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PERFORMANCE AND EFFICIENCY MEASURES OF LAYER PRODUCTION ENTERPRISES IN THE ASHANTI REGION OF GHANA

Stephen Opoku – Mensah

Agropreneurship Department,
Institute of Entrepreneurship and Enterprise Development,
Kumasi Polytechnic,
Kumasi, Ghana

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ABSTRACT: Poultry production in Ghana has been constrained by several factors including high production cost and competition from imports. To be competitive and remain viable over the long haul, poultry agribusinesses would have to be efficient and profitable. The scale and size of agribusinesses play a role in their overall performance and sustainability. Given that the fact that commercial layer bird production in Ghana is dominated by small and medium scale enterprises, this paper sought to evaluate the financial viability and efficiency levels of these enterprises through a comparative analysis.

The study was conducted in five districts of the Ashanti Region of Ghana, which has a large share of commercial layer bird production. A multi-stage technique was used to sample data from 100 layer bird farmers. The farm budgetary technique was used to ascertain the profitability of enterprise whiles a t-test was conducted to compare the efficiency measures of the categories of layer enterprises.

Findings from the study revealed that commercial layer bird production is a viable agribusiness venture with positive gross margins and net farm income. The major drivers of production cost were the variable cost (feed, day-old-chicks, medication, and hired-labor). A comparative analysis of selected economic parameters indicates that medium scale farms are more efficient and have favorable gross margins, net farm income, rate of return on investment, profitability index, and benefit cost ratio. Similarly, the medium farms performed better on the production efficiency measures such as egg-lay rate, egg–to–feed ratio, income over feed cost and mortality rates, than the small scale farm enterprises.

The study concludes that layer bird production is still viable and can be sustained given the scale of operation. Medium scale farms are able to employ resources more efficiently and they benefit from economies of scale, hence their overall better performance compared to the small scale enterprises. Small scale poultry farmers should be supported to improve on their management skills, operational efficiency and expand operations in order to benefit from higher performance through economies of scale and efficiency.

KEYWORDS: Layer production, production efficiency, financial performance, medium and small enterprises.

1 INTRODUCTION

Poultry production has emerged as one of the most vibrant sub-sectors of global livestock production, given the surging demand from consumers, particularly in the peri-urban, urban and cosmopolitan areas. For example, [1] and [2], have indicated that global chicken consumption is expected to grow in tandem with population growth. Poultry production stands out amongst the major livestock due to the several merits it holds. First, poultry products are generally widely acceptable as it is free of the religious and social taboos occasionally associated with pigs and cattle. Apart from serving as a good source of quality protein, vitamins and minerals from eggs and meat, with less fat than pig and cattle [3] and [4], poultry production also generates employment [5], provides income for actors within the value chain and a major contributor to economic growth [6]. Again chicken, for example, has a comparatively higher feed conversion efficiency rate than other livestock and returns to investment can be very quick [7].

Ghana's commercial poultry industry, and chicken sub-sector in particular, which is the focus of this study, is dominated by layer and broiler bird production raised mostly by profit-motivated entrepreneurs as commercial ventures, on intensive and semi-intensive systems of production [8]. And like most agribusinesses, the sub-sector is dominated by small and medium scale enterprises. According to [8] and [9], Ghana's commercial poultry sector is categorized into three, namely: large-scale (over 10,000 birds), medium-scale (5,000–10,000 birds) and small-scale (50–5,000 birds) enterprises. It is estimated that over 80% of commercial poultry production enterprises are found in the small and medium scale category [9] whiles the large scale category make up the remaining 20%. The bulk of commercial chicken (including layer birds) emanates from the Ashanti, Brong-Ahafo and Greater Accra regions of Ghana with production concentrated particularly in the urban and sub-urban areas where a market for their products exist.

The capacity of the poultry sub-sector to serve as a major source of food security and economic growth within the agricultural sector was given a major boost during the 1970-1990's with the Government of Ghana providing infrastructural facilities and services such as the establishment stated owned poultry feed mills, hatcheries, highly subsidized veterinary services [10]. However, a change in policy direction which culminated in a gradual withdrawal of government support to the agricultural sector has been cited as the source or reason for the decline in the performance of the poultry sub-sector [8]. More significantly however, it is believed that poor technical know-how of farmers, the use of outdated production technology and poor managerial capacity of agri-entrepreneurs have all contributed to a systematic decline of the performance of the once vibrant poultry industry. Specific production and market related factors that have hampered growth include high cost of feed inputs and medication [11], [12], [13]; disease outbreaks and high mortalities [11], [14], [15]; poor market access [9], [14], [16]; inadequate to access credit facilities [9], [17]; and the absence of processing facilities to for value-added poultry products that meet the preference of consumers. In addition, it appears Ghana's poultry sector reels under a weak value chain system, with poor backward and forward linkages. All these have culminated in the sharp decline of domestic output and the dominance of a more competitive and cheaper imported poultry products (especially meat) from the E.U, America, and lately Brazil [8], [11] and [9]. This unfortunate trend of affairs over the period has resulted in an almost 'dead' broiler sub-sector and a 'struggling' layer sub-sector [8] and [18]. Indeed Ghana's domestic chicken meat supply from commercial sources had declined from about between 80-90% of total national demand in the 1990's to about 10% share of chicken consumed by the year 2010 [9] and [19]. Currently it is only the layer bird production which appears to be thriving somewhat, because of the absence of competition from imported eggs. The profitability, financial and economic sustainability of poultry enterprises in Ghana has been questioned in view of the current industry trends. Evidence suggests that Ghana's commercial poultry industry is not competitive enough and can potentially be endangered if this trend continues.

