest of the money after selling the birds. All the respondents who entered into this sort of deferred payment agreement produced more than 500 birds.

4.4 Production Costs

Production cost refers to the combined cost of all the inputs (variable and fixed cost inputs) used in producing the birds. The components of production cost across the sampled farms in the study area include labour cost, cost of day old chicks, medication cost, feed cost, capital cost and miscellaneous cost.

4.4.1 Labour Cost

Table 4.16 shows the average labour cost per farm across the various farm sizes. The analysis indicates that the average labour cost per farm among the respondents who produced less than 500 birds was GH¢552.50. The producers of between 500 and 1000 birds incurred an average labour cost of GH¢982.50 per farm. The rest of the respondents recorded an average labour cost of GH¢1326.50 per farm. The analysis shows the average labour cost per farm among the respondents to be GH¢715.00. This indicates that a typical broiler farm in the study area incurs an average labour cost of GH¢1.03 per bird.

Table 4.16 Average Labour Cost per Farm among the Respondents

Farm Size	No. of Farms	Average Labour Usage (Man-days)	Average Labour Cost / Man-day(GH¢)	Total Labour Cost (GH¢)	Labour Cost per Bird (GH¢)
< 500	51	85	6.50	552.50	1.11
500 - 1000	59	150	6.55	982.50	0.98
1001 - 1500	4	201	6.60	1326.60	0.88
Sample	114	110	6.50	715.00	1.03

Source: Survey Result from this study (2011)

Table 4.17 shows the distribution of the labour cost per bird (1.5 kg live weight) among the respondents. The analysis indicates that the labour cost per bird among the sampled farms ranges from GH¢0.57 to GH¢ 2.97 with the mean of GH¢1.03. The survey also shows that the respondents who produced less than 500 birds recorded the highest labour cost per bird ranging from GH¢ 0.74 to GH¢ 2.97 per bird with the mean of GH¢1.11 per bird. The respondents who produced between 500 and 1000 birds incurred labour cost ranging from GH¢ 0.65 to GH¢ 2.04 per bird with the mean of GH¢0.98 per bird. The rest of the respondents who produced between 1001 and 1500 birds recorded labour cost ranging from GH¢ 0.57 to GH¢ 1.02 per bird with the mean of GH¢ 0.88 per bird.

The analysis on labour cost shows that the labour cost per bird among the respondents in the study area decreases with an increase in farm size. This implies that larger broiler farms gained cost advantage in terms of labour cost per bird.

Table 4.17 Labour Cost per Bird (1.5kg Live Weight) in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	0.74	1.11	2.97
500 - 1000	0.65	0.98	2.04
1001 - 1500	0.57	0.88	1.02
Sample	0.57	1.03	2.97

Source: Survey result from this study (2011)

4.4.2 Cost of Day Old Chicks

The unit cost of day old chick across the various local hatcheries and importers during the production period (between January and June ,2011) is presented in Table.4 18. The survey showed that the cost of a day old chick was GH¢1.50 at Akate and Topman Farms hatcheries. The unit cost of day old chick at Asamoah Yamoah and Darko Farms hatcheries was GH¢1.40 and GH¢1.30 respectively. The cost of a day old chick at Nfum Farm hatcheries was GH¢1.20. On the other hand, the cost of an imported day old chick from Rees and Co., Frankhuson, and Multivet Companies was GH¢ 2.0.

Table 4.18 Unit Cost of Day Old Chick across the Various Hatcheries/Importers

Hatchery Companies / Importers	Unit Cost (GH¢)
Akate Farms	1.50
Darko Farms	1.30
Asamoah Yamoah Farms	1.40
Nfum Farms	1.20
Topman Farms	1.50
Rees and Co. *	2.00
Frankhuson *	2.00
Multivet *	2.00

Source: Survey result from this study (2011) * importers of day old chicks

Table 4.19 shows the unit cost of day old chick across the various farm sizes of the respondents. The unit cost of day old chick across the sampled farms in the study area ranges from GH¢1.20 to GH¢2.0 with a mean of GH¢1.50. The analysis shows that the respondents who produced between 1001 and 1500 birds purchased their day old chicks at a cost ranging from GH¢1.30 to GH¢1.50 per chick with the mean of GH¢ 1.40 per chick. The unit cost of day old chick among the rest of the respondents ranges from GH¢1.20 to GH¢2.00 with the mean of GH¢1.50.

The analysis indicates that none of the respondents who produced between 1001 and 1500 birds purchased a day old chick at a cost of GH¢2.00. This implies that they depended solely on day old chicks from the local hatcheries unlike the rest of the respondents.

Table 4.19 Unit Cost of Day Old Chick across the Various Farm Sizes in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	1.20	1.50	2.00
500 - 1000	1.20	1.50	2.00
1001 - 1500	1.30	1.40	1.50
Sample	1.20	1.50	2.00

Source: Survey result from this study (2011)

4.4.3 Medicines/Disinfectants Cost

This encompasses analyses on costs of vaccine, drug and disinfectants used by the respondents.

4.4.3.1 Cost of Vaccine

The survey indicates that a typical broiler farm in the study area incurred a vaccine cost of GH¢50. Table 4.20 shows the details on the vaccine use and cost by a typical broiler farm in the study area. Since an average broiler farm has 545 birds (1.5 kg live weight each), an average vaccine cost per bird was obtained to be GH¢0.09 (50/545 = 0.09).

Table 4. 20 Cost of Vaccine for a Typical Broiler Farm in the Study Area

Type of Vaccination	Vaccine Used	Quantity Used	Unit Cost	Total Cost
1st Gumboro	DM97	1bottle (1000 dose)	15	15
1st Newcastle	HB1	1bottle (1000 dose)	10	10
2nd Gumboro	DM97	1bottle (1000 dose)	15	15
2nd Newcastle	Lasota,	1bottle (1000 dose)	10	10
Total	-	-	-	50

Source: Survey Result from this study (2011)

Table 4.21 shows the vaccine cost per bird among the respondent based on their farm sizes. The survey shows that the cost of vaccines per bird among the sampled farms ranges from GH¢0.05 to GH¢0.17 with the mean of GH¢0.09. The analysis indicates that the respondents who produced less than 500 birds incurred vaccine cost ranging from GH¢0.07 to GH¢0.17 per bird with the mean of GH¢0.10 per bird. The producers of 500 to 1000 birds spent between GH¢0.06 and GH¢0.14 on vaccine per bird with the mean of GH¢0.16 per bird. The rest of the respondents who produced between 1001 and 1500 birds recorded vaccine cost ranging from GH¢0.05 to GH¢0.10 per bird with the mean of GH¢0.7 per bird.

Table 4.21 Vaccine Cost per Bird (1.5 kg Live Weight) in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	0.07	0.10	0.17
500 - 1000	0.06	0.09	0.14
1001 - 1500	0.05	0.07	0.10
Sample	0.05	0.09	0.17

Source: Survey result from this study (2011)

The analysis shows that the respondents who had larger farm sizes recorded lower vaccine cost per bird. This implies that as the farm size increases, the vaccine cost per bird decreases. As stated earlier, according to the respondents, 1 bottle of vaccine is to be administered to 1000 birds. Therefore, the respondents who produced less than 1000 birds had to use a measured portion of the vaccine and discard the rest. According to the respondents, once the vaccine is opened, the leftover cannot be used again. This presupposes that the respondents who produced 1000 birds gained cost advantage in term of vaccines usage per bird.

4.4.3.2 Cost of Drugs

The survey showed that a typical broiler farm in the study area recorded drug cost of GH¢136.75. The analysis indicates the average cost of antibiotic administration (T-Sian, Nodex) to be GH¢40 and cost of drug for coccidiosis treatment/prevention (Cipcox, Nacox) to be GH¢ 45 per 1kg container. The average cost of pure vitamin (Multiaminilyte) was GH¢50 per 1kg container. Table 4.22 show the cost of Drugs for a typical broiler farm in the study area.

Table 4. 22 Cost of Drugs for a Typical Broiler Farm in the Study Area

Treatment(s) Given	Drug(s) Used	Quantity Used (kg)	Cost per kg (GH¢)	Total Cost (GH¢)
Energy Supplement	Glucovit	0.5	3.5	1.75
Antibiotic Administration	T-Sian, Nodex	1	40	40
Coccidiosis Treatment	Cipcox, Nacox,	1	45	45
Pure vitamin Supplement	Multiaminolyte	1	50	50
Total	-	-	-	136.75

Source: Survey Result from this study (2011)

The analysis indicates that a typical broiler farm with drug cost of GH¢136.75 and farm size of 545 birds (1.5kg live weight each) incurs drug cost of GH¢0.25 (136.75/545 = GH¢0.25) per bird

Table 4.23 shows the drug cost per bird (1.5kg live weight each) among the respondents. The cost of drugs per bird among the sampled farms ranges from GH¢0.13 to GH¢ 0.47 with the mean of GH¢ 0.25 depending on the type of disinfectant used and farm size which influences the quantity (of disinfectants) used. The analysis on drug cost further indicates that the respondents who produced less than 500 birds incurred cost per bird ranging from GH¢0.18 to GH¢0.47 with the mean of GH¢0.25. The respondents who produced between 1000 and 1500 birds recorded drug cost within the range of GH¢0.14 and GH¢0.37 per bird with the mean of GH¢0.24 per bird. The respondents who produced between 1001 and 1500 birds recorded drug cost ranging from GH¢0.13 to GH¢0.26 per bird with the mean of GH¢0.22 per bird. Table 4.23 shows the cost of disinfectants per bird among the respondents. The analysis indicates that the large farms recorded lower drug cost per bird.

