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Productivity and Financial Viability of Commercial Broiler Farm Using Climate Controlled System: The Case in a State-Owned University in Nueva Ecija, Philippines

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ABSTRACT

This study analyzed the performance and profitability of broiler production in a climate controlled system (CCS) operated by a state-owned academic institution under a contract growing scheme. Production efficiency such as average live weight (ALW), feed conversion ratio (FCR), and livability or harvest recovery (HR) of broilers under CCS in 11 growing cycles were analyzed and compared with broilers in conventional housing. The financial viability of the CCS was examined using cost and return analysis. All the data were subjected to t-test with uneven number of observation using the General Linear Model of Statistica for Windows Version 8, 2007. Moreover, regression analysis was done to further determine the effects of type of housing on productivity and profitability.

Broilers under conventional and CCS housing system have similar ALW (P>0.05) of 1.63 kg and 1.65 kg, respectively, at 35 days. Both of these values are higher than the standard set by the integrator. However, FCR and HR of the broilers under CCS were significantly better (P<0.05). They have more growth uniformity and cumulative livability than those in conventional housing. With better FCR and HR, there is higher revenue per bird in CCS than in conventional housing, PHP 14.69 vs PHP 11.96. Moreover, return over total expenses was significantly higher at 150% for CCS and 84% in conventional housing. The higher productivity of broilers under CCS compensated for the higher cost of investment.

Keywords: *Broilers, climate controlled system, profitability, productivity*

INTRODUCTION

The Central Luzon State University is one of the premiere agricultural education institutions in the Philippines. It operates agri-business enterprises as income-generating projects and as laboratory facilities for students. The enterprises include among others the broiler project that started in 1996 and operates under contract with San Miguel Foods Inc. (SMFI). It has four open-side-elevated conventional housing units of 6,000-bird capacity per house. The conventional housing system is cheaper to build and operate but arm performance is highly vulnerable to climate change.

From 2008 to 2010, the project generated an average annual income of PHP 1.1 million with return on expenses (ROE) of 150.87%. In 2008, it has been cited as one of the best (ranked 9th) contract growers in Region III. However, the earnings could have been higher if HR were above 95%. From 2005 to 2008, the average mortality rate was 5.13% and increased further to 5.8% from 2009 to 2011 that significantly reduced HR. Therefore, the HR of 94.87% and 94.20%, respectively, was lower than SMFI's standard of 95.0%.

In response to this major problem, a new housing unit (25,000 bird-capacity) with CCS, mechanized facilities and equipment was constructed and operationalized in August 19, 2011. This was funded with loans from the Land Bank of the Philippines and Technology Application and Promotion Institute of the Department of Science and Technology (TAPI-DOST) and partial investment from CLSU.

CCS is now the trend in contract broiler production and integrators (SMFI) require the use of CCS for existing and new growers. Interest to build tunnel ventilation or CCS as a method of enhancing broiler performance and reducing mortality during warm weather started in 1990. According to Liang et al. (2013), poultry producers have experienced increased production efficiency that is partially attributable to advances in housing technology and instrumentation. Raising broilers in CCS allows more birds per unit area and is reported to have improved feed efficiency, growth rate, and livability (Lacy and Czarick 1992). However, CCS requires higher initial investment and operating cost than the conventional system because electricity costs two-fold higher (Lacy and Czarick 1992). Overall, the improvement in performance of broilers raised in house with CCS offset the additional operating costs. According to SMFI (2012), broiler operation in CCS can have a payback period of 4.7 to 6.9 years depending on flock performance.
After more than two years of operation under CCS, there is a need to evaluate the CLSU Broiler Project's performance in terms of productivity and profitability. The project is an excellent venue in determining the performance and economic viability of this system *vis a vis* the conventional type. Results of the study will serve as basis for the CLSU Administration in its future decision-making of expanding production. Moreover, the study provides empirical data of CCS viability under management of a government-owned educational institution.