According to the Institute of Statistical Social and Economic Research [20], 2011 report, whiles the livestock industry grew by 5.1% in 2010, the poultry subsector declined by 12.81%, confirming the overwhelming assertion of the weakening fortunes of the domestic poultry industry. The capacity of commercially-oriented agri-entrepreneurs to operate poultry enterprises on a profitable and sustainable basis remains a daunting challenge. In the midst of changing consumer demand and preference, the rising cost of production (inputs) and stiff competition from the unbridled chicken imports, the questions that arises is whether the domestic poultry industry can survive, stay in business and continue to be sustainable over the long haul. This challenge brings to the fore again the position and significance of smallholder farmers who dominate most agri-enterprises in Ghana and to what extent farm enterprise capacity, size and scale of operation impacts on output, productivity and profitability. Does scale and size of operations matter in the economic performance of agri-enterprises? For most agribusiness production establishments, the major determinant of financial or economic viability of the enterprise depend on the gap between the values of outputs generated and the cost of inputs consumed in a production cycle, which is also influenced by the scale and efficiency of operation.

Agribusiness in general is recognized as one of the most challenging and the riskiest economic activities [21]. The long–term performance of agribusinesses is largely dependent on profitability. Hence, maximizing profitability of farms is of utmost importance to the competitiveness and well being of farmers' as well as other actors within the poultry–value chain. The capacities of commercial layer enterprises (whether small or medium) to deplore and manage production inputs efficiently can to a large extent determine or influence the profitability of the business. Rising cost of production without corresponding output values ultimately erodes the margins of farm enterprises, which can ultimately lead to losses and shutdowns. The foregoing issues present an opportunity to delve into the financial viability and management efficiency of layer production enterprises with respect to scale of operation in the light of the growing campaign to support domestic poultry production against competition from imports. The key questions to be addressed in this study are whether commercial layer bird production (small or medium) in Ghana is still profitable? If it is, what is the extent and degree of profitability? What do the financial, and production efficiency parameters indicate for various farm sizes? Does the scale and size of operation have an impact on performance? The objective of this study was to determine the performance of

commercial layer bird enterprises by measuring and comparing the production efficiency levels and the financial profitability of the categories of layer enterprises.

The paper provides detailed analysis of the relative cost and returns that accrue to layer production enterprises, according to scale of operation and overall profitability. Profitability and financial analysis of capital intensive agribusiness enterprises like poultry production constitutes a relevant aspect of Ghana's socioeconomic development, especially within the context of ever rising production cost, competition from imported product and a strong advocacy, in recent times, to support and protect the domestic poultry industry. Thus, an empirical study of the financial prospects and production efficiency of domestic layer bird enterprises would be prudent at this stage as it has implications for the sustainability of the industry and the livelihoods of many people who depend on it. Finally, it has implications for policy within the poultry industry in particular and agribusiness as a whole.

2 RESEARCH METHODOLOGY

2.1 DESCRIPTION OF THE STUDY AREA

The survey was conducted in selected towns and districts in and around the Ashanti Region of Ghana. The five locations selected for the survey included the Kumasi Metropolis, Atwima Nwabiagya district, Bosomtwi district, Ejisu-Juaben Municipal, and Asante Akim North District. The region lies between longitudes 0.15W and 2.25W, and latitudes 5.50N and 7.46N. It shares boundaries with four other regions, namely, Brong-Ahafo to the north, Eastern Region to the east, Central Region to the south and the Western Region to the south west. According to the National Housing and Population Census Report of 2010 the region has an estimated population of 2.6 million inhabitants with about fifty percent located in the capital city, Kumasi. The major economic activity is spread between agriculture, timber and logging, manufacturing, and an informal sector dominated by trade and commerce. The region has a vibrant commercial poultry sector (the largest in terms of number of enterprises and stock size) with several small and medium scale enterprises dotted across the various districts and towns. The prevalence of commercial poultry enterprises within the peri-urban and urban areas is justified in the fact that there is a ready market and consumer population.

