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PROFITABILITY OF BROILER AND LAYER PRODUCTION IN THE BRONG AHAFO REGION OF GHANA

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ABSTRACT

The study sought to compare the profitability of broiler and layer production in the Brong Ahafo Region of Ghana. Six poultry farms, comprising three layer farms and three broiler farms, were purposively sampled for the study. Data were obtained from production records of the farms and by questionnaire administration. Profitability analysis was carried out using the cost, revenue and profit functions to derive total cost, total revenue and total profit respectively. Constraints were analyzed using the Kendall's coefficient of concordance. The results showed that both broiler and layer production were profitable in spite of some constraints facing their production. The major constraints associated with layer production were inadequate finance and scarcity/high cost of maize. For broiler production, the major constraints were inadequate finance and competition with imported frozen chicken. Access to credit, extension education and training on production practices were recommended as measures to improve commercial poultry production in the country.

Keywords: broiler, constraints, Kendall's coefficient of concordance, layer, poultry production, profitability.

INTRODUCTION

Livestock rearing is an important subsidiary occupation that supplements the income of smallholder farm families and rural households in most developing countries. Among livestock-based vocations, poultry production has assumed an important role as a commercial activity with enormous potential for rapid economic growth (Ekunwe *et al*., 2006). As indicated by Assa (2012), poultry production is the fastest growing component of global meat production, with developing and transitional countries assuming a leading role. According to Rajendran and Mohanty (2003), poultry farming has become foremost among the subsidiary occupations of farmers to supplement their incomes because it assures quick returns, requires minimum space and investment, and can be carried out by ordinary farmers. Poultry also possess greater efficiency in converting feed into egg and meat compared to other livestock enterprises. Commercial layer farms play an important role in meeting national protein supply (Kabir and Haque, 2010) through the supply of eggs in addition to poultry meat. Commercial broiler production on the other hand, provides mainly poultry meat as birds are raised solely for meat.

The poultry industry in Ghana is important for employment generation, source of income and regular supply of protein for human consumption. The poultry industry has a huge potential for growth and has been identified as a key sector with the potential to create jobs and help address the short fall in the supply of animal protein. Consequently, in the 1960s, the Government of Ghana gave impetus to poultry production resulting in a large number of poultry farms springing up as profit-making enterprises around towns especially in the southern parts of the country where the growing population attracted ready market for fresh eggs and poultry meat (Buamah, 1992). The growth of the sector has however been hampered by several factors such as high cost of feed and medication as well as competition with cheaper imported frozen chicken products from European markets (Aning, 2006; Killebrew and Plotnick, 2010). According to Rondon and Ashitey (2011), commercial poultry production in Ghana grew rapidly in the 1980-1990s, becoming a vibrant industry that supplied 80 percent of the available poultry meat and eggs in the country. Problems with the supply of day-old chicks, lack of veterinary drugs and incidence of poultry diseases however, slowed down the growth of the industry.

According to Aning (2006), poultry production in Ghana has a large component of village poultry involving an extensive system of raising local chickens, guinea fowls and ducks on free-range. This sub-sector comprises about 66% of Ghanaian households. There is also an active commercial sector concentrated mainly in the Greater Accra, Ashanti and Brong Ahafo Regions. Commercial poultry production is usually carried out in the urban areas to take advantage of large markets. According to Killebrew and Plotnick (2010), demand for livestock products, including poultry, is expanding in West Africa as a result of population growth and increased urbanization. Commercial poultry production in Ghana takes the form of raising birds for eggs (layer production system) or raising birds for meat (broiler production system). There are large-scale farmers producing above 100, 000 birds, medium-scale farmers producing 5, 000 - 10, 000 birds and small-scale farmers producing 50 - 5, 000 birds. According to Ekunwe *et al*. (2006), egg production is the major index of performance of commercial layer business producing about 90 percent of the income from the enterprise. Layer production is also more prominent because there is less competition with eggs produced domestically as compared to broiler

production which faces competition from cheaper imported chicken products from the U.S. and European markets. Consequently, there are reports of some broiler farmers winding up production in the face of competition from imports (Aning 2006). Broiler production is usually carried out to meet seasonal (festive) demand and the regular demand by the hospitality industry while layer production is carried out for regular supply of eggs for various uses by households and the hospitality industry.