Table 4.23 Drug cost per bird (1.5kg live weight) among the respondents

Farm Size	Minimum	Mean	Maximum
< 500	0.18	0.25	0.47
500 - 1000	0.14	0.24	0.37
1001 - 1500	0.13	0.22	0.26
Sample	0.13	0.25	0.47

Source: Survey result from this study (2011).

4.4.3.3 Cost of Disinfectants

The cost of disinfectants per bird among the sampled farms ranges from GH¢0.01 to GH¢ 0.07 with the mean of GH¢ 0.03 depending on the type of disinfectant used and farm size which influences the quantity (of disinfectants) used. The analysis on disinfectant cost further indicates that the respondents who produced less than 500 birds incurred cost ranging from GH¢0.02 to GH¢0.08 with the mean of GH¢0.04. The respondents who produced between 1000 and 1500 birds recorded disinfectants cost within the bracket of GH¢0.01 and GH¢0.05 per bird with the mean of GH¢0.03 per bird. The rest of the respondents recorded disinfectants cost ranging from GH¢0.01 to GH¢0.03 per bird with the mean of GH¢0.02 per bird. The analysis shows that the large farms recorded lower disinfectants cost per bird. Table 4.24 shows the cost of disinfectants per bird among the respondents.

Table 4.24 Cost of Disinfectants per Bird (1.5 kg Live Weight) in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	0.02	0.04	0.07
500 - 1000	0.01	0.03	0.05
1001 - 1500	0.01	0.02	0.03
Sample	0.01	0.03	0.07

Source: Survey result from this study (2011)

In total, the cost of disease prevention and treatment per bird (1.5kg live weight) which is the summation of the costs of vaccine, drug and disinfectants among the sampled farms ranges from GH¢0.19 to GH¢0.61 with the mean of GH¢0.37. Table 4.25 shows the summary on the disease prevention and treatment cost per bird among the respondents.

Table 4.25 Medicines/Disinfectants Cost per Bird (1.5kg Live Weight) in GH¢

Cost Components	Minimum	Mean	Maximum
Vaccine	0.05	0.09	0.17
Drug	0.13	0.25	0.47
Disinfectants	0.01	0.03	0.07
Medicines/Disinfectants	0.10	0.37	0.61

Source: Survey result from this study (2011)

4.4.4 Feed Cost

Table 4.26 shows the trend of average prices of broiler feed items in the study area for the first six months of the year 2011 within which production was carried out. The average price of maize, which forms major cost component of broiler feed, was relatively steady from January to April. However, it experienced 6.3 percent and 11.5 percent increases in May and June respectively. Average prices of starter, grower and finisher feeds experienced similar price hikes since maize price influences the cost of the named feeds.

Almost all the sampled broiler farms carried out their production between January and April ending in order to meet the Easter festivity where most Ghanaian families prefer to buy live birds. As shown in Table 4.26, average feed prices were relatively stable during that period of production.

Table 4.26. Average prices of broiler feed items in the study area from January to June 2011.

Feed/Feed Item	January (GH¢)	February (GH¢)	March (GH¢)	April (GH¢)	May (GH¢)	June (GH¢)
Maize (120kg)	61.28	61.60	61.73	62.30	66.20	73.79
Starter (50kg)	43.06	43.46	43.52	43.67	46.83	50.06
Grower (50kg)	43.30	43.33	43.33	43.33	45.33	45.33
Finisher (50kg)	40.00	40.00	40.00	40.00	42.00	45.00

Source: Survey result from this study (2011).

The data from farmers indicates that feed cost per bird (1.5kg live weight) among the sampled farms in the study area ranges from GH¢5.84 to GH¢10.20 with the mean of GH¢7.26. The analysis further indicates that the respondents who produced less than 500 birds incurred feed cost ranging from GH¢5.93 to GH¢9.45 per bird with the mean of GH¢7.86 per bird. The feed cost per bird among the producers of 500 to 1000 birds ranges from GH¢5.65 to GH¢9.30 with the mean of GH¢6.90. The rest of the respondents who produced between 1001 and 1500 birds recorded feed cost ranging from GH¢5.41 to

GH¢6.49 per bird with the mean of GH¢6.0 per bird. Table 4.27 showsthe feed cost per bird among the respondents. The result shows that feed cost per bird among the respondents decreases with an increase in farm size

Table 4.27 Feed Cost per Bird (1.5kg Live Weight) in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	5.93	7.86	9.45
500 - 1000	5.65	6.90	9.30
1001 - 1500	5.41	6.00	6.49
Sample	5.41	7.26	9.45

Source: Survey result from this study (2011).

Table 4.28 shows the cost of preparing 1 ton of a typical broiler grower feed among the respondents. The analysis shows the cost of preparing one ton of a typical broiler grower feed among the sampled farms to be GH¢742.25. This implies that if a broiler bird (1.5kg live weight) consumes an average of 6.9kg of feed from a day old to maturity (table 4.15), then 1 ton (1000kg) of feed should be consumed by 145 birds. The average feed cost (only self–prepared feed) per bird of 1.5kg live weight is then calculated to be GH¢5.12 (that is, 742.25/145 = GH¢5.12).

It can be deduced from the analysis on average cost of self-prepared feed per bird (1.5kg live weight) that if all the sampled broiler farms had relied on self–prepared feed they (respondents) would have recorded a lower average feed cost of GH¢5.12 per bird instead of the GH¢7.26.

Table 4.28 Cost of Preparing 1 Ton of a Typical Broiler Grower Feed

Feed Components	Quantity Used (kg)	Cost per kg (GH¢)	Total Cost (GH¢)
Maize	600	0.52	312
Soybean	250	1.20	300
Wheat Bran	75	0.32	24
Copra Cake	12.5	0.34	4.25
Fishmeal/Herrings	50	1.80	90
Oyster Shell	10	0.60	6
Broiler Premix	2.5	2.40	6
Total	1000	-	742.25

Source: Survey result from this study(2011)

4.4.5 Fixed Cost of Capital Assets

Cost of fixed capital assets covers the cost of all the fixed inputs used in producing the birds. This is generally considered a principal cost factor in establishing a poultry (broiler) farm. However, since the fixed capital assets are not used for only one production period, its cost is spread over the number of years/periods in which the assets will be used. Therefore, the contribution of fixed cost to the total production cost of a single production period tends to be low. The analysis of cost of fixed capital assets covers the land cost (leasing cost), depreciated cost of building(s), and depreciated cost of farm equipments (feeders, drinkers, brooders , buckets, shovels, wheelbarrows).

4.4.5.1 Land Cost

The survey showed the average cost per a hectare (ha) of farmland across the study area to be GH¢18533. However, as stated earlier, an average broiler farm in the study area used 0.15 hectares of land (about 1.5 plots) but not 1 hectare. Table 4.29 shows the details on the cost of farmlands used by the respondents.

Table 4.29 Cost of Farmlands Used by the Respondents

Farm Size	Average Land Size (ha)	Average Cost per ha (GH¢)	Total Land Cost (GH¢)	Average Leasing Period (years)	Annual Land Cost (GH¢)	Land Cost per Production Period (GH¢)
< 500	0.10	18533	1853	50	37.06	18.53
500 - 1000	0.20	18533	3707	50	74.14	37.07
1001 - 1500	0.30	18533	5560	50	111.20	55.60
Sample	0.15	18533	2780	50	55.60	27.80

Source: Survey Result from this study (2011)

As shown in Table 4.29, the analysis on land cost indicates that the total cost of the farmlands used by the respondents ranged from GH¢1853 to GH¢ 5560 with the mean of GH¢2780. The annual cost of the farmlands ranged from GH¢37.06 to GH¢111.20 with an average of GH¢55.60. However, the respondents carried out an average of 2 productions in a year. Therefore, the land cost per production period ranged from GH¢18.53 to GH¢55.60 with the mean of GH¢27.80. This means that an average farm in the study area with 545 birds incurred land cost of GH¢0.05 (27.50/545 = GH¢0.05) per bird.

The distribution of land cost per bird among the respondents shows that land cost among the sampled farms ranges from GH¢0.03 to GH¢0.12 per bird with the mean of GH¢0.05 per bird (table 4.30). The distribution further indicates that the respondents who produced less than 500 birds recorded land cost within the range of GH¢0.04 to GH¢0.12 per bird with the mean of GH¢0.06. The producers of 500 to 1000 bird incurred land cost that ranges from GH¢ 0.04 to GH¢0.10 per bird with the mean of GH¢ 0.05 per bird. The remaining respondents who produced between 1001 and 1500 birds recorded land cost that ranges from GH¢0.03 to GH¢0.08 per bird with the mean of GH¢0.04 per bird. Table 4.30 shows the distribution of land cost per bird.

Table 4.30 Land Cost per Bird (1.5kg Live Weight) in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	0.04	0.06	0.12
500 - 1000	0.04	0.05	0.10
1001 - 1500	0.03	0.04	0.08
Sample	0.03	0.05	0.12

Source: Survey result from this study (2011)

4.4.5.2 Depreciated Cost of Farm Building(s)

The calculation in table 4.31 indicates that a typical broiler farm in the study area incurred farm buildings depreciation cost of GH¢165 (125+40). This implies that the average cost per bird should be GH¢0.30 (165/545 = 0.30). Table 4.31 shows the depreciated cost of farm buildings for a typical broiler farm in the study area.