2.2 SAMPLING TECHNIQUE AND DATA COLLECTION METHODS

The study was conducted through a survey of 100 poultry farmers comprising 60 small scale operators and 40 medium scale operators. A multistage sampling technique was used to collect data from poultry farmers in the Ashanti Region. First upon consultations with MoFA, Veterinary Services Division of MoFA, and the Ghana National Association of Poultry Farmers GNAPF officials, a purposive sampling was used to select five districts in the region with a high concentration of poultry farmers. Secondly the farmers in each selected district were stratified into two, namely small scale and medium scale farmers based on a list provided by the veterinary services division of MoFA in the Ashanti region. Thirdly a random sampling technique was used to select the small and medium scale layer farmers with at least 15 farmers selected from each district. The data collection instrument employed was a well-structured, mostly close-ended questionnaire. Data were collected from individual farm enterprises on four major variables, namely; the socioeconomic characteristics of farmers, cost and returns, management practices, and the constraints in layer production. Data were analyzed using descriptive statistics and a budgetary technique. The t-test statistics was used to test for significance of differences in management and production efficiency parameters between small and medium scale farm sizes.

2.3 ANALYTICAL FRAMEWORK AND METHOD OF ANALYSIS

2.3.1 PROFITABILITY ANALYSIS – GROSS MARGIN AND NET FARM INCOME ANALYSIS

The underlying analytical framework employed in this study was the use of profitability analysis (gross margins and net returns). Profitability is a measure of the ability of an enterprise to generate enough revenue above the cost incurred in production over a period of time. Gross margins and net returns can be used as proxies for profitability. To evaluate the production cost and return for the various farm enterprises, the budgetary technique was employed. This technique can be appropriately used to compare profitability of different farm enterprises or among farms irrespective of the farm's size [22]. Mathematically, gross margin, which is a function of production cost and output is expressed as the difference between the total value of output (gross returns) and the sum of the variable cost of production.

Gross Margins or Gross Profits were computed as:

$$\text{Gross Margin } (GMi) = \sum_{i=1}^{n} Pi\, Qi - \sum_{i=1}^{n} TVCi \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The Net Farm Income (NFI) or Net Return (NR) is estimated by adjusting for fixed cost items such as interest charges (excluded in this study), depreciation allocated to equipments, buildings and maintenance cost. The Net Farm Income or Net Return can be estimated as follows:

$$\text{Net Farm Income } (NFIi) = GMi - \sum_{i=1}^{n} TFCi \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Net Farm Income is the profit earned over a production period showing the returns to entrepreneurs' labor, management, equity capital, etc. The significance of NFI in such analysis is more pronounced, particularly when fixed costs and overheads are large as the case may be for some medium to large scale agribusiness enterprises [23] and it gives a true value of profit over the accounting period. Otherwise for most agribusiness ventures (which are small scale) NFI is approximately close to the GM, since overheads are small and constitute a small fraction of total production cost.

The variables used in the expression in equations (1) and (2) can be defined as:

$GMi = the\ gross\ margin\ earned\ per\ unit\ by\ the\ ith\ farm\ enterprise\ (in\ GH¢)$

$NFIi = net\ farm\ income\ earned\ per\ unit\ by\ the\ ith\ farm\ enterprise\ (in\ GH¢)$

$\sum_{i=1}^{n} Pi\, Qi = summation\ of\ value\ generated\ from\ the\ sale\ of\ outputs\ (eggs\ and\ spent\ layers)\ by\ the\ ith$

$farm\ enterprise\ (in\ GH¢)$

$\sum_{i=1}^{n} TVCi = summation\ of\ total\ variable\ cost\ items\ consumed\ in\ raising\ birds\ for\ the\ 80\ week\ cycle$

$per\ ith\ farm\ enterprise\ (in\ GH¢)$

$\sum_{i=1}^{n} TFCi = summation\ of\ estimated\ fixed\ cost\ items\ (depreciation\ of\ buildings\ and\ equipments)$

$per\ ith\ farm\ enterprise\ (in\ GH¢)$

2.3.2 MEASURE OF PRODUCTION EFFICIENCY IN LAYER BIRD ENTERPRISES

Efficiency of farm agribusinesses refers to the relationship between inputs used and the outputs generated per farm unit enterprise and this is dependent largely on the managerial and technical skills of the operator [24]. Performance analysis of agri-enterprises can indeed be conducted through an analysis of physical, economic and financial efficiency. Physical efficiency measures the variables like crop yield, mortality rates, weaners per litter, egg-lay rate, egg-feed ratio, feed conversion efficiency, etc. For example, key industry players report that a layer bird can produce between 240 and 285 eggs per complete 72–week to 80 – week cycle [25]. Economic measures of efficiency include variable cost of production per livestock, return per Ghana Cedi of feed, return per Ghana Cedi on hired labor, etc. Financial measures of efficiency include the concentration with which agri-enterprise unit deploys assets to gross revenues, value of farm production, financing and marketing decisions. These three measures of efficiency have an impact on overall productivity, profitability and ultimately the performance of agri-enterprises.