MATERIALS AND METHODS

Theoretical and conceptual framework

The cost of housing and other facilities make up the high investment in broiler production, whereas the cost of day-old-chicks (DOC), labor, feeds, biologics, power and water, and house repair and maintenance constitute the high operating cost. There are two types of housing under the CLSU Broiler Project, the CCS and the conventional type. The design and structure of these houses were primarily based on the industry's recommended specifications, technology, size of operation, and financial capability of CLSU. The CCS is more expensive to put up than the conventional housing, PHP 382 per bird vs PHP 250 per bird, respectively. However, the latter has a shorter life span, so it needs repair and maintenance after five years, and bi-yearly or yearly thereafter. Conversely, CCS housing has longer life span of 15-20 years and requires less maintenance and operating cost. It has higher bird capacity that makes the cost per unit area less expensive. Moreover, the use of CCS has higher productivity gains for broilers. The good atmosphere for growth improves broilers' feed efficiency, growth rate, and livability. Presented in Table 1 are the observed differences in the design and structure of houses under the CLSU Broiler Project.

The evaluation of CCS was anchored on the partial equilibrium analysis given demand and supply for broiler (Figure 1). The use of CCS increases productivity and supply as indicated by the shift of the supply curve from S_0 to S_1. Given the same level of demand, farms under CCS have higher output at the prevailing price (Q_1), hence, higher income in the form of grower's fee from production (P_eQ_1- P_eQ_0).

Table 1. Design and structural differences of Farm A and Farm B, CLSU Broiler Project

Factor or Condition	Farm A	Farm B
Design and structure	monitor type roofing; open-side-elevated; lumber on concrete columns and wooden trusses	closed housing and not elevated; concrete floor and side walls with windows and steel trusses
Micro-climate control (Temperature, relative humidity and ventilation)	no direct control; curtain management and use of fans to modify house micro-climate	directly controlled by electronic sensors; use of cooling pads and exhaust fans to control micro-climate
Feeding system	trough and tube feeders	in-line automatic feeders
Watering system	galloners and bell waterers	in-line automatic nipple drinkers
Brooding set-up	infrared heater; floor with laid with plastic sacks, rice hull and old newspaper	infrared heater; plastic slatted floor laid with old newspaper
Floor	elevated-slatted floor; uses wood or bamboo slats; allows minimum 1 ft^2 floor space per bird or 10.76 birds per m^2	plastic slat floor overlaid on ground concrete floor; allows minimum 0.64 ft^2 floor space per bird or 16.82 birds per m^2
Roofing system	corrugated GI sheets; monitor-type without insulation	corrugated GI sheets; double span with insulation

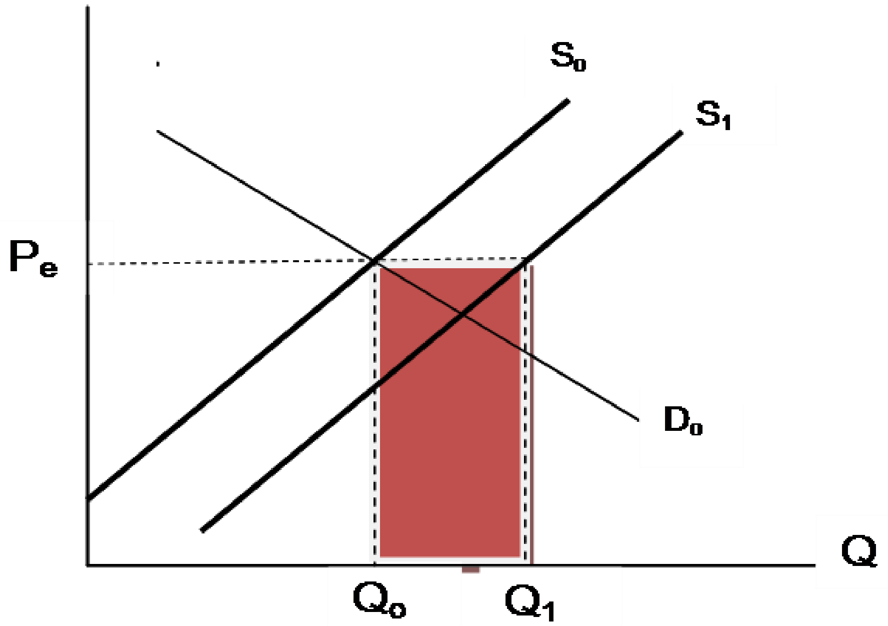

Figure 1. Partial equilibrium analysis to determine effect of CCS on broiler production

Under contract growing, chicks, feeds, and biologics are provided by the integrator (SMFI), whereas, the over-all management, housing, and facilities are provided by the grower (CLSU). A set of efficiency indicators is set by the integrator. In order to meet these indicators, management practices employed at the farm should conform with standard operation onfeeding, brooding, bio-security, vaccination and drug administration, and cleanliness of the broiler house and surroundings (Table 2).