Table 4.31 Depreciated Costs of Farm Buildings for a Typical Broiler Farm

Type of Farm Building	Cost (GH¢)	Useful Life (years)	Annual Depreciation (GH¢)	Production Periods per Year	Cost per Period (GH¢)
Normal size Cement Block and Mesh Pens	5000	20	250	2	125
Storeroom	1200	15	80	2	40

Source: Survey result from this study (2011)

The distribution of depreciated cost of farm buildings per bird across the various farm sizes of the respondents ranged from GH¢0.17 to GH¢0.46 with the mean of GH¢0.30. The survey result shows that the respondents who produced less than 500 birds recorded a depreciated cost of buildings that ranged from GH¢ 0.17 to GH¢ 0.39 per bird with the mean of GH¢0.21. The producers of 500 to 1000 birds incurred a depreciated building cost ranging from GH¢0.22 to GH¢0.46 per bird with the mean of GH¢0.30 per bird. The rest of the respondents who produced between 1001 and 1500 birds recorded a depreciated building cost that ranged from GH¢0.20 to GH¢0.35 per bird with the mean of GH¢0.26 per bird. Table 4.32 shows the depreciated cost of building(s) per bird among the respondents.

Unlike the producers of between 500 and 1000 birds who used an average of two normal size cement block and wire mesh pens, the producers of less than 500 birds used an average of one pen of the same type. This explains why the latter (producers of less than 500 birds) recorded lower farm building depreciation cost per bird. In addition, even though some (50%) of the producers of between 1001 and 1500 birds used 3 pens, the rest of them (50%) managed to use 2 pens in order to do away with the cost of constructing additional pen.

Table 4.32 Depreciated Cost of Building(s) per Bird (1.5kg Live Weight) in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	0.17	0.21	0.39
500 - 1000	0.22	0.30	0.46
1001 - 1500	0.20	0.26	0.35
Sample	0.17	0.30	0.46

Source: Survey result from this study (2011)

4.4.5.3 Depreciated Cost of Farm Equipments

This encompasses the combined depreciated cost of feeders, drinkers, brooders, shovels, buckets, and wheelbarrows owned/used in producing the broiler birds as stated earlier. The analysis indicates that an average broiler farm in the study area recorded a depreciated cost of GH¢55.36 on farm equipments. This implies that a typical broiler farm with 545 birds (1.5kg live weight each) incurred farm equipments depreciated cost of GH¢0.10 (55.36/545=0.10) per bird. Table 4.33 shows the depreciated cost of farm equipments for a typical farm.

Table 4.33 Depreciated Costs of Farm Equipments for a Typical Farm

Type of Assets	No. Used	Unit Cost (GH¢)	Total Cost (GH¢)	Useful Life (Year)	Annual Depreciation (GH¢)	Depreciation for the Production period (GH¢)
Feeders	36	12	432	7	61.71	30.86
Drinkers	26	5	130	6	21.67	10.83
Brooders	4	10	40	5	8.00	4.00
Shovels	2	9	18	3	6.00	3.00
Buckets	5	6	30	6	5.00	2.50
Wheelbarrow	1	50	50	6	8.33	4.17
Total	-	-	-	-	110.71	55.36

Source: Survey result from this study (2011)

The analysis shows that the depreciated cost of farm equipments per bird among the sampled farms ranges from GH¢ 0.08 to GH¢ 0.32 with the mean of GH¢ 0.10. The survey result shows that the depreciated cost of farm equipments per bird among the respondents who produced less than 500 birds ranges from GH¢0.10 to GH¢0.32 with the mean of GH¢0.11. The respondents who produced between 500 and 1000 birds recorded a depreciated cost of farm equipments that ranges from GH¢0.09 to GH¢0.30 per bird with the mean of GH¢0.10 per bird. The respondents who produced between 1001 and 1500 birds recorded a depreciated cost of farm equipments ranging from GH¢0.08 to GH¢0.27 per bird with the mean of GH¢0.9. Table 4.34 shows the depreciated costs.

Table 4.34 Depreciated Cost of Farm Equipments/ Bird (1.5kg Live Weight) in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	0.10	0.11	0.32
500 - 1000	0.09	0.10	0.30
1001 - 1500	0.07	0.09	0.27
Sample	0.07	0.10	0.32

Source: Survey result from this study (2011)

In total, the fixed cost of capital assets per bird (1.5kg live weight) which is the summation of the land cost, depreciated cost of buildings and farm equipments among the sampled farms ranges from GH¢0.29 to GH¢0.96 per bird with the mean of GH¢0.45 per bird. Table 4.35 shows the capital cost per bird among the respondents.

Table 4.35 Fixed Cost of Capital Assets per Bird (1.5kg Live Weight) in GH¢

Cost Components	Minimum	Mean	Maximum
Land	0.03	0.05	0.12
Buildings	0.17	0.30	0.52
Farm Equipments	0.07	0.10	0.32
Fixed Cost of Capital Assets/bird	0.29	0.45	0.96

Source: Survey result from this study (2011).

The relatively low fixed cost of capital assets per bird among the respondents could arise from the fact that most of the farms in the study area used improvised equipments in their production. For instance, instead of using brooding hover that is quite expensive, most of the farms use clay pot and charcoal as brooding device. In addition, most of the farms use ordinary plastic bowls as drinkers and feeders to reduce cost.

4.4.6 Miscellaneous Cost

The analysis on cost of miscellaneous items covers the costs of energy, water, transportation and milling.

4.4.6.1 Cost of Energy

The survey showed that a typical broiler farm in the study area incurred an energy cost of GH¢81. The analysis shows that GH¢56 of the energy cost was due to the cost of charcoal used for brooding. An average energy cost per bird (1.5kg live weight) was then calculated to be GH¢0.15 taking into consideration that an average farm produced 545 birds (81/545 = 0.15). Table 4.36 shows the energy cost of the respondents.

Table 4.36 Energy Cost of the Respondents

Energy Sources	Average Cost per Farm (GH¢)	Average Cost per Bird (1.5kg Live Weight) in GH¢
Electricity	25.00	0.05
Charcoal	56.00	0.10
Total	81.00	0.15

Source: Survey Result from this study (2011)

The energy cost per bird among the sampled farms in the study area ranges from GH¢0.07 to GH¢0.24 with the mean of GH¢0.15. The analysis shows that the respondents who produced less than 500 birds incurred energy cost within the range of GH¢0.10 to GH¢0.21 per bird with the mean of GH¢0.17 per bird. The respondents who produced between 500 and 1000 birds incurred energy cost that ranges from GH¢0.08 to GH¢0.20 per bird with the mean of GH¢0.13. The energy cost per bird among the producers of 1001 to 1500 birds ranges from GH¢0.07 to GH¢0.15 per bird with the mean of GH¢0.10 per bird. Table 4.37 shows the energy cost per bird (1.5kg live weight) among the respondents.

Table 4.37 Cost of Energy per Bird (1.5kg Live Weight) in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	0.10	0.17	0.21
500 - 1000	0.08	0.13	0.20
1001 - 1500	0.07	0.10	0.15
Sample	0.07	0.15	0.21

Source: Survey result from this study (2011)

4.4.6.1 Cost of Water

The survey showed that a typical broiler farm in the study area used 338 gallons (25 litres each) of water. As stated earlier, an average broiler farm depended solely on water from wells. The cost per a 25-litre gallon of water from well in the study area was GH¢ 0.05. The total cost of water for an average broiler farm was calculated to be GH¢16.90. This implies that the water cost per bird (1.5 kg live weight) would be GH¢ 0.03 (16.9/545 = 0.03). Table 4.38 shows the water cost per bird for a typical broiler farm in the study area.

Table 4. 38 Water Cost for a Typical Broiler Farm in the Study Area

Water Sources	Average Gallons of Water Used per Farm	Average Cost per Gallon (25 Litres) GH¢	Total Cost (GH¢)	Water Cost per Bird (1.5kg Live Weight) (GH¢)
Well	338	0.05	16.90	0.03
Pipe Borne Water	338	0.10	33.80	0.06

Source: Survey Result from this study (2011)

The analysis indicates that water cost per bird among the sampled farms in the study area ranges from GH¢0.01 to GH¢0.07 with the mean of GH¢0.03. The analysis shows that the respondents who produced less than 500 birds incurred water cost within the range of GH¢0.03 to GH¢0.07 per bird with the mean of GH¢0.04 per bird. The respondents who produced between 500 and 1000 birds incurred water cost that ranges from GH¢0.02 to GH¢0.06 per bird with the mean of GH¢0.03.The water cost per bird among the producers of 1001 to 1500 birds ranges from GH¢0.01 to GH¢0.04 per bird with the mean of GH¢0.02 per bird. Table 4.39 shows the water cost per bird among the respondents.

Table 4.39 Water Cost per Bird (1.5kg Live Weight) in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	0.03	0.04	0.07
500 - 1000	0.02	0.03	0.06
1001 - 1500	0.01	0.02	0.04
Sample	0.01	0.03	0.07

Source: Survey result from this study (2011)

4.4.6.3 Transportation Cost

This covers the cost of transporting day old chicks, feed items and other farm inputs from the hatcheries and marketing centers to the farms during the production period. It also includes the cost of transporting produce (broilers) outside the farm for sale. The transportation cost per bird among the sampled farms ranges from GH¢0.03 to GH¢0.10 with the mean of GH¢0.07. The survey result indicates that the respondents who produced less than 500 birds recorded transportation cost that ranges from GH¢0.06 to GH¢0.10 per bird with the mean GH¢0.07 per bird. The respondents who produced between 500 and 1000 birds incurred transportation cost within the range of GH¢0.04 to GH¢0.09 per bird with the mean of GH¢0.08 per bird. The rest of the respondents who produced between 1001 and 1500 birds recorded transportation cost that ranges from

GH¢0.03 to GH¢0.08 per bird with the mean of GH¢0.06 per bird. Table 4.40 shows the transportation cost per bird.