Assumptions: The analysis in this study made a number of assumptions including the following:

- The cost of family labor was left out since almost all farmers used hired labor. The other few who used family labor could not readily assign any value to wages or salaries paid to family members who were deemed to be assisting.
- Similarly, the cost of litter used was ignored since it was very insignificant and in most cases was obtained for free
- The fixed cost of production was estimated by taking the historical cost and useful life span of fixed assets to arrive at the depreciation of assets per production season per farm enterprise. The interest charges of working capital were excluded from the analysis because many farmers did not take any commercial loans, whiles the handful that accessed credit was reluctant to provide details of terms and conditions for any further analysis.

- Products from the farm (eggs and birds) that were consumed or given as gifts were also ignored in the analysis, since only a handful of farmers indicated that gifts were given but they could not provide any accurate data.
- The gross production output value was calculated as the product of the volumes of eggs and spent layers and prices received by farmers.

Finally a comparative analysis of scale economies was measured using the t–test to test for the statistical significance of the differences in the profitability, economic returns and production efficiency between small and medium scale layer enterprises.

3 RESULTS AND DISCUSSION

3.1 PROFITABILITY AND RETURNS OF LAYER ENTERPRISE (PER BIRD ANALYSIS)

An analysis of the cost and returns on a per bird basis (as this gives a detailed and better understanding of enterprise performance) is presented. A summary of the various components of the variable cost, fixed costs and revenue are presented in Table 1, whiles Table 2 shows the profitability indicators across farms.

3.1.1 COST OF PRODUCTION FOR THE FARM ENTERPRISE CATEGORIES

A detailed analysis of the variable cost components revealed that feed, day-old-chicks, hired labor and medication were the major cost centers in the layer production enterprises. The analysis compares the two sets of farm enterprises and also the overall average. The feed cost per bird was higher on small farms (GH¢44.04) which represents 80% of total variable cost whiles medium size farms was GH¢39.84 representing 75% of variable cost and an overall average cost of GH¢40.85 representing 77%. This compares similarly with the findings of [26] (Olaadebo and Ojo, 2102) who found that small farms had higher feed cost than medium sized farms. Feed cost per bird for medium size farms was 5% lower than small scale farms, suggesting that medium farms are able to manage feed cost more efficiently. The generally high feed cost of layer enterprises collaborates the findings of several empirical studies across as indicated by [26], [27], [28], [29], [10]. The unit cost of day-old-chick was higher for medium farms (GH¢2.65) compared to the small farms (GH¢2.52). Majority of the medium farms used imported breed of D.O.C which makes it more expensive than the locally bred D.O.C which was patronized by many small scale operators. The percentage cost of both small and medium farm sizes was however the same and represented 5% of the total variable cost. The cost for hired labor per bird was also relatively higher for medium scale farms (GH¢2.60) representing 5% than the small farms (GH¢1.52) which was 3% of variable cost. Medium scale farmers are more commercially oriented and thus tend to hire more labor, hence the high percentage cost incurred on this variable. On the other hand small scale operators usually depend on family labor and this accounts for the relatively lower cost expended. Similarly, medium scale farmers spent much higher on medication and veterinary services than small scale farmers, suggesting that medium scale producers took health issues more seriously as a means to enhance growth and reduce mortalities. More importantly the economic impact of mortalities or losses from disease outbreak can be more severe for medium scale operators than small scale farmers, hence the extra devotion by medium scale operators to good health care of the chickens.

The total variable cost per bird was much higher for small scale farms (GH¢54.78) than the medium scale farms (GH¢52.87). Similarly fixed cost per bird was found to be higher on small farm size (GH¢55.33) than medium size farms (GH¢53.31). The total production cost on a per bird basis was therefore higher on the small farms than the medium farms. These findings are similar to that obtained by [28] who showed that both variable cost and fixed cost were higher for small scale farms than medium and large scale types.

3.1.2 REVENUE GENERATED FROM FARM ENTERPRISES CATEGORIES

Revenue from poultry enterprise was generated from the sale of fresh eggs and spent-layers. On the average the layer enterprise earned GH¢77.99 (88%) per bird from the sale of eggs. The revenue earned from the sale of eggs was found to be slightly higher in medium sized farms (GH¢78.63) per bird representing 88% than the small farm sized farms (GH¢75.85) also representing 87%. On the other hand, sales revenue from spent–layers was slightly higher for small farms (GH¢11.22) than medium scale farms (GH¢10.87). The total revenue earned was however found to be higher for medium farms (GH¢89.50) than small farm sizes (GH¢87.06). Again, this finding was found to be in line with the results obtained by [28] and [30] who showed that small scale operators do not earn as much returns as do medium or large scale operators.