Unlike pigs and cattle, there are fewer religious or social taboos associated with poultry. Hence products from poultry provide an acceptable form of animal protein to a vast majority of people. Poultry production assures quick returns within weeks in the case of broilers, and months in the case of layers (Rajendran and Mohanty, 2003). According to Smith (1990), poultry enterprise can produce meat within eight weeks. In the first year of its laying life, a fowl is capable of producing about 300 eggs but under tropical conditions this has averaged about 180 - 200 eggs, even though higher levels have been reported (Oluyemi and Robert, 1978; Kumar and Pandey, 1999). The poultry industry can therefore be relied upon for fast and efficient source of animal protein.

Problem statement

Poultry production is an important part of farming in Ghanaian agriculture. Apart from depending on poultry for food, farmers depend on poultry farming as an additional occupation to supplement their income. In Ghana, the main production lines are broilers and layers. Broiler production is usually done to meet the seasonal (festive) demand while layer production is embarked upon for regular supply of eggs for various uses particularly in the hospitality industries. Chicken and egg production level in the country falls short of the domestic demand so that considerable amount of frozen chicken products are imported into the country annually from the U.S., the European Union and others part of the world. Insufficient data on the costs and returns of poultry production and the problems involved in each of the two production lines make it difficult for most potential poultry farmers to determine which production line to invest in. As indicated by Ekunwe *et al*. (2006), many poultry entrepreneurs approach poultry production with mere enthusiasm rather than the actual knowledge of basic poultry production techniques. This research therefore sought to compare the profitability of broiler and layer production and their constraints in order to enhance investment decision making by poultry farmers. The results of the study will also help new entrants into the industry to make informed decisions about which production line to choose.

Objectives of the study

The main objective of the study was to compare the profitability of broiler and layer production in the Brong Ahafo Region of Ghana. The specific objectives included:

a) To compare the profitability of broiler and layer production in the study area
b) To identify and rank the constraints to broiler and layer production

MATERIALS AND METHODS

Study area

The study was carried out in the Dormaa municipality of the Brong Ahafo Region of Ghana. The municipality is a leading poultry producing centre in the region. The region lies within the transitional zone of the country and covers an area of 39, 557 km^2 making it the second largest region in Ghana. It has a tropical climate, with high temperatures averaging 23.9^oC and a double maxima rainfall pattern. Rainfall ranges from an average of 1000mm in the northern parts to 1400mm in the southern parts. The region has two main vegetation types, the moist semi-deciduous forest, mostly in the southern and south-eastern parts, and the guinea savannah woodland, which is predominant in the northern and north-eastern parts of the region. Majority of the population are farmers.

Sampling, data collection and analysis

Six poultry farms, comprising three layer farms and three broiler farms, were purposively sampled for the study. The sampled broiler farms included A.C. Unity Farm, Aban Tawia Farms and Asamoah Farms while the layer farms included Stew-X Farm, A.M. Unity Farm, and Richtomprince Three Brothers Farm. One thousand (1000) birds per farm were used as the study unit for analysis, from day-old to the time they are disposed of data on cost of production, revenue and constraints to poultry production were collected using the production records of the farms and questionnaire administration. Average production cost and average revenue for each production system were calculated and used for the analysis of the profitability of broiler and layer production in the study area.

The data were coded and analyzed with the aid of the Statistical Package for the Social Sciences (SPSS, Version 16). The cost, revenue and profit functions were used to derive the total cost, total revenue and total profit of the poultry enterprises. The benefit-cost ratio (BCR) was used to measure the worth of the projects over time. The constraints were analyzed using Kendall's coefficient of concordance and tested for significance in terms of the F - distribution. The results were presented descriptively using frequencies and tables.