Table 4.40 Transportation Cost per Bird (1.5kg Live Weight) in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	0.06	0.07	0.10
500 - 1000	0.04	0.08	0.09
1001 - 1500	0.03	0.06	0.08
Sample	0.03	0.07	0.10

Source: Survey result from this study (2011).

4.4.6.4 Milling Cost

This covers the cost of milling maize and other feed items such as cottonseed, soybean and copra cakes. The milling cost per bird among the sampled farms ranges from GH¢0.03 to GH¢0.16 with the mean of GH¢0.08. The distribution of milling cost indicates that the respondents who produced less than 500 birds recorded milling cost that ranges from GH¢0.06 to GH¢0.16 per bird with the mean GH¢0.09 per bird. The respondents who produced between 500 and 1000 birds incurred milling cost within the ranges of GH¢0.05 to GH¢0.12 per bird with the mean of GH¢0.08 per bird. The rest of the respondents who produced between 1001 and 1500 birds recorded milling cost that ranges from GH¢0.04 to GH¢0.10 per bird with the mean of GH¢0.07 per bird. Table 4.41shows the milling cost per bird among the respondents.

Table 4.41 Milling Cost per Bird (1.5kg Live Weight) in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	0.06	0.09	0.16
500 - 1000	0.05	0.08	0.12
1001 - 1500	0.04	0.07	0.10
Sample	0.04	0.08	0.16

Source: Survey result from this study (2011

The miscellaneous cost which is the summation of the energy, water, transportation, and milling costs ranges from GH¢0.25 to GH¢0.57 per bird (1.5 kg live weight) with the mean of GH¢0.33 per bird. Table 4.42 shows the miscellaneous cost per bird

Table 4.42 Miscellaneous Cost per Bird (1.5kg Live Weight) in GH¢

Cost Components	Minimum	Mean	Maximum
Energy	0.07	0.15	0.21
Water	0.01	0.03	0.07
Transportation	0.03	0.07	0.10
Milling	0.04	0.08	0.16
Miscellaneous Cost/Bird	0.25	0.33	0.57

Source: Survey result from this study (2011).

The relatively low values recorded for miscellaneous cost across the sampled farms might be due to the fact that most of the farms had devised means of reducing their utility cost. For instance, Instead of using four or five small electric bulbs in a big pen, most of the farms used just two big energy saving bulbs to reduce the electricity consumption and save cost. Some of the farms also bought feed that could last for a month or two to reduce expenditure on transportation.

4.4.7 Production Cost per Bird (1.5 kg Live Weight)

The analysis shows that the production cost per bird (1.5kg live weight) among the sampled farms ranges from GH¢9.70 to GH¢13.00 with the mean of GH¢10.94.

The result shows that feed cost contributed GH¢7.26 to the mean production cost per bird among the respondents in the study area. This implies that, on average, feed cost accounted for 66.73% (7.26/10.94*100 = 66.36) of the mean production cost per bird. This result confirms the report by FAO (2006) that feed cost makes up over 60% of the total poultry production cost in Ghana. Table 4.43 shows the summary on production cost per bird indicating the contribution of each of the inputs to the mean production cost.

Table 4.43 Summary on Cost of Production per Bird (1.5kg Live Weight) in GH¢

Cost Components	Minimum	Mean	Maximum
Labour	0.57	1.03	2.97
Medicine/Disinfectant	0.10	0.37	0.61
Day Old Chick	1.20	1.50	2.00
Feed	5.41	7.26	9.45
Fixed Capital Assets	0.29	0.45	0.96
Miscellaneous Items	0.25	0.33	0.57
Production Cost per Bird	9.70	10.94	13.00

Source: Survey result from this study (2011).

The survey result indicates that the respondents the who produced less than 500 birds incurred production cost that ranges from GH¢10.30 to GH¢13.00 per bird (1.5kg live weight) with the mean of GH¢11.06 per bird. The producers of 500 to 1000 birds incurred production cost ranging from GH¢9.80 to GH¢12.58 per bird with the mean of GH¢10.86 per bird. The rest of the respondents who produced between 1001 and 1500 birds recorded broiler production cost that ranges from GH¢9.70 to GH¢10.33 per bird with the mean of GH¢9.97 per bird. Table 4.44 shows the production cost per bird (1.5kg live weight) among the respondents with respect to their farm sizes.

The analysis shows that the production cost per bird among the sampled farms in the study area decreases with an increase in farm size.

Table 4.44 Production Cost per Bird (1.5kg Live Weight) in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	10.30	11.06	13.00
500 - 1000	9.80	10.86	12.58
1001 - 1500	9.70	9.97	10.33
Sample	9.70	10.94	13.00

Source: Survey result from this study (2011).

4.5 Returns

This covers analysis on the prices received per bird (1.5 kg Live Weight) as well as the profit obtained per bird across the sampled farms.

4.5.1Prices Received per Bird (1.5kg Live Weight)

The survey shows that the sampled respondents sold their broilers at prices that range from GH¢12 to GH¢15 per bird with the mean of GH¢13.85 per bird. The analysis indicates that the respondents who produced less than 500 birds sold their broilers at a price ranging from GH¢13.00 to GH¢15.00 per bird with the mean of GH¢13.95 per bird. The respondents who produced between 500 and 1000 birds received GH¢13.00 to GH¢15.00 per bird with the mean of GH¢13.82 per bird. The rest of the respondents who produced between 1001 and 1500 birds sold their broilers at a price ranging from

GH¢12.00 to GH¢14.00 per bird with the mean of GH¢13.60 per bird. Table 4.45 shows the price received per bird by the respondents.

The differences in the prices received per bird across the sampled farms in the study area were influenced by the production cost and the location of the farm. The result shows that the respondents who produced between 1001 and 1500 birds sold their broilers at a price quite lower than that of the other respondents. This could probably be due to the relatively lower production cost they (producers of between 1001 and 1500 birds) recorded compared to the rest of the respondents. Similarly, the mean price received per bird among the respondents who produced between 500 to 1000 was lower than that of the respondents who produced less than 500 birds. As stated earlier, the respondents sold their birds mainly at the farmgate. Therefore, the farms located within the towns or close to the main roads also received higher prices than those located in the villages/outskirts of towns.

Table 4.45 Price(s) Received per Bird (1.5kg Live Weight) by the Respondents in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	13.00	13.95	15.00
500 - 1000	13.00	13.82	15.00
1001 - 1500	12.00	13.60	14.00
Sample	12.00	13.85	15.00

Source: Survey result from this study (2011).

4.5.2 Profit Obtained per Bird (1.5kg Live Weight)

The profit obtained per bird among the sampled farms ranges from GH¢0.90 to GH¢3.48 with the mean of GH¢2.97. The analysis further shows that the profit obtained per bird among the respondents who produced less than 500 birds ranges from GH¢0.90 to GH¢3.20 with the mean of GH¢2.89. The producers of between 500 and 1000 birds obtained profit that ranges from GH¢1.00 to GH¢3.32 per bird with mean of GH¢2.96 per bird. The rest of the respondents who produced between 1001 and 1500 birds obtained profit that ranges from GH¢2.55 to GH¢3.80 per bird with the mean of GH¢3.63. Table 4.46 shows the profit obtained per bird by the respondents.

The analysis shows that the profit obtained per bird among the respondents increases with an increase farm size.

Table 4.46 Profit Obtained per Bird (1.5kg Live Weight) in GH¢

Farm Size	Minimum	Mean	Maximum
< 500	0.90	2.89	3.20
500 - 1000	1.00	2.96	3.32
1001 - 1500	2.55	3.63	3.80
Sample	0.90	2.97	3.80

Source: Survey result from this study (2011).

4.6 Mortality Rate of Birds

Mortality rate is a measure of the number of birds that died during the production period. The survey shows that the mortality rate among the sampled farms ranges from 4.00% to 10.20% with the mean of 7.24%. The respondents who produced less than 500 birds recorded mortality rate that ranges from 4.00% to 10.10% with the mean of 7.10%. The producers of 500 to 1000 birds recorded mortality rate that ranges from 4.80% to 10.11% with the mean of 7.20%. The rest of the respondents who produced between 1001 and 1500 birds recorded mortality rate ranging from 5.00% to 10.20% with the mean of 8.90%. Table 4.47 shows the mortality rate among the respondents.

Table 4.47 Bird Mortality Rate among the Respondents in Percentages (%)

Farm Size	Minimum	Mean	Maximum
< 500	4.00	7.10	10.10
500 - 1000	4.80	7.20	10.11
1001 - 1500	5.00	8.90	10.20
Sample	4.00	7.24	10.20

Source: Survey result from this study (2011).

The death of the birds (mortality) represents an extra cost to the farm since monies were used in purchasing those birds. This presupposes that an increase in mortality rate necessarily implies an increase in production cost that eventually reduces returns or net income.

4.7 Socioeconomic Characteristics of Respondents

This covers analyses on qualities of the respondents that influenced their managerial ability/bird mortality rate and production costs.