Table 1: Profitability Analysis (Cost, Revenue and Net Farm Income) for Small Scale and Medium Scale Layer Enterprise – per bird analysis

Parameters	Farm Category		
	Small (GH¢)	Medium(GH¢)	Overall average (GH¢)
REVENUES:			
SALES FROM EGGS	75.85 (87)	78.63 (88)	77.99 (88)
SALES FROM BIRDS	11.22 (87)	10.87 (12)	10.96 (12)
SALES FROM MAURE			
TOTAL REVENUE	87.06 (100)	89.50 (100)	88.95 (100)
VARIABLE COST:			
DOC	2.52 (5)	2.65 (5)	2.62 (5)
FEED	44.04 (80)	39.84 (75)	40.85 (77)
UTILITY	0.65 (1)	1.14 (2)	1.02 (2)
MEDICATION	2.53 (5)	3.52 (7)	3.28 (6)
TRANSPORT	1.51 (3)	1.16 (2)	1.25 (2)
HIRED LABOUR	1.52 (3)	2.60 (7)	2.34 (4)
EGG TRAYS	1.64 (3)	1.51 (3)	1.54 (3)
MISCELLANENOUS COST	0.38 (1)	0.44 (1)	0.43 (1)
TOTAL VARIABLE COST	54.78 (100)	52.87 (100)	53.33 (100)
BUILDINGS	0.44 (80)	0.33 (75)	0.35 (76)
EQUIPMENT	0.11 (20)	0.11 (25)	0.11 (24)
TOTAL FIXED COST	0.55 (100)	0.44 (100)	0.47 (100)
TOTAL COST	55.33	53.31	53.62
GROSS PROFIT	32.29	36.63	35.62
NET RETURNS	31.73	36.19	35.16

Source: Field data analysis, 2013. The percentages of cost and revenues are in parenthesis ( ).

3.1.3 PROFITABILITY ANALYSIS AND INDICATORS OF LAYER PRODUCTION ENTERPRISES

In determining the profitability levels of the various farm enterprises seven key parameters or indicators were analyzed, a summary of which is posted in Table 2. Profitability of layer enterprise is measured in terms of gross margin and net farm income. The gross margins and net farm incomes per bird were estimated to be higher for the medium scale farms (GH¢36.63) and (GH¢32.29) than the small scale farms (GH¢36.19) and (GH¢31.37) respectively. The overall gross margin and net farm income for the enterprises was GH¢35.62 and GH¢35.16 respectively. The overall gross profit margin was approximately 40% indicating that for every GH¢100 spent on layer bird production, a gross return of GH¢40 was realized as profit. The analysis also showed that on the whole the profitability index PI was 0.40 indicating that for every GH¢1 invested in layer production a net return of GH¢0.40 was realized. Similarly, an overall return on investment, ROI of 65.36 was obtained indicating that approximately 65% of net return is realized for every GH¢1 invested in layer production. The benefit cost ratio (BCR) was also estimated at 1.66 which is greater than 1, and thus indicate a favorable measure of performance. A comparative analysis of the two categories of layer enterprises on the basis of the selected profitability parameters show that medium farm sizes performed better on the key parameters than the small scale farms. This suggests that medium farm operators tend to be more prudent with better production operations, management skills and above all enjoyed some economies of scale compared to the smaller scale operators.

Table 2: Measures of Profitability Indicators Layer Enterprise Categories

Parameters	Small	Medium	Overall average
GROSS MARGINS (GH¢)	32.29	36.63	35.62
Net Returns Turn (GH¢)	31.73	36.19	35.16
Gross Profit Margin (%)	37.08	40.93	40.05
Profitability Index - PI	0.36	0.40	0.40
Return on Investment - ROI (%)	57.36	67.90	65.36
Benefit Cost Ratio – BCR	1.59	1.69	1.67
Rate of Return on Variable Cost- RRVC	1.58	1.68	1.66
Operating Ratio – OR	0.63	0.59	0.60

Source: Survey data analysis

3.2 Performance of Financial, Economic and Production Efficiency (Comparative Analysis of Small and Medium Scale Layer Enterprises)

Although the results and discussion of the first two objectives involved a comparison of the two sets of layer enterprise, this section delves further to measure and ascertain the extent to which medium and small scale layer enterprises differed or performed on a number of selected criteria or indicators. The major performance indicators to be measured under the comparative analysis include producer and management characteristics, scale and size of operation, measures of production cost and returns, measures of profitability, and farm production efficiency measures. Differences in means tests are then used to measure the variables that are statistically different between the two categories of farm enterprises. This is to provide further evidence of the degree or extent of variability in the factors of economic performance and efficiency between the two sets of layer enterprises in the study area.