Table 2. Management practices for broilers employed in Farm A and Farm B, CLSU Broiler Project

Activities	Farm A	Farm B
Before arrival of DOC	Cleaning and disinfection of boiler house and poultry equipments and facilities two weeks before loading	Cleaning and disinfection of boiler house and poultry equipments and facilities two weeks before loading
Brooding		
▪ Provision of heat	▪ 29.4 - 32.4 °C for 2 weeks	▪ 29.4 - 32.4 °C for 2 weeks
▪ Litter materials	▪ Rice hull and old newspapers	▪ Old newspapers
▪ Source of heat	▪ Infrared heaters	▪ Infrared heaters
▪ Elimination of NH_3	▪ Proper curtain management	▪ Exhaust fans
▪ Medication	▪ Via drinking water using galloner following SMFI program	▪ Via drinking water using nipple drinkers following SMFI program
▪ NCD vaccination	▪ Via drinking water at day 14	▪ Via drinking water at day 14
▪ Feeds	▪ *Ad libitum* feeding of chick booster using chick feeders	▪ *Ad libitum* of chick booster using feeder lines
▪ Record keeping	▪ Daily recording of mortality & feed intake, and weekly live weight	▪ Daily recording of mortality & feed intake and weekly live weight

Growing		
▪ Bird capacity/pen after brooding	▪ 600 (10 pens/building)	▪ 5,000 (5 pens per building)
▪ Ventilation & elimination of NH_3	▪ Proper curtain management	▪ Exhaust fans
▪ Medication	▪ Via drinking water using bell waterers following SMFI program	▪ Via drinking water using nipple drinkers following SMFI program
▪ Feeds	▪ *Ad libitum* feeding of starter mash (3^{rd}wk) & grower crumbles (4^{th}wk) using tube feeders	▪ *Ad libitum* feeding of starter mash (3^{rd}wk) & grower crumbles (4^{th}wk) automatic feeders lines
▪ Record keeping	▪ Daily recording of mortality & feed intake, and weekly live weight	▪ Daily recording of mortality & feed intake, and weekly live weight
Finisher		
▪ Ventilation & elimination of NH_3	▪ Proper curtain management	▪ Exhaust fans
▪ Medication	▪ Via drinking water using bell waterers following SMFI program	▪ Via drinking water using nipple drinkers following SMFI program
▪ Feeds	▪ *Ad libitum* feeding of finisher diet (5^{th}wk) using tube feeders	▪ *Ad libitum* feeding of finisher diet (5^{th}wk) using automatic feeder lines
▪ Record keeping	▪ Daily recording of mortality & feed intake, and weekly live weight	▪ Daily recording of mortality & feed intake and weekly live weight
Harvesting of broilers	Manual hauling using contractual labor excluding undersize birds	Manual hauling using contractual labor excluding undersize birds

The performance of the CLSU Broiler Project under CCS was examined in terms of its productivity, grower's fee, and profit. This conceptual framework is depicted in Figure 2. The output of the contract farms are paid by the integrator in terms of grower's fee. This is determined by the farm's productivity as indicated by ALW, HR, and FCR upon harvest every cycle. Payment based on the SMFI scheme can be divided into 50-60% ALW, 20-40% FCR, and 10-20% HR. In essence, ALW is the most important factor in the computation of the total grower's fee.