4.7.1 Managerial Ability

Managerial ability/efficiency is influenced by education/training, farming experience and access to technical advice. The detailed analyses of the respondents (production managers) level of education/training, experience in broiler production and source of technical advice during the production period in question are discussed below.

4.7.1.1 Education/Training

The survey showed that 80.70% of the respondents (production managers) attained secondary level of education. The rest of the respondents (19.30%) attained tertiary level of education. This implies that all the respondents (production managers) attained education above basic or primary level. The secondary level of education comprises those (respondents) who attended or completed Junior High, Middle School, Senior High, Technical and Vocational Schools. The tertiary level of education covers those (respondents) who attended or completed Post Secondary Training.

The respondents did not necessarily receive any special form of production training during the production period under consideration. The respondents reported that, in recent years, they hardly hear something like production training for poultry farmers. This confirms the report by Owusu-Afari (2010) that there is inadequate capacity-building programmes to equip the poultry farmers in Ghana with proven techniques for efficient and rewarding production.

Nonetheless, it is evident that all the respondents (production managers) attained education above basic or primary level and could read, write, and adopt innovations/ technologies that could ensure efficient management of resources.

Educated farmers may be able to plan, keep proper farm records and access information concerning disease conditions more accurately. Moreover, education improves the farmers' ability to formulate/compound feed using the right percentages of the feed ingredients during the various stages of the production process. Finally, education increases the ability of the farmers to properly mix and administer vaccines to reduced mortality that could translate into high production cost.

The distribution on educational level of the respondents in shown in Table 4.48.

Table 4.48 Educational Level of the Respondents

Highest Level of Education Achieved	Frequency	Percentage (%)
Basic	0	0.00
Secondary	92	80.70
Tertiary	22	19.30
Total	114	100.00

Source: Survey result from this study(2011).

4.7.1.2 Farming Experience

The analysis shows that the years of experience in broiler production among the respondents ranges from 1year to 27 years. The distribution of years of experience (Table 4.49) shows that 59.65% of the respondents had been in broiler production for 6 to 10 years. Only 19.30% of the respondents were in the category of 1 to 5 years of experience. 14.91% of the respondents had been in broiler production for 11 years to 15 years. The years of experience among the rest of the respondents (6.14%) were 16 years and above. This result indicates that most of the farmers were relatively experienced in broiler production and could bring their experience to bear in terms of efficient management. Years of experience in broiler production enables the farmers (respondents) to gain more ideas/knowledge on their resources and practices resulting in proper utilization of production inputs. For instance, out of experience, the farmers are able to know the appropriate brooding temperatures for the birds, timing of feedings, lighting and vaccinations without necessarily consulting a veterinarian.

Table 4.49 Years of Experience in Broiler Production Among the Respondents

Years of Experience (years)	Frequency	Percentage (%)
1 – 5	22	19.30
6 - 10	68	59.65
11 - 15	17	14.91
16 and above	7	6.14
Total	114	100.00

Source: Survey result from this study (2011).

4.7.1.3 Source(s) of Technical Advice/Support

The survey showed that the respondents sought technical advice/support from other experienced broiler farmers and the veterinary service/veterinarians anytime they encountered difficulties during the production period. Surprisingly, extension services/agents did not play any role in providing technical advice/support to the sampled farms in the study area. Almost all the farmers (production managers) claimed they had never been visited by an extension agent before. The analysis shows that 63.16% of the respondents received technical advice/support from both the veterinary services and the experienced broiler farmers. 30.70% of the respondents receive technical advice/support solely from the veterinary services. The remaining respondents (6.14%) received technical advice/support from the other experienced farmers only. The analysis confirms that none of the farmers received technical advice/support from the extension services. Table 4.50 shows the distribution of the respondents' source of technical advice /support.

Table 4.50. Source of Technical Advice/Support Among The Respondents.

Source of Technical Advice/Support	**Frequency**	**Percentage (%)**
Veterinary Service only	35	30.70
Extension Agents only	0	0.00
Experienced Broiler Farmers only	7	6.14
Both veterinary Service and Experienced Broiler Farmers	72	63.16
Total	114	100.00

Source: Survey result from this study (2011)

4.8 Regression Results

Maximum–likelihood estimates of parameters of the Cobb-Douglas stochastic frontier cost function and the inefficiency model together with the estimated standard errors and their statistical significance levels are presented in Table 4.51. All the coefficients of variables of the stochastic cost frontier model have the expected signs (positive coefficients) indicating that an increase in price of any of the inputs as well as an increase in output level will eventually increase total production cost. The result in Table 4.51 implies that 1% increase in price of labour , disease treatment and prevention, day-old chick, feed, capital assets and miscellaneous items (water, energy, transportation, milling) will lead to approximately 0.09%, 0.01%, 0.13%, 0.27%, 0.01%, and 0.06%, increases in total production cost respectively. This indicates that production cost response to input prices is inelastic. Similarly, 1% increase in output level will lead to approximately 0.66% increase in total production cost.

The positive coefficients or elasticities of cost with respect to all inputs confirm the assumption that cost function monotonically increases in input prices as stated by Ogundari *et al*. (2006). Price of feed, day old chick and output level are statistically significant at 1%. Labour price is statistically significant at 5%. This result indicates that the named variables were significantly different from zero. That is, they are very important cost elements in broiler production. However, this does not mean that the other variables such as the price of a medicine/disinfectant, miscellaneous items and fixed price of capital assets do not influence total production cost. Instead, this implies that a percentage increase in price of any of such inputs would not increase total production cost that much.

Table 4.51: Maximum–Likelihood Estimates of Parameters of the Cobb-Douglas Stochastic Cost Frontier and the Inefficiency Models

Variable	Parameter	Estimate	
Stochastic Cost Frontier Model			
Constant	β_0	1.4295***	(2.9958)
Labour price (GH¢/man-day)	β_1	0.0864**	(2.3033)
Average price of medicine/disinfectant (GH¢/unit)	β_2	0.0134	(0.3393)
Average price of day-old chick (GH¢/chick)	β_3	0.1300***	(2.3853)
Average feed price(GH¢/kg)	β_4	0.2726***	(5.3202)
Average price of fixed capital assets (GH¢)	β_5	0.0092	(0.3898)
Average price of miscellaneous items (GH¢)	β_6	0.0614	(0.4849)
Output level (kilogrammes of birds produced)	β_7	0.6611***	(9.6719)
Inefficiency Model			
Constant	ϕ_0	0.3993***	(13.1900)
Educational level(years)	ϕ_1	-0.0029 *	(-1.2850)
Farming experience(years)	ϕ_2	-0.0007	(-0.5600)
Farm size (quantity of birds kept)	ϕ_3	-0.0099***	(-3.1000)
Technical advice from veterinary services	ϕ_4	-0.2537***	(-10.490)
Sigma-square	$\sigma^2 = \sigma^2 v + \sigma^2 u$	0.0262***	(2.7838)
Gamma	$\gamma = \sigma^2 u / \sigma^2 v + \sigma^2 u$	0.8867***	(5.5506)
Log likelihood function	llf	102.61	

Source: Survey result from this study (2011)

The figures in parentheses are the t-ratios. ***, **, * denote that coefficients are statistical significant at 1%, 5% and 10% respectively.

As shown in the lower part of Table 4.51, all the explanatory variables in the inefficiency model gave the expected sign (negative) of the coefficients. The negative coefficients for educational level and farming experience imply that educated and experienced farmers in broiler production are more cost efficient than other farmers who do not fall into this category. Whereas the coefficient of educational level was statistically significant at 10 %, that of the farming experience was not significant. This further gives an indication that more educated farmers were able to adopt efficient cost management strategies to significantly reduce their production cost. This is in line with the result by Ng'eno *et al.*(2010), and Udoh and Etim (2009), that higher level of farmer's education significantly reduce inefficiency in poultry production. However, the effect of farming experience being statistically insignificant in this study contradicts the result by Udoh and Etim (2009) that farming experience significantly improve efficiency in poultry production. This contradiction might have stemmed from the fact that most of the experienced farmers relied hugely on their own knowledge /ideas and did consider adopting new cost management strategies that could significantly reduce their production cost.

The negative coefficient for farm size is an indication that larger farms in the study are more cost efficient than the smaller farms. The 1% statistical significance level for farm size also implies that the influence of changes in farm size on cost efficiency was very important. This might be due to the fact that most of the large broiler farms in the study area used their self-prepared feed and, hence, the average cost involved in acquisition of feed was lower than that of the small farms that depended on commercial feed. As stated earlier, feed is a major cost component in broiler production and its effect on cost efficiency cannot be underestimated. In addition, unlike the smaller farms, the larger farms ensured full utilization of production inputs. For instance, there were no leftover vaccines to be discarded as it was the case in the smaller farms. This could result in a substantial cost savings by the larger farms.

The technical advice from veterinary services was statistically significant at 1%. The negative coefficient for this variable indicates that the respondents who received technical advice from veterinary services were more cost efficient than their counterparts who sought technical advice from other sources (such as fellow farmers). This might have stemmed from the fact that the farmers in this category might have received accurate and timely information especially on certain disease conditions of the birds from the veterinary services. This could result in reduction in bird mortality rate leading to a reduction in their production cost and eventual improvement in their cost efficiency.