Calculation of cost, revenue and profit

The cost of production is the sum of the fixed cost and the variable cost of operation. That is, $C = F_c + V_c$ where C represents the total cost to produce 1000 birds, F_C is the fixed cost and V_C represents variable cost.

Denoting the sum of the total cost of production for the three farms by ΣC (3 layer farms and three broiler farms were sampled), we have $\sum C = C_1 + C_2 + C_3$ where C_1, C_2, and C_3 represent total cost for farm 1, farm 2 and farm 3, respectively.

The revenue function gives the total revenue from the sale of *X* birds. Revenue was computed as $R = PX$ where R is revenue, P is price per bird and X is the number of birds. The total revenue (TR) for the three farms was calculated as $TR = \sum R = R_1 + R_2 + R_3$ where R_1, R_2 and R_3 are the revenues from farm 1, farm 2 and farm 3, respectively.

The profit function gives the total profit (π) when total cost is deducted from total revenue. The profit, cost and revenue functions are related by the formula $\pi = R - C$ where π is the profit, R is the revenue and C is the cost.

Total profit for each production system (made up of farm 1, 2 and 3) was derived by using the equation $\sum \pi = \sum R - \sum C.$ Σπ is the total profit for the three farms, $\sum R = R_1 + R_2 + R_3$ and $\sum C = C_1 + C_2 + C_3$ (C_1, C_2 and C_3 are the cost for farm 1, farm 2 and farm 3, respectively).

Analysis of constraints

The Kendall's Coefficient of Concordance was used to analyze the constraints. The Kendall's coefficient of concordance (W) is a statistical technique used to identify and rank a given set of factors (constraints) into the most pressing and then measures the degree of agreement among the judges (respondents). The identified factors are ranked from the most pressing to the least pressing using the numerals 1, 2, 3 …n, in that order. The factor (constraint) with the least total score is ranked as the most pressing while the factor with the highest score is ranked as the least. The computed total rank is then used to calculate the coefficient of concordance (W) which ranges between 0 and 1. A value of 1 indicates that the judges (respondents) were in perfect agreement over the ranking of the factors/constraints, and a value of 0 indicates perfect disagreement among respondents.

$$W = \frac{12\left[\sum T^2 - \left(\sum T\right)^2 / n\right]}{nm^2\left(n^2 - 1\right)}$$

Where T = sum of ranks for factors being ranked; m = number of respondents; n = number of factors being ranked; and, W = Kendall's Coefficient of Concordance.

The Coefficient of Concordance (W) was tested for significance in terms of the F - distribution. The F - ratio is given by $F = \left[(m-1)W/(1-W)\right]$, with numerator and denominator degrees of freedom being $(n-1)-(2/m)$ and $m-1\left[(n-1)-2/m\right]$ respectively (Edwards, 1964).

Test of hypothesis

The following hypothesis was tested:

H_o: Respondents do not agree on the ranking of the constraints facing poultry production in the study area.

The null hypothesis is rejected if the calculated F - value is greater than the tabulated F - value. Rejection of the null hypothesis implies that the respondents agree with each other on the ranking of the constraints.

RESULTS AND DISCUSSIONS

The layer and broiler production system in the study area

Both the layer and broiler production systems studied use the deep-litter system of housing. The method of rearing the birds is the all-in all-out method. Thus birds were kept in the same housing from day-old till they were disposed of. Farmers used the deep litter system because it was cheaper and easier to operate compared to the battery cage system. It was also considered suitable for flocks reared on earthen floor.

Estimation of total cost of layer production

Table-1 shows the cost of layer production in the sampled farms.

Table-1. Estimated cost of layer production (GH¢).