There is a standard payment scheme which is dependent on these performance indicators. Harvest is scheduled when the estimated ALW of a flock is already above 1.55 kg. This is the minimum target weight to get the maximum fee of PHP 5.30 per kg live weight. The minimum for livability or harvest recovery (HR) is 95% for a fee of PHP 1.50 per bird. A 96% HR will have a maximum fee of PHP2.00 per bird. An FCR of 1.96 will be paid PHP 2.39 per bird, while an FCR of 1.6 will be paid PHP 7.63 per bird. Performance below the standards leads to lower pay and in some cases even a payback of the grower to the integrator. This happens if the value of the broilers accepted at the dressing plant upon harvest is not enough to compensate for the cost of chicks, feeds and biologics. In essence, to attain the highest possible grower's fee it is important that best performances in all the three parameters are met.

Payment is constant throughout the growing cycles as stipulated in the contract. Hence, it is the productivity that determines the grower's fee. The grower's fee and the farm's operating expenses determine the profit per growing cycle. The operating expenses include payment for labor, LPG and rice hull for brooding, water, lighting repair and maintenance for housing and facilities, and other miscellaneous expenses.

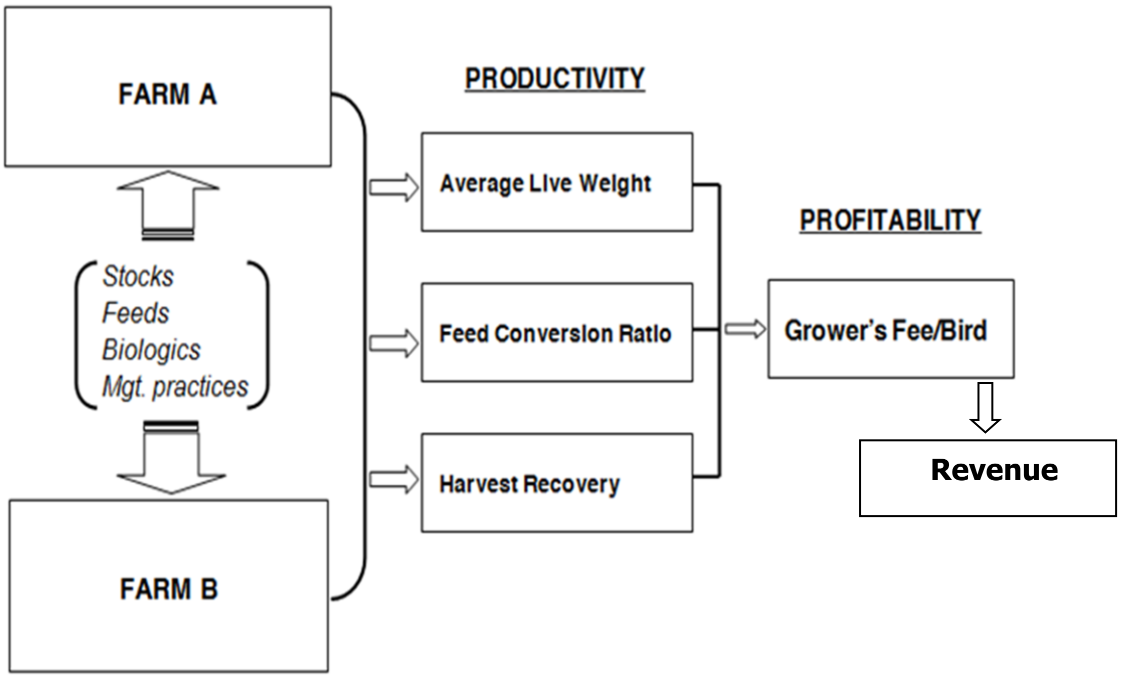

Figure 2. Conceptual framework to determine the effects of CCS on productivity and profitability of contract broiler operation

Data gathered and analysis

Under CLSU recording, the Broiler Project is divided into two separate modules, Farm A for the four conventional housing and Farm B for CCS. However, the operation of the broiler houses whether under CCS or conventional housing are synchronized from chick-in to harvest in every cycle. They use the same broiler strain and give the same nutrition and health program as required by SMFI. Practically, the main differences are the design and structure of the houses and the facilities for feeding and watering.

The study used the data collected from September 2011 until July 2013, covering 11 synchronized batches for both farms. Data are summaries of periodic (weekly) report from the 11 batches. The data for Farm A were taken as the average of the four conventional houses because the housing design, management and equipment used are the same.