Sigma-square (σ^2) which represents overall variance from the frontier model has an estimate of 0.0262 which is significant statistically at 1%. This indicates that the variation from the frontier is very important and cannot be overlooked. The estimated gamma parameter (γ) of the model is 0.8867 and statistically significant at 1%. This implies that about 89% of the variation in the total production cost among the sampled farms was due to differences in their cost efficiencies. Thus, 89% of the variation in composite error term was due to the inefficiency component. This also suggests that about 11% of the variation was due to random shocks outside the farmer's control. For instance, weather condition/temperature during the brooding stage influences the amount of money that will be spent on brooding.

4.8. 1 Generalized Likelihood Ratio Tests of Hypotheses

The results of the generalized likelihood ratio tests (λ) of the major hypotheses are presented in Table 4.52. The first null hypothesis that specified that the boiler farms were cost efficient in their production ($H_{0:}\ \gamma=0$) was rejected at 5% significance level. This result suggests that there were some levels of cost inefficiencies among the broiler farms in the study area.

The second null hypothesis that specified that production level/scale ($y=0$) has no effect on broiler production cost was rejected at 1% significance level. This implies that production level/scale significantly influenced the production cost among the sampled broiler farms in the study area.

Table 4.52: Generalized Likelihood Ratio Tests of Hypotheses

Hypothesis	Log likelihood	Test statistic (λ)	Critical value(s)	Decision
$H_{0:}\ \gamma= 0$	102.61	3.87**	2.71	Rejected H_0
$H_{0:}\ y=0$	41.51	122.2 ***	9.21	Rejected H_0

Source: Survey result from this study (2011).

***, ** imply statistical significance at 1% and 5% respectively

4.8.2 Cost Efficiency Levels of the Respondents

The cost efficiency level of the sampled broiler farms in the study area ranged from 1.03 to 1.43 with the mean level of 1.14. This result implies that an average broiler farm in the study area incurs costs that are about 14% above the minimum defined by the frontier. Thus, about 14% of the total cost incurred was avoidable if an average broiler farm in the study area were to be very efficient in terms of cost. Table 4.53 shows the distribution and summary statistics of cost efficiency levels of the farms.

Table 4.53 Distribution and Summary Statistics of Cost Efficiency Levels of the Respondents

Efficiency Level	Relative Frequency (%)
1.00 – 1.09	44.74
1.10 – 1.19	35.09
1.20 – 1.29	13.16
1.30 – 1.39	6.14
1.40 – 1.49	0.88
Total	100.00
Minimum	1.03
Maximum	1.43
Mean	1.14
Standard deviation	0 .09

Source: Survey result from this study (2011)

This confirms the findings by Alrwis and Francis (2008) that cost of production may be relatively high, as a result of inefficiencies. The higher the cost efficiency value, the more inefficient the farm is.

The distribution shows that 44.74% of the sampled farms had cost efficiency levels between 1.00 and 1.09. The result further shows that 35.09% of the respondents had cost efficiency levels around 1.10 and 1.19. These results give an indication that majority of the broiler farms in the study were fairly efficient in producing their respective levels of output using cost minimizing input ratios. That is, majority of the broiler farms in the study area put in some effort aimed at minimizing input wastage in production so as to reduce their total production cost.

Nonetheless, 13.16% of the sampled farms had cost efficiency levels between 1.20 and 1.29. Seven (7) of the respondents representing 6.14% had cost efficiency levels ranging from 1.30 to 1.39. The remaining respondent (1) which represents 0.88% of the total respondents had cost efficiency level of 1.4263, which is within the bracket of 1.40 to 1.49 efficiency level range. This result indicates that, though majority of the farmers were fairly efficient, a few of them were almost grossly inefficient. That is, cost management / minimization strategies (if they existed) of 20% of the sampled farms did not work out.

4.8.3 Economies of Scale

The result of scale effect (economies of scale) among the sampled broiler farms which was computed as the inverse coefficient of cost elasticity with respect to output was 1.513 (That is, 1/ 0.6611 = 1.513). The result indicates the presence of positive scale effect (economies of scale) among the broiler farms in the study area. The computed value for economies of scale also suggests that about 1.51% increase in output could increase total production cost by only 1% and reduce unit cost of producing broiler. Thus, all things being equal, 1% increase in output increases total production cost by less than 1%

The presence of economies of scale also implies that the large farms in the study area had lower production cost per bird. The economic implication of the economies of scale result is that most of the sampled farms were operating below the optimal scale levels and could reduce costs by increasing output further. This result also suggests that most of the broiler farms in the study area were in the stage I of the production possibility frontier (PPF), meaning there were unexploited scale economies. This confirms the findings of Reddy *et al*. (2004), that the stage I of production can be regarded as the sub-optimal stage where the resources are underutilized.

4.9 Analysis of Broiler Farmers' Constraints

The study revealed the various challenges faced by the sampled broiler farms in the study area as shown in Table 4.54. The constraints were ranked with 1 as the topmost and 12 as the least problem based on the outcome (mean scores) of the analysis of the data on farmers constraints using the Kendall's coefficient of concordance (W). Thus, the constraint with the least mean score is ranked the most pressing problem with the highest mean score being the least pressing. The Kendall's W was 0.84 and significant at 1% indicating that there was 84% agreement among the rankings by the sampled broiler farms. This implies that about 84 % of the respondents considered high feed cost as their topmost problem followed by lack of access to credit, competition from cheap poultry import in that order as shown in Table 4.54.

Surprisingly, the farmers claimed they hardly hear of capacity building programmes for poultry farmers in recent years yet they (farmers) ranked it as the least of their concerns or constraints (ranked 12). Since capacity-building programmes are meant to equip farmers with new ideas and techniques for efficient production, failure to acknowledge its importance as revealed in this study could lead to inefficiencies in production or cost management. This implies that, the farmers did not even consider their own cost management difficulties or inefficiencies as significant constraint to production.

Table 4. 54 Constraints of the Sampled Broiler Farms and their Rankings

Constraints of the Sampled Broiler Farms	Mean Score	Rank
High feed cost	1.14	1
Lack of access to credit	2.27	2
Lack of Government support	3.96	4
Competition from cheap poultry import	3.25	3
Diseases outbreaks	4.60	5
Marketing difficulties	6.78	6
High cost of medication	9.92	10
High cost of day old chicks	8.20	8
High labour cost	9.28	9
Lack of quality day old chicks from most local hatcheries	8.08	7
Inadequate capacity building programmes for farmers	10.29	12
High energy cost	10.23	11
Test Statistics		
Kendall's W	0.84	
Chi-Square	1057.00	
Asymptotic Significance	0.00***	
Sample	114	

Source: Survey result for this study (2011) *** represent 1% level of significance

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This study determined the cost efficiency levels and the economies of scale among the broiler farms in the Ashanti region of Ghana. In addition, the factors that influenced the cost efficiency levels of the sampled broiler farms (114) were identified and examined accordingly. Stochastic frontier cost model was employed in determining the cost efficiency levels. The conclusions and recommendations of this study are presented in the following sub-sections.

5.1 Conclusions

The study revealed that the cost efficiency levels of the sampled broiler farms ranged from 1.03 to 1.43 with the mean of 1.14. This implies that, on average, the broiler farms in the study area incurred about 14% cost above the frontier cost (an indication of about 14% cost inefficiency). Thus, on average, the farms could have produced the same levels of outputs using about 86 % of the total cost incurred if they were to be efficient.

Farmer's educational level, experience in broiler production, farm size and technical advice from veterinary services were identified as factors that influenced levels of observed cost efficiencies on broiler farms in the study area. However, the empirical result showed that large farm sizes, farmers' educational level and technical advice from veterinary services were the factors that significantly improved cost efficiency among the broiler farms in the study area.

The economies of scale of the broiler farms in the study area was computed to be 1.513. This indicates the presence of positive scale economies among the broiler farms. Even though this study was applied to small-scale broiler farms, the result appears that an increase in the present scale of broiler production would bring down the average production cost per bird. The analyses on cost confirmed that the farmers (respondents) with larger farm sizes recorded lower production cost per bird (1.5kg live weight).

Last but not least, the empirical results of this study point to fact that, despite some levels of cost inefficiencies identified, the broiler farms in the study area have the potential of increasing their scale of production and becoming more profitable. The analysis on profitability confirmed that the respondents with larger farm sizes recorded higher profit per bird (1.5kg live weight) due to the lower production cost they recorded per bird.

5.2 Policy Recommendations

Based on the empirical results obtained from this study, the following recommendations are deemed very expedient to improve upon the cost efficiency levels of the broiler farms.

It is very evident from the findings of this study that the farm manager's level of education has a crucial role to play in improving the cost efficiency levels of the broiler farms. The farms owners should therefore recruit farm managers who have at least acquired formal education up to the Senior High School (S.H.S) standard or at best use them on part-time basis.

The empirical result of this study showed that technical advice from veterinary services improved cost efficiency in the study area. In view of this, the government through the Ministry of Food and Agriculture should train more veterinarians to be deployed to the various poultry/broiler farming villages/communities to enable the broiler farmers receive technical advice from a professional source instead of relying hugely on their fellow farmers for technical advice. This could help improve the efficiency level of the farmers.

Moreover, the study revealed that large farm size significantly improved cost efficiency among the sampled farms in the study area. This implies that the farmers who had larger farm sizes were more cost efficient than their counterparts who operated small farm sizes due to the full utilization of production inputs particularly the fixed resources by the former. The analysis on economies of scale affirmed that an increase in farm sizes (scale of production) by the respondents could result in reductions in their average production cost per bird and eventually increase their profit. It is, therefore, recommended that the Government should support the broiler farmers with funds to enable them increase their scale of production to possibly benefit from the cost advantage associated with scale.