Cost item	Stew-X Farm	A. M. Unity Farm	Richtomprince Three Brothers Farm
Feed cost	47600	47600	47600
Chick cost	1600	1600	1600
Vaccine	530	530	530
Electricity bill	130	140	135
Water bill	60.0	65.0	68.0
Labor /three workers	2520	2520	2520
Depreciation on building	800	820	820
Depreciation on equipment	202	202	202
Tax	102	95.0	104
Total	53, 544	53, 572	53, 579

About 3.30 - 3.50 tonnes of feed per month is required for one thousand (1000) birds for a period of 18 months (72 weeks) after which the birds are disposed from the farm. The cost of a tone of feed was GH¢ 800. The cost of layer day-old chick was GH¢ 1.60. Also, vaccine (medication) cost was the same for the three layer farms because layer production has a stipulated period of vaccination.

Estimation of revenue from layer production

Layers become spent after about 18 months and are then sold. Commercial hens usually begin laying eggs at 16-20 weeks of age, although production gradually declines soon after from approximately 25 weeks of age. By approximately 72 weeks of age, flocks are considered economically unviable and are slaughtered after approximately 12 months of egg production, although chickens will naturally live for 6 or more years. Revenue from layer production is the sum of the revenue from eggs and sale of spent layers. At the time of the study, the price of a tray of egg was GH¢6.00 while a spent layer weighing averagely 1.60kg was sold at GH¢8.00. Table-2 shows the estimated revenue from layer production.

Table-2. Estimated revenue from layer production.

Items	Stew X Farm	A. M. Unity Farm	Richtomprince Three Brothers Farm
Revenue from disposed birds	900 birds x 8.00 = 7200	875 birds x 8.00 = 7000	925 birds x 8.00 = 7400
Revenue from sale of eggs	8916 x 6 = 53508	8400 x 6 = 50,400	8830 x 6 = 52980
Total Revenue (GH¢)	60700	57400	60380

Estimation of total cost of broiler production

Table-3 shows the estimated cost of production for the sampled broiler farms.

Table-3. Estimated cost of broiler production.

Cost items	A. C. Unity Farm	Aban Tawia Farm	Asamoah Farm
Feed cost	5600	5600	5600
Chick cost	1500	1500	1500
Vaccine	180	180	180
Electricity bill	35.0	36.0	33.0
Water bill	25.0	24.0	27.0
Labour/three workers	420	420	420
Depreciation on building	420	400	410
Depreciation on equipment	145	145	145
Tax	24.0	20.0	21.0
Total	8349	8325	8336

Each of the broiler farms required seven (7) tonnes of feed for the one thousand birds for a period of eight weeks until the birds are disposed of. A tone of feed cost GH¢ 800. A broiler chick was sold at GH¢ 1.5. As in the case of layer farms, vaccine (medication) cost was the same for all broiler farms since broiler production also required a stipulated period of vaccination.

Estimation of revenue from broiler production

The revenue from broiler production is the amount obtained from the sale of the flock. A cock was sold at GH¢ 10. Table-4 shows the estimation of revenue for the three broiler farms.

Table-4. Estimated revenue from broiler production.

Item	A. C. Unity Farm	Aban Tawia Farm	Asamoah Farm
Revenue from sale of birds	932 x 10	950 x 10	935 x 10
Total Revenue (GH¢)	9320	9500	9350

Profitability of layer production

For the 1000 birds per farm, a profit of GH¢ 17785 per production cycle was realized for the three layer farms. The average profit per farm was computed at GH¢ 5928.

Profitability of broiler production

For the study unit of 1000 birds per farm, a profit of GH¢3, 160 per production cycle was realized for the three broiler farms. The average profit per farm was computed at GH¢ 1, 053. The production cycle was 2 months (8 weeks) compared to 18 months (72 weeks) in the case of layer production. Hence there are possibilities for multiple production cycles in the case of broiler production. For instance, in the 18 months cycle for layer production, a maximum of 9 production cycles are possible with broiler production, *ceteris paribus*.