3.2.1 Comparison of Producer and Management Characteristics

A summary statistic of the producer and management characteristics of small and medium scale layer farmers is presented in Table 3. The results show that the mean age of medium scale farmers (51.13 years) is significantly higher than that of small scale operators (45.32 years) at the 1% level. The number of years of schooling of medium scale farmers is also higher and significantly different at 5% from that of small scale farmers. The medium scale farm owners also had more years of experience (17.20 years) than small scale operators (8.12 years) and the difference is significant at the 1% level. Again, the medium farmers again hired more labor (11.38) than the small operators (2.55) and the difference is significant at 1%. The use of more hired labor by medium scale operators again reflects the scale and degree of commercialization of operations which has a bearing on profitability. In summary medium scale farmers who happen to be much older, better educated, with much longer years of business experience and also hired more labor were more commercially-oriented compared to the small scale farmers. These personal and management characteristics have an impact on the overall performance of the enterprise, as has been demonstrated in this study.

Table 3: Measures of Producer and Management Characteristics

Characteristics	Average	Small	Medium	Difference	T-statistic	P-value
Age of Producer (yrs)	47.64	45.32	51.13	-5.808	-2.712	0.008
Education of producer (yrs)	11.60	3.27	3.78	-0.508	-2.117	0.038
Years of Experience (yrs)	11.75	8.12	17.20	-9.083	-6.507	0.000
Formal Training in poultry	0.87	0.77	0.93	-0.158	-2.283	0.025
Number of hired labor	6.08	2.55	11.38	-9.083	-6.507	0.000
Other source of income	0.36	0.35	0.37	-0.025	-0.253	0.081

Source: Survey data

3.2.2 Measure of Scale and Size of Layer Enterprises

A comparison of the scale and size of operation of the two categories of layer enterprise was done using four indicators, namely flock size, laying population, egg lay rate and egg volume. The results show that there were significant relationships between all the selected parameters or characteristics. Medium scale farmers obviously had much larger stock size, more

bird-laying population density, higher volume of egg production and higher egg-lay-rate per farm compared to the small scale operators and these were significantly different at 1% (Table 4). The apparent superior performance and dominance of the medium scale operators in layer production confirms the fact that scale and size matters in typical agribusiness ventures.

Table 4: Measures of Scale and Size of Different Farm Enterprises

Parameters	*Average*	*Small*	*Medium*	*Difference*	*T-statistic*	*P-value*
Flock size	*3,924*	*1,570*	*7,455*	*-5,885*	*-18.81*	*0.000*
Laying population	*3,336*	*1,275*	*6,426*	*-5,151*	*-16.59*	*0.000*
Percentage egg-lay	*82.11%*	*80%*	*85%*	*-0.548*	*-3.618*	*0.000*
Egg lay rate	*9.34*	*9.06*	*9.76*	*-0.700*	*-4.535*	*0.000*

Source: Survey data analysis

3.2.3 COMPARISON OF PRODUCTION COST PARAMETERS FOR DIFFERENT LAYER ENTERPRISES

A detailed production cost analysis on different categories of layer enterprises revealed that there were significant differences in almost all the cost variables or elements measured except utility cost (Table 5). The D.O.C cost, medication, and hired labor of medium farms is higher and significantly different at 1% from that of small farms. On the other hand small farm operators tend to have high production cost influenced mainly by feed, transport and egg tray cost which is found to be significantly different at 1% from that of medium the scale operators. On the whole the small scale farmers incurred higher variable production cost (GH¢71.09) than the medium farms (GH¢62.42) and this difference is statistically significant at 1% level. The higher feed cost borne by small farms is the main item driving the production cost and relative inefficiency compared to the medium farms. The relatively higher variable cost and fixed cost incurred by small farms invariably affected the total cost of production per bird (GH¢67.06) compared to the total cost for medium farms sized (GH¢62.84). There is a statistically significant difference in the overall production cost between the two farm enterprises. This suggests that the various cost components make a key difference and can impact profitability across farm categories.

Table 5: Measures of Production Cost and Expenditure across Farms – a comparative analysis (in GH¢)

Parameters	*Average*	*Small*	*Medium*	*Difference*	*T-statistic*	*P-value*
Cost of D.O.C	*2.56*	*2.51*	*2.64*	*-0.135*	*-4.504*	*0.000*
Cost of feed	*42.71*	*44.44*	*40.12*	*4.320*	*6.252*	*0.000*
Cost of Medication	*1.98*	*1.61*	*2.54*	*-0.930*	*-10.17*	*0.000*
Cost of Hired Labor	*2.89*	*2.48*	*3.50*	*-1.012*	*-5.90*	*0.000*
Transport cost	*1.56*	*1.85*	*1.12*	*0.732*	*5.571*	*0.000*
Utility cost	*1.02*	*0.99*	*1.05*	*-0.063*	*-0.485*	*0.629*
Egg tray cost	*1.62*	*1.68*	*1.52*	*0.159*	*5.709*	*0.000*
Total variable cost	*67.32*	*71.09*	*62.42*	*8.676*	*5.130*	*0.000*
Total fixed cost	*0.75*	*0.96*	*0.42*	*0.541*	*5.229*	*0.000*
Total cost	*68.37*	*72.06*	*62.84*	*9.218*	*5.352*	*0.000*