The following are the productivity indicators and how the data were collected for Farm A and Farm B:

1. Average Live Weight (ALW)

- 5% of the bird population was sampled in taking the ALW at weeks 0, 1, 2, 3, and 4. ALW at Week 0 corresponds to the weight of the chick during delivery.
- ALW at harvest was taken from the harvest report from the SMFI dressing plant. However, harvesting occurred at different periods depending on the ALW of the broilers and the market demand. Harvest occurred from 34 to 42 days, with highest percentage occurring at day 35. In this regard, the weight of broilers was adjusted at 35-day in the analysis. It was computed based on ALW on day 28 (week 4) and ALW at harvest (34-42 days). The formula used for the adjustment is:

$$ALW_{35} = ALW_{d28} + [(ALW_h - ALW_{d28})/(D_h - 28)] \times 7$$

Where: ALW_h = ALW at harvest

ALW_{d28} = ALW at day 28 (Week 4)
D_h = age of birds on harvest date

2. Cumulative Feeds Consumed (CFC) per 1000 birds, in bags. CFC = Periodic CFC/ (periodic flock ending inventory/1000).
3. Cumulative Livability (CL)

CL = (Periodic flock ending inventory / number of birds at Week 0) x 100%

4. Cumulative FCR

FCR = [Bags of feed per 1000 birds x 50kg per bag x (periodic flock ending inventory/1000)]/[(periodic flock ending inventory x ALW)] or
FCR = (Bags of feed per 1000 birds x 50kg per bag)/ (ALW x 1000)

5. Grower's Fee per Bird

GF = ALW x $SMFI_{ALW\ rate}$ + $SMFI_{FCR\ rate}$ + $SMFI_{HR\ rate}$

To analyze the financial performance of the Broiler Project, cost and return analysis on per bird basis was done. The grower's fee per bird was taken from the SMFI report while the operating and investment costs were taken from the Accounting Office of CLSU.

Statistical analysis

The data as described above were analyzed using the General Linear Model of *Statistica* for Windows Version 8, 2007. The effects of Type of Housing, Season and Housing-Season interaction on the farms' performance were tested using the ANOVA Two Factors with Replication. Initial results indicated that Season and Housing-Season interaction have no significant effects on performance; therefore, the said factors were eliminated in the final analysis. The effects of type of housing on the different parameters were analyzed by Student's T-Test.

Regression analysis was also done to further analyze the effects of housing on farms' performance. The following regression model was estimated:

$Y_i = \alpha + \beta X_1 + \varepsilon_i$

Where: Y_i = dependent variable, ALW, FCR and HR
α = constant value
β = coefficient
X_1 = type of housing, 1 for Farm B, CCS and 0 for Farm A, conventional
ε_i = error term

RESULTS AND DISCUSSION

Production performance of the broiler farms

Average live weight. Average live weight (ALW) of birds in Farm A and Farm B from 0 to 5 weeks old (Table 3) did not yield significant differences (P>0.05). There is almost identical growth pattern in ALW in both farms (Figure 3). This is not surprising as genetic make-up and the nutrition of the birds are the same in both farms. The growth pattern is not affected by the housing condition as indicated by the non-significant differences of ALW at various ages. The micro-climate in Farm A is also suitable to elicit normal growth of birds in a density of 10.76 birds/m^2. Whereas, in Farm B where there is higher density at 16.82 birds/m^2, the favorable temperature and humidity limited the stress of overcrowding. This concurs with the results of Tayeb et al. (2011) that birds raised in densities of 8.66, 10.41, and 13.36 birds/m^2 had no significant differences in live weight. Increased stocking density does not necessarily lead to stress as long as the other vital factors for birds' comfort like ventilation, temperature, and humidity are adequately provided

(Kleyn, 2013). The average final weight per bird in Farm A was 1.63 kg and in Farm B was 1.65 kg. Both values are higher than Magnolia's ALW standard of 1.55 kg at harvest.