Cost composition in layer production

The operational cost composition in layer production is shown in Table-5. Feed cost represented the highest cost item in layer production with a very high percentage close to 89%. It is followed by cost of labour and chick cost. Together, these accounted for 96.6% of the total cost of layer production. Rajendran and Mohanty (2003) reported that feed cost represented more than 84% of layer production cost in a study in India.

Table-5. Cost composition in layer production (in GH¢).

Cost item	**Average cost of production**	**Percentage** (%)
Feed cost	47, 600	88.8
Chick cost	1, 600	3.00
Vaccine	530	1.00
Utility	199	0.40
Labour	2, 520	4.70
Depreciation	1, 015	1.90
Tax	100	0.20
Total	53, 565	100

Cost composition in broiler production

Figure-2 shows the operational cost composition of the broiler farms sampled. Feed cost was the most important cost item followed by chick cost and labour cost. Together, these accounted for 90% of the total cost of broiler production. As noted by Koney (1993), feed cost represents the most important fraction of the cost price, exceeding 60% of broiler production cost.

Table-6. Cost composition in broiler production.

Cost item	**Average cost of production** (GH¢)	**Percentage** (%)
Feed cost	5,600	67.1
Chick cost	1,500	18.0
Vaccine	180	2.20
Utility	60.0	0.70
Labour	420	5.00
Depreciation	555	6.70
Tax	21.7	0.30
Total	8,336.7	100

Mortality rate

The study showed that mortality rate averaged 6.6% in layer production and 17% for broiler production. The reliability of the source of day-old chicks was found to be important in ensuring low mortality rates.

Analysis of constraints

The constraints militating against layer and broiler production were identified and analysed using the Kendall's Coefficient of Concordance. Table-7 shows the constraints for layer production.

Table-7. Identification and ranking of constraints facing layer production.

Constraints	Overall rank	TWS	Ranks score of constraints						
			1	2	3	4	5	6	7
Inadequate finance	1st	4	2	1	0	0	0	0	0
Scarcity/high cost of maize	2nd	5	1	2	0	0	0	0	0
Low/fluctuating price	3rd	9	0	0	3	0	0	0	0
Scarcity/high cost of day-old chicks	4th	10	0	0	2	1	0	0	0
High mortality rate	5th	11	0	0	1	2	0	0	0
Adulteration of fishmeal	6th	16	0	0	0	0	2	1	0
Theft of birds	7th	21	0	0	0	0	0	0	3
W = 0.85; TWS = Total weight score; F-ratio = 11.3; F- tabulated = 3.20 at 5% significance level									

Since the F-calculated (11.3) is greater than F-tabulated (3.20), the null hypothesis (Ho) that there is no agreement among the respondents on their ranking of the constraints is rejected. The Kendall's coefficient of concordance shows that 85% of the sampled poultry farmers were in agreement with the ranking of the constraints.

Inadequate finance was identified as the most critical constraint by respondents. Poultry producers found it difficult to cope with the high cost of production. Difficulty in sourcing loans and other financial services to invest in the business hamper layer production in the study area. Farmers have therefore been unable to expand their scale of production or purchase the required inputs like feedstuff and medicine to enhance their production. Scarcity and high cost of maize was the next important constraint. Other constraints were low and fluctuating prices, scarcity and high cost of day old chicks, high mortality rate, adulteration of fishmeal, and theft of birds. The findings are consistent with Ekunwe and Soniregun (2007) who identified the major constraints faced by layer producers in Nigeria in the order of inadequate finance, high cost of feed, low egg price and high cost of medicine and vaccine. Amos (2006) also identified high cost of feeding and veterinary drugs as the main factors affecting layer production in Ondo State in Nigeria.

Table-8 shows the analysis of the constraints facing broiler production in the study area.

Table-8. Identification and ranking of constraints facing broiler production.