Source: Survey data analysis

3.2.4 COMPARISON OF REVENUE AND CASH INFLOWS FOR LAYER BIRD ENTERPRISES

An analysis of revenue generated for the two farms category constitutes an important variable of interest in this study as it has implications for determining efficiency, productivity and profitability of different farm categories. First, the volume of eggs produced per bird was higher for medium size farms (9.76 crates) than small farms (9.06 crates) and this difference was statistically different at 1% (Table 6). Secondly, the revenue generated from the sale of eggs and spent–layers, though slightly higher on medium farms than small farms, there is no statistically significant difference in revenue generated between the two categories of farm enterprises. However, the sum total value earned from the sale of eggs and spent layers was higher for medium farms (GH¢89.75) than small farms (GH¢86.46). This difference is statistically significant at 1% level. The analysis indicates that both small and medium farms received almost the same unit price from the sale of poultry products indicating that none of the farm types enjoyed the advantage of a niche market or product differentiation. However the medium farms took advantage of or benefitted significantly from the volumes of output (eggs and spent layer) and this resulted in the statistical difference in overall revenue earnings for the two farm categories.

Table 6: Per bird Revenue and Cash Inflows (in GH¢)

Parameters	Average	Small	Medium	Difference	T-statistic	P-value
Volume of egg	9.34	9.06	9.76	0.700	-4.535	0.000
Value of Egg sale	76.93	75.69	78.80	-3.118	-2.350	0.220
Value of Spent layer	10.84	10.77	10.95	-0.183	-0.916	0.362
Total Revenue earned	87.78	86.46	89.75	-3.295	-2.432	0.018

Source: Survey data analysis

3.2.5 Comparison of Profitability Indicators of Layer Bird Enterprises

A comparative analysis of a number of selected profitability indicators is presented to provide additional insight into the degree of productivity, efficiency and performance level of the various farm enterprises and to ascertain whether farm size has an impact on profitability.

Table 7: Measures of Profitability Indicators across Farm Enterprises

Parameters	Average	Small	Medium	Difference	T-statistic	P-value
Gross Margin (GH¢)	20.15	15.36	27.34	-11.97	-5.787	0.000
Net farm returns (GH¢)	19.41	14.40	26.91	-12.513	-5.894	0.000
Benefit – cost ratio	1.31	1.22	1.44	- 0.218	-6.294	0.000
Profitability Index	0.22	0.16	0.30	-0.1322	-6.329	0.000
Gross Ratio	0.78	0.84	0.70	-0.1322	6.329	0.000
Operating Ratio	0.77	0.82	0.70	0.1261	6.219	0.000
Return on Investment	30.93	22.21	44.02	-21.8045	-6.284	0.000

Source: Survey data analysis

All the eight selected parameters of profitability indicators were found to be different between small and medium enterprises. The analysis show that medium scale farms performed superior on all the profitability indicators and this is significantly different at 1% from the small scale farms. The superior performance of medium farm types of the key profitability indicators can be attributed to a combination of factors, including the effect of scale and size, the relatively high degree of efficiency in the use of production resources, better management practices and economies of scale all of which culminated in the lower cost and higher returns.

3.2.6 Measures of Production Efficiency in Layer Enterprises

Efficiency measures across the categories of farms in terms of physical and financial output levels were considered as it has an impact on the overall performance of agribusiness enterprises. A number key variables and parameters of efficiency were selected for comparison among the two farms categories. Egg production, for example, is a major index of performance for layer enterprises, as it constitutes close to 80% of total revenue generated by layer bird production enterprises, hence its inclusion as an efficiency parameter. The volume of egg produced as well as egg–lay rate per bird for medium farms is higher and significantly different at 1% from that of small farm operators. A rather disturbing observation was the high mortalities (exceeding 10%) reported by both medium and small scale operators. Mortality, which is a critical indicator of efficiency measure and influenced by bio-safety and management practices, was relatively lower for medium farms (15%) than small scale operators (20%). The relatively high mortality rates, thus affected the percentage reproductive flock population for both enterprises. Thus, the percentage of laying birds for medium farms was (85%) and this is significantly different at 1% from that of small farms (80%). Another important parameter of efficiency is egg–feed price ratio, EFPR which is used to measure the ratio between receipts from egg and expenditure on feed. Medium scale farms realized higher EFPR (1.64) compared to small farms (1.37) and this difference is statistically significant at 1%. Conventionally an EFPR of 1.4 and above is the desirable, indicating that small farmers were not efficient egg producers obviously due to high feed cost. However, the meat–feed price ratio for both medium farms (0.24) and small farms (0.19) is less than one, indicating that meat output from the farms does contribute markedly to the economic viability and efficiency of layer enterprises. This finding is not surprising given the fact that layer enterprises derive 70-90% of their returns from eggs as opposed to meat. This probably suggests that meat–feed price ratio would not be a good performance indicator of economic efficiency in layer production compared to broiler birds which are produced purposely for meat.