Table 3. Average live weight of broilers from 0 to 5 weeks old by type of housing

	Cumulative Average Live Weight (g)							
AGE (wk)	**Farm A**		**SEM**	**Farm B**		**SEM**	**P-value**	
0	42.55	±	0.77	42.55	±	0.74	0.5000	ns
1	165.55	±	4.70	163.82	±	3.60	0.3868	ns
2	397.00	±	12.18	414.64	±	13.68	0.1736	ns
3	759.64	±	25.97	806.82	±	28.30	0.1168	ns
4	1257.36	±	44.17	1293.00	±	42.10	0.2829	ns
5	1631.91	±	56.85	1650.76	±	39.56	0.3941	ns

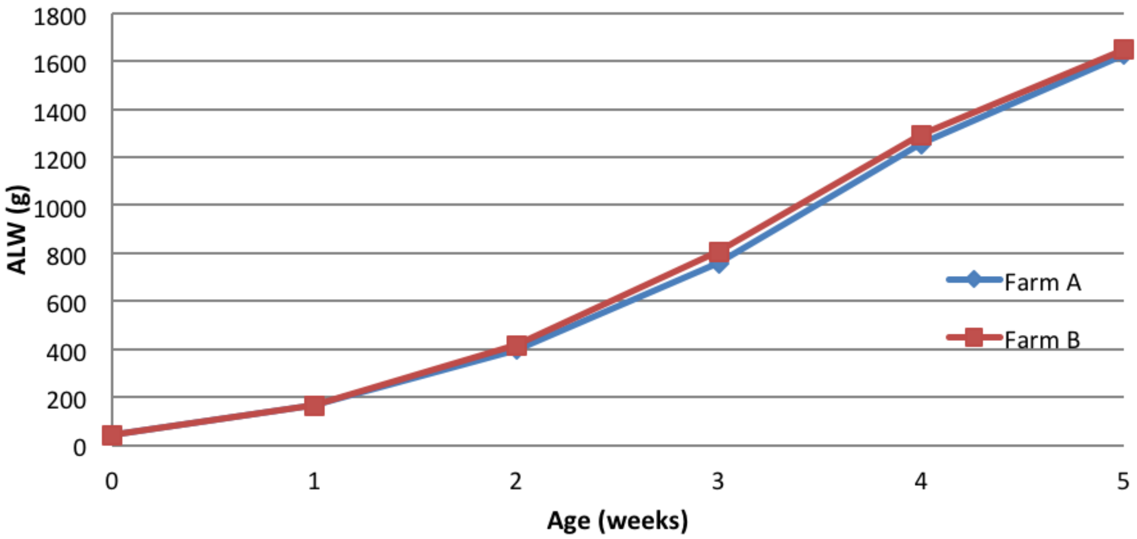

Figure 3. Growth pattern of broilers in Farm A and Farm B from 0 to 5 weeks old.

Livability. Livability or number of surviving birds at harvest is a good indicator of the degree of comfort the birds experienced during the entire growing period. There is higher livability in Farm B than in Farm A (Table 4). The climate controlled system enabled Farm B to attain 96% livability at Week 5 which is higher than SMFI's standard of 95% (SMFI 2012). Whereas, in Farm A, the harvest recovery was only 93.49%, lower than SMFI's standard and Farm B's. Figure 4 shows the pattern of livability of broilers in Farm A and Farm B from Week 1 to Week 5. Livability in Farm A declined at a faster rate than in Farm B, reaching its lowest at Week 5 at less than 94%. For Farm B, the decline was at a slower rate. Moreover, the difference in livability between the farms continued to widen until Week 5. The tunnel ventilation in Farm B promoted higher livability because it provided the birds with better environmental protection against unstable temperature and humidity and other environmental problems.

Table 4. Cumulative livability of broilers from 1 to 5 weeks old by type of housing

	Mean Cumulative Livability (%)							
AGE (wks)	**Farm A**		**SEM**	**Farm B**		**SEM**	**P-value**	
1	98.3382	±	0.2258	98.9473	±	0.1057	0.0141	*
2	97.2627	±	0.2663	98.3536	±	0.1432	0.0013	**
3	96.0618	±	0.3369	97.7536	±	0.2387	0.0003	**
4	94.7055	±	0.5483	97.1227	±	0.2837	0.0007	**
5	93.4982	±	0.7863	96.0000	±	0.4207	0.0066	**

On the contrary, broilers in Farm A are predisposed to higher stress due to fluctuations in temperature and humidity that directly influenced livability (Figure 4). Moreover, the condition is aggravated by the presence of lower air quality due to accumulation of noxious gases, dust, and pathogenic microbes. The condition in Farm A reduced the resistance of the broilers against respiratory diseases that led to higher bird mortality. On the other hand, these problems are not common in a controlled environment; hence, there is significantly higher livability in Farm B.