REFERENCES

1. Abdulai A. and Huffman, W. (2000): Structural Adjustment and Economic Efficiency of Rice Farmers in Northern Ghana. *Economic Development and Cultural Change*, 48: 503-520.
2. Adeoti, A.I.,(2004): Impact of HIV/AIDS and Related Sicknesses on the technical Efficiencies of Farms in Benue State, Nigeria. Issues in *African Rural Development Monograph Series. Monograph* #34.
3. Aigner, D.J., Lovell, C.A.K and Schmidt, P. (1977): "Formulation and estimation of stochastic frontier production function models". *Journal of Econometrics*; 6:21– 37.
4. Alabi, M. And Aruna A.B.(2006): Economic Efficiency of Family Poultry Production In Niger-Delta, Nigeria . *Journal of Central European Agriculture. Volume 6 (2005) No. 4 (531-538)*
5. Ali M. and Byerlee D. (1991): "Economic efficiency of small farmers in a changing world: A survey of recent evidence". *Journal of International Development, 3(1):1–27*
6. Allen J. And Liu Y. (2007): Efficiency and Economies of Scale of Large Canadian Banks. *The Canadian Journal Of Economics, Vol. 40, No.* 1 (Feb., 2007), Pp. 225-244 *Http://www.Jstor.Org/Stable/4620603* .
7. Al-hassan, S. (2008): Technical Efficiency of Rice Farmers in Northern Ghana. AERC Research Paper 178. *African Economic Research Consortium, Nairobi* .

8. Alrwis, K. N. and Francis, E. (2008): Technical, Allocative, and Economic Efficiencies of Broiler Farms in the Central Region of Saudi Arabia: Data Envelopment Analysis Approach. King Saud University. Saudi Arabia. Riyadh 11451

9. Aning K. G, Turkson P. K. and Asuming-Brepong S. (2008): Ghana Pro-Poor Highly Pathogenic Avian Influenza Reduction Report. Background Presentation Paper Pages 19-45

10. Aning, K.G,(2006)**:** The Structure and Importance of Commercial and Village Based Poultry in Ghana. Final Review Report . Pages 18-27

11. Asare- Boadu K. (2010): High Production Cost killing Poultry Industry. Modern Ghana*News:http://www.modernghana.com/news/230092/1/high-production-cost- killing-poultry-industry.html.*

12. Ashagidigbi W.M, Sulaiman S.A. And Adesiyan, A. (2011): Technical And Allocative Efficiency Of Poultry Egg Producers In Nigeria. *Agricultural Journal 6 (4): 124-130*,

13. Battese, G.E. and Coelli, T. (1995): A model of technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical Economics, 20: 325–32*

14. Battese, G.E. and Corra. G.S. (1977): "Estimation of a production frontier model: With application to pastoral zone of Eastern Australia". *Australian Journal of Agricultural Economics, 21:169-179*

15. Bashin, V.K. (2002): Credit Allocation and Technical efficiency of vegetable growers in the Brong-Ahafo Region of Ghana. *African Economic Research Consortium 556*

16. Boshrabadia M. H. Villano R. and Fleming E.(2007): Technical Efficiency And Environmental-Technological Gaps In Wheat Production In Kerman Province Of Iran . *Aust. Journal of Agricultural Economics 38 (2008) 67–76*

17. Begum I A., J. Buysse M., Alam J. , And Van Huylenbroeck G.(2009): Economic Efficiency Of Poultry Farms In Bangladesh . Contributed Paper Prepared For Presentation At The International Ciation Association Of Agricultural Economists Conference, Beijing, China, August , 2009 16-22. *International Journal of Poultry Science 6 (12): 994-998, 2007 Issn 1682-8356*

18. Canbäck S. Samouel P And Price D.(2006): Do Diseconomies Of Scale Impact Firm Size And Performance? A Theoretical And Empirical Overview. *Journal of Managerial Economics*, 2006, *Vol. 4, No. 1* (February), Pp. 27-70

19. Chirwa, E.W.(2002): Sources of Technical Efficiency Among Smallholders Maize Farmers in South Malawi . A Research Report Presented at the Biannual Research Workshop of the *African Economic Research Consortium*, Nairobi, Kenya.

20. Coelli, T., Prasada Rao, D.S., O'Donnell C. J., and Battese G.E. (2005): An Introduction to Efficiency and Productivity Analysis. Springer Science +Business INC. United States of America. SPIN 11053217

21. Darko K. (2010): Ghana's Poultry Industry Still Faces Challenges . GHANA - The government has been urged to revive the poultry industry. Poultry Site News. Wednesday, October 20, 2010. *www.thepoultrysitelatestnews.com/Ghana's Poultry Industry Still Faces Challenges*

22. Duffuor, K. (2010): Budget Statement And Economic Policy of The Government of Ghana For The 2011 Financial Year Presented to Parliament on 18th November.

23. Economics Revision Focus (2004): Economies and Diseconomies of Scale. Tutor2u™. *www.Tutor2u.Net*

24. Farrell, M.J. (1957): "The Measurement of Productive Efficiency." *Journal of Royal Statistical Society A120, 253*

25. Flake L .and Ashitey E. (2008): Foreign Agricultural Service; Global Agriculture Information Network, Ghana Poultry and Products Annual Report Pp1- 6

26. Filippini M. and Farsi M. (2004): An Analysis of Efficiency And Productivity in Swiss Hospitals. Final Report To The: Swiss Federal Statistical Office And Swiss Federal Office For Social Security.

27. Food and Agriculture Organisation (2006): Animal Production and Emergency Centre for Transboundary Animal Diseases Socio Economics,

Production and Biodiversity Unit. Poultry Sector Country Review:Ghana*www.fao.org/avianflu/en/farmingsystems.html*

28. Food and Agriculture Organisation of the United Nations (FAOSTAT). (2008): FAOSTAT dat. Rome. *http://www.faostat.fao.org/*

29. Food and Agriculture Organisation **(**2013): *Poultry Sector Ghana.* FAO Animal Production and Health Livestock Country Reviews. No. 6. Rome

30. Giroh, D.Y. Waizah, Y, and Umar, H.Y. (2010): Technical Efficiency and Cost of Production among Gum Arabic Farmers in Jigawa State, Nigeria. Report and Opinion of the Rubber Research Institute of Nigeria, 2 (1)

31. Kibaara, B.W (2005): Technical Efficiency in Kenyan's Maize Production: Application of the Stochastic Frontier Approach, Colorado State University, USA.

32. Killebrew, K. and Plotnick, R. (2010): Poultry Market in West Africa: Ghana. Evans School Policy Analysis and Research (EPAR), University of Washington. Brief No. 83

33. Kristiansen N. H. (2009): Empirical Review on Economies of Scale. *Journal of Managerial Economics, 2009, Vol. 6, No. 5 , Pp. 30-62*

34. Kumbhakar S.C., Lovell C.A. (2000): Stochastic Frontier Analysis. Cambridge University Press, Cambridge.

35. Lawal M.A (2007): Efficiency of sweet orange production among small scale farmers in Osun State, Nigeria. *African Journal of General Agriculture Studies on Population and Health. Volume 3 No 2. Pages 127-132*

36. Leeson, S. (2008): Assessing Efficiency In Broiler Production. *Canadian Journal of Animal Science. 68:881-890.*

37. Lipsey R. G. (2000): Economies of Scale in Theory and Practice. Simon Fraser University and Canadian Institute for Advanced Research. Vancouver V6b- 5k3

38. Knox Lovell C. A. (2008): Frontier Analysis in Health Care**.** University of Georgia, Athens GA 30602, USA

39. Meeusen, W. and Van Den Broeck, J. (1977): "Efficiency estimation from Cobb–Douglas production functions with composed error". *International Economic Review, 18(2): 435–43*

40. Ministry of Food And Agriculture, (2010): Facts And Figures (2009). Statistics, Research and Information Directorate (SRID) .Ghana.

41. Nayer A. J. (2006): Resource Use Efficiency in Urban Farming: An Application of Stochastic Frontier Production Function. *International Journal of Agriculture and Biology .Vol. 3* Pages 1-7

42. Ng'eno, V., Lagat, B. K.; Korir, M.K.; Ngeno, E.K.; and Kipsat, M.J (2010): Resource Use Efficiency in Poultry Production in Bureti District, Kenya Poster presented at the Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa, September 19-23

43. Ogundari, K., Ojo S.O. and Ajibefun, I.A. (2006): Economies of Scale and Cost Efficiency in Small Scale Maize Production: Empirical Evidence from Nigeria *Journal of Social Science, 13(2): 131-136* .

44. Oji, U. O. And Chukwuma A. A.(2007): Technical Efficiency Of Small Scale Poultry-Egg Production In Nigeria: Empirical Study Of Poultry Farmers In Imo State, Nigeria. *Research Journal of Poultry Sciecies1 (3-4):16-21,2007 Issn:1993-5285*

45. Ollinger M., Macdonald J. M., and Madison M.(2005): Technological Change And Economies of Scale In U.S. Poultry Processing. *American Journal Agricultural Economics 87(1)* (February 2005): 116–129

46. Osman M. (2008): Technical Efficiency of Broiler Farms in Brong Ahafo Region of Ghana. *International Journal of Poultry Science 7 (12): 1227-1231, 2008*

47. Otoo, J. (2009): Crisis in Ghana's Poultry Industry. Ghana Business News.*www.moderghana.com/* Crisis in Ghana's Poultry Industry.