Additionally, some financial indicators related to efficiency, namely income over feed cost IOFC, net farm income, benefit–cost ratio, and returns to labor were analyzed. Medium farms enjoyed higher net farm income per bird (GH¢26.91) than small farms (GH¢14.40) and the difference is significant at 1%. The benefit cost ratio increased with increase in size of the layer farm enterprise. It was greater and thus more efficient on medium farms (1.44) compared to small farms (1.22). Returns to hired labor per bird for medium scale farms was GH¢73.14 and GH¢66.52 for small scale farms, and this difference was significant at 1% level. This indicates that although medium farms used more hired labor and incurred higher cost, the investment was worthwhile as it translated into better output levels (revenue) compared to that of small farms. The analysis also indicated that the medium farms had higher superior egg-lay rate (9.78 crates per bird) compared to smaller scale farms (9.07 crates per bird) and this difference was statistically significant at 1% level. It must be stated, though, that overall both farms tend to be competitive in terms of egg-lay rate as they fall within the acceptable measures of production. The foregoing amply demonstrates that there is a positive and significant relationship between the scale and size of layer bird agribusiness enterprises and production efficiency measures. This assertion is in consonance with the findings of [28] and [31].

Table 8: Measures of Production Efficiency

Parameters	*Average*	*Small*	*Medium*	*Difference*	*T-statistic*	*P-value*
Laying population	***3,336***	***1,275***	***6,426***	***-5151***	***-16.59***	***0.000***
Egg volume	***9.34***	***9.06***	***9.76***	***0.700***	***-4.535***	***0.000***
Laying Percent Rate (%)	***82.11***	***80***	***85***	***-0.548***	***-3.618***	***0.000***
Egg Lay rate	***9.34***	***9.06***	***9.76***	***-0.700***	***-4.535***	***0.000***
Mortality rate (%)	***17.95***	***20***	***14***	***0.055***	***3.642***	***0.000***
IOFC per bird (GH¢)	***29.34***	***24.56***	***36.51***	***-11.94***	***-6.937***	***0.000***
Meat-feed price ratio	***0.21***	***0.19***	***0.23***	***-0.040***	***-5.941***	***0.000***
Egg-feed price ratio	***1.49***	***1.37***	***1.68***	***-0.317***	***-7.89***	***0.000***
Egg price ratio	***1.49***	***1.08***	***1.27***	***-0.190***	***-6.172***	***0.000***
Net farm income (GH¢)	***19.41***	***14.40***	***26.91***	***-12.51***	***-5.894***	***0.000***
Returns to labor (GH¢)	***69.16***	***65.52***	***73.14***	***-6.613***	***-3.977***	***0.000***
Benefit – cost ratio	***1.31***	***1.22***	***1.44***	***-0.218***	***-6.294***	***0.000***

Source: Survey data analysis

4 CONCLUSION AND RECOMMENDATION

The study was undertaken to analyze the economic performance of small and medium scale layer bird enterprises for agri-entrepreneurs in the Ashanti region of Ghana. The budgetary technique was used to determine the profitability and a t–test was used to measure the comparative performance across the different categories of farms. The study revealed that layer production is generally financially viable. Key profitability indicators, namely gross margin, net farm income, benefit cost ratio, rate of return on investment and profitability index were all favorable. A comparative analysis of the layer enterprises suggests that, on a per bird basis, medium farms performed better and differed significantly from the small scale farms by having a lower production cost (feed, transport and egg tray cost); lower fixed costs and lower total cost of production. Similarly, the revenue, gross margins and net farm income for medium farms were higher and significantly different from that of small farms. Finally, medium scale farms have better or favorable production efficiency indices (egg lay rate, egg–feed price ratio, egg–price ratio, returns to labor, mortality rates) than small farms and these differences are statistically significant. This study has demonstrated that the relatively higher and better performance of medium farms can be attributed invariably to a combination of factors, including better producer management capacity, the sheer size and scale of operations which enable enterprises to enjoy economies of scale and efficient utilization of production resources. Therefore, the size and scale of operation play an important role as far as layer production agribusinesses are concerned.

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