Constraints	Overall rank	TWS	Rank score of constraints						
			1	2	3	4	5	6	7
Inadequate finance	1st	4	2	1	0	0	0	0	0
Competition with frozen chicken	2nd	5	2	0	1	0	0	0	0
Scarcity/high cost of maize	3rd	8	0	1	2	0	0	0	0
High mortality rate	4th	9	0	0	3	0	0	0	0
Adulterated fishmeal	5th	14	0	0	0	2	0	1	0
Low/fluctuating price	6th	16	0	0	0	0	2	1	0
Scarcity/high cost of day old chicks	7th	18	0	0	0	0	0	3	0
W = 0.71; TWS = Total weight score; F-ratio = 4.96; F-tabulated = 3.20 at 5% significance level									

Since F-calculated (4.96) is greater than F-tabulated (3.20), the null hypothesis (Ho) that there is no agreement among respondents over their ranking of the problems encountered by broiler farmers in the study area is rejected. The Kendall's coefficient of concordance showed that 71% of the sampled poultry farmers were in agreement with the ranking of the constraints limiting broiler production.

Inadequate finance was identified by respondents as the most critical constraint limiting farmers' ability to carry out management practices like feeding and disease control as well as the purchase of day-old chicks. The competition with frozen chicken represented another major problem affecting broiler production in the study area. According to Killebrew and Plotnick (2010), competition from rising imports of frozen poultry products is one of the most significant challenges confronting the poultry sector in Ghana. The open market policy of the government has led to free movement of poultry products at cheaper prices into the country and respondents find this

as a major challenge to broiler production in the country. According to Government of Ghana sources, broiler production has declined rapidly from 80 percent of the market demand in 2000 to 10 percent in 2010 (Rondon and Ashitey, 2010). The decline in production is as a result of very high cost of production (feed and drug) and high energy prices. As in the case of layer production, scarcity of maize emerged as a major problem in broiler production. Maize has competing uses in the country and the absence of sufficient yellow maize seemed to compound the problem of farmers. Amos (2006) identified high cost of feed as a main factor affecting broiler production in Ondo State in Nigeria. Other problems identified included high mortality rate, adulteration of fishmeal, low and fluctuating prices as well as scarcity and high cost of day-old chicks.

CONCLUSIONS

Poultry production in Ghana is beset with high cost of production and the inadequate supply of inputs. Farmers' inability to mobilize the needed financial resources to invest in their production activities has contributed to the downward trend in poultry production in the country. From the study, both broiler and layer production were found to be profitable in spite of the many constraints facing them. The major constraints in broiler production were inadequate finance and competition with imported chicken whiles inadequate finance and scarcity/high cost of maize were the major constraints in layer production. The cost structure for both production lines indicated that feed cost, cost of day-old chicks and cost of labour were the most important cost items accounting for 90% of the production cost in the case of broiler production and 96.6% of the production cost in the case of layer production. The choice of which poultry enterprise an entrepreneur should engage in would be informed by the entrepreneur's ability to overcome the different constraints affecting each enterprise. For layer production, entrepreneurs must consider their financial resources and the cost of feed while in the case of broiler production; entrepreneurs must consider their financial resources as well as competition with imported frozen chicken. Efforts to improve poultry production in the country must look at measures to ensure efficiency of production, supply of inputs such as feed and medicine and disease control surveillance. In addition, measures must be put in place to provide credit facilities to poultry farmers to carry out their production activities.

RECOMMENDATIONS

The study recommends that poultry farmers should endeavour to form cooperatives to enable them to access loans from the various financial institutions at the district and regional levels. Poultry producers should also take advantage of trainings and advisory services provided by institutions such as the National Board for Small-Scale Industries (NBSSI) and the Business Advisory Centre/Rural Enterprise Project (BAC/REP). These institutions should also target poultry farmers for training in order to enhance their managerial competence and competitiveness in business.

There is also the need to motivate and resource agricultural extension agents to regularly visit and educate farmers on modern poultry production practices to reduce mortality of birds and prevent disease outbreaks.

It is also recommended that efforts should be made to improve maize production through the provision of incentives and input subsidies to farmers in order to provide feed for the poultry industry.

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