48. Owusu-Afari, E.(2010): Ghana - Problems in poultry industry. Meat Trade News Daily. *www. meattradenewsdaily.co.uk/ Ghana - Problems in poultry industry*

49. Paudel, P. and, Matsuoka A. (2009): Cost efficiency estimates of maize production in Nepal: a case study of the Chitwan district .*Agric. Econ. – Czech, 55, 2009 (3): 139–148*

50. Podpiera J. and Pruteanu A.(2005): Deteriorating Cost Efficiency in Commercial Banks Signals Increasing Risk of Failure CERGE-EI,

Charles University and Czech National Bank. Czech National Bank, Na Pˇríkopˇe 28, 11503, Prague 1, Czech Republic

51. Reddy S.S., Ram P.R., Sastry T.V.N., Devi I.B (2004): Agricultural Economics. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.

52. Seidu, A. (2008): Farm Level Efficiency of Broiler Farms in Brong Ahafo Region of Ghana. Unpublished Dissertation, University of Cape Coast, Ghana

53. Taru V. B., Nkwi G. E., Medugu A. I. And Reuben J.(2010): Economics Of Broiler Production In Meme Division Of Cameroon. Kamla-Raj 2010. *Journal Agricultural Science, 1(2): 83-87*

54. Tijani, A.A., Alimi, T. and Adesiyan A.T. (2006): Profit Efficiency among Nigerian Poultry Egg Farmers: A Case Study of Aiyedoto Farm Settlement, Nigeria. *Research journal of Agricultural and Biological Sciences, 2(6): 256-261*

55. Tran V.H.S, Coelli T., Euan F. (1993): Analysis of Technical Efficiency of state rubber farms in Vietnam. *Journal of Agricultural Economics*: *9: 183-201*.

56. Udoh, E.J.(2005): Technical inefficiency in vegetable farms of humid region: An analysis of dry season farming by urban women in South – South zone, Nigeria"*Journal of Agriculture and Social Sciences.* Available at *http://www.ijabjass.org*

57. Udoh, E . J and Akintola, F.C (2008): Technical Efficiency of Poultry Egg Production in Ogun State. *International Journal of Poultry Science 6 (9): 622-629, 2008* Pages 2-4

58. Udoh E. J. and Etim A. N., (2009): Measurement of Farm level Efficiency of Broiler Production in Uyo, Akwa Ibom State, Nigeria. *World Journal of Agricultural Sciences 5: 832-835*

59. United States Department of Agriculture (USDA)(2008): Foreign Agricultural Service, Ghana Poultry and Products Annual,2008 Gain Report Number: GH8006

60. United States Department of Agriculture (USDA)(2011): Foreign Agricultural Service, Ghana Poultry and Products Brief, Annual Gain Report Number:GH8007

61. Yusuf S.A. and Malomo, O. (2007) : Technical Efficiency of Poultry Egg Production in Ogun State: A Data Envelopment Analysis (DEA) Approach. *International Journal of Poultry Science* 6 *(9): 622-629, ISSN 1682-8356.*

62. Weill L.(2009): Measuring Cost Efficiency in European Banking A Comparison of Frontier Techniques .LARGE, Université Robert Schuman, Institut d'Etudes Politiques, 47 avenue de la Forêt-Noire, 67082 Strasbourg Cedex, France

APPENDIX I : SAMPLED AREAS AND DISTRIBUTION OF SAMPLE FARMS

Selected Districts	**Selected Villages/Suburbs**	**Broiler Producers (Jan. to June, 2011)**	**Number Sampled**
Atwima Nwabiagya	Ntensere	4	3
	Barekuma	4	3
	Kokobin	5	3
	Afari	4	3
	Mfensi	4	3
	Fiano	5	3
Atwima Mponua	Mpasatia	5	3
	Twenedaso	4	3
	Sreso Tinpom	3	2
	Abompe	4	3
	Kokoboso	5	3
	Atwima Agogo	3	2
Atwima Kwanwoma	Boko	5	3
	Tweneduase	4	3
	Hwediem	4	3
	Ampabaame No.2	4	3
	Kromoase	5	3
	Kotwe	3	2
Kwabre East	Mamponteng	4	3
	Besease	5	3
	Ankaase	4	3
	Bosore	5	3
	Fawoade	3	2
	Ahwiaah oversees	4	3
Ahafo Ano South	Mankranso	4	3
	Wioso	5	3
	Kunsu	4	3
	Sabrunum	4	3
	Dotiem	5	3
Sekyere South	Boaman	4	3
	Wiamose	4	3
	Tetrem	4	3
	Amoako	5	3
	Morso	4	3
Ejisu – Juaben	Ejisu	4	3
	Tikrom	4	3
	Achiase	4	3
	Kobease	4	3
Kumasi Metropolis	Kwadaso	4	3
	Boadi	4	3
	Atonsu Agogo	4	3
	Edwenase	4	3
Total		167	114

APPENDIX II : RESEARCH QUESTIONNAIRE

This questionnaire on Economies of Scale and Cost Efficiency in Broiler Production is purely for academic work. In order to avoid inconsistencies in the data, only information from farmers who received their day-old chicks between January and April,2011 is required.

Kindly Tick [√] or state accordingly

1. General Information of Respondents

(a)Farm location/village……………………………………………………………

(b) Gender Male [ ] Female [ ]

(c) Age 15-20 years [ ] 21-30 years [ ] 31-40 years [ ] 41-50 years [ ] above 50 years [ ]

(d) Educational background Junior High School Level [ ] Senior High School Level [ ] Tertiary Level [ ] Non-formal [ ] others (specify) ……………………

(e) Number of years in broiler production Less than 2 years [ ] 2-4 years [ ] 5-7 years [ ] 8-10 years [ ] above 10 years [ ]

2. Production Information

2. a.i) Source(s) and frequency of technical advice/ support for your broiler production

Source of Technical Advice/Support	Frequency
Extension agents	
More Experienced Broiler Farmers	
Veterinary Service	
Others(specify)	

a.ii) Name any technical difficulty encountered for which you could not get advice throughout the production cycle (if any) ……………………………………………

2. b) Production Inputs

i) Records on Day Old Chicks Received Between January and April, 2011

Number of Chicks Received	Date Received	Unit Price(GH¢)	Mortality	Production Period

ii) Expenditure on Labour Input per Batch in Man-hours

Stage of Production	Workers in Charge	Working Hours per Day	Duration of the Stage	Cost per Labourer per Hour (GH¢)	Total Cost of Labour
Brooder Stage					
Grower Stage					
Finisher Stage					

iii) Expenditure on Other Variable Cost Items

Item	Unit	Month of Purchase	Quantity Used	Unit Cost (GH¢)	Total Cost (GH¢)
FEED					
Broiler Starter Feed	Kg				
Broiler Grower Feed	Kg				
Broiler Finisher Feed	Kg				
Other feeds(specify)	Kg				
FEED SUPPLEMENTS					
Vitamin Premix supplement	Kg				
Mineral supplement	Kg				
Other feed supplements(specify)	Kg				
VACCINES/DRUGS/CHEMICALS					
Newcastle vaccination/vaccine	dose				
Gumboro Vaccination/vaccine	dose				
Coccidiosis vaccine	dose				

Other vaccinations(specify)	dose				
Endoparasites (worms, liver fluke) Control Drugs(if any)	dose				
Ectoparasite(Mite,Lice) Control Drugs(if any)	dose				
Antibiotics/Disinfectants	mg				
MISCELLANEOUS ITEMS / SERVICES					
Water	Liter				
Lightening/energy	KWh				
Transportation of goods	-				
Litter	Kg				
Milling of maize					
Credit Cost/ Source (Specify)..……………..	GH¢				

2.b.iii) Expenditure on Fixed Cost Items

Items	Quantity	Year Acquired	Initial Cost Per Unit (GH¢)	Useful Life	Monthly Payment on Leased / Rented Items	Cost of Repairs	Total Cost (GH)
Sheds/Pens							
Feeders							
Drinkers							
Brooder(s)							
Vehicle (specify)							
Buckets							
Shovels							
Water Reservoirs							

Wheelbarrow(s)							
Push truck(s)							
Sacks							
Land/Ownership				-			
Others specify (including leased /rented items)							

2.c. What were the prices of the following feed items (50kg bag) in the months stated?

Feed Item	January	February	March	April	May	June
Maize						
Starter						
Grower						
Finisher						

3. a Market/Sales Information

Number of Birds Sold	Month of Sale	Weight per Unit Bird	Unit Price (GH¢)	Birds Given Out As Gift	Family Consumption	Total Output
		2kg-3kg				
		1.5-1.9kg				
		1-1.4kg				
		>1kg				

3. b . What were the prices of the following weights of broilers in the months stated?

Weight Per Unit Bird	Unit Price in January	Unit Price in February	Unit Price in March	Unit Price in April	UnitPrice in May	Unit Price in June
2kg-3kg						
1.5-1.9kg						
1-1.4kg						
>1kg						

4. Identify and rank the following constraints in order of importance (Rank from 1,2…12)

Constraints of the Sampled Broiler Farms	Rank
High feed cost	
Lack of access to credit	
Lack of Government support	
Competition from cheap poultry import	
Diseases outbreaks	
Marketing difficulties	
High cost of medication	
High cost of day old chicks	
High labour cost	
Lack of quality day old chicks from most local hatcheries	
Inadequate capacity building programmes for farmers	
High energy cost	