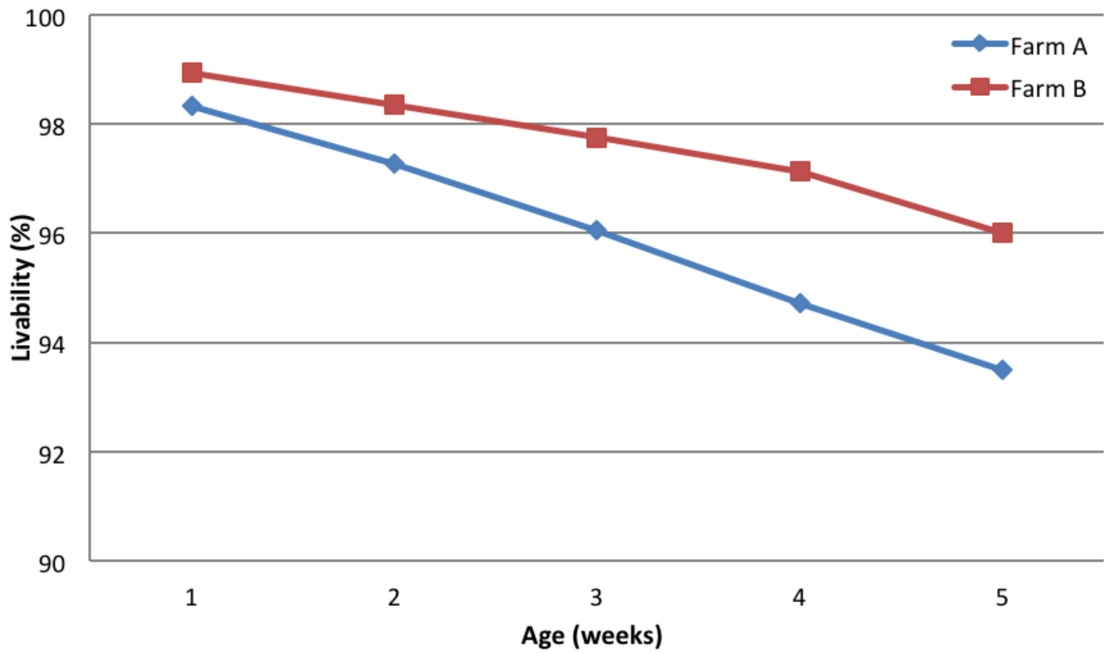

Figure 4. Cumulative livability of broilers in Farm A and Farm B from 1 to 5 week old.

Feed conversion efficiency. Feed Conversion Ratio **(**FCR) is the indicator of feed conversion efficiency. FCR during the brooding period, first two weeks, indicated no significant differences (P>0.05) as shown in Table 5. Onwards up to Week 5, however, mean cumulative FCR of Farm B was significantly better than Farm A. At Week 5, the final FCR of Farm B was 1.7764±0.0175 while in Farm A was 1.8952±0.0266. This means that in Farm B, the birds consumed only about 1.78 kg of feeds to produce a kg of meat, whereas in Farm A about 1.90 kg was consumed to produce the same amount of meat. The difference in FCR of about 0.12 was highly significant (P<0.01). The trend in FCR values is depicted in Figure 5. The efficiency to utilize feed for growth decreases with age. It is important that all possible measures are taken to sustain efficient growth of broilers from brooding until harvest. In broiler production, brooding is very important. According to Arbor Acres (2011), the brooding period is a critical time for gut development, hence the efficiency of feed utilization. The controlled environment in Farm B provided better brooding conditions than Farm A. This is confirmed by the significantly higher livability of birds in Farm B vs. Farm A during the brooding period (Week 1 P<0.05, Week 2 P<0.01) and the entire growing period from weeks 3 to 5 (P<0.01). The controlled environmental temperature in the entire growing period in Farm B contributed to lower mortality, hence better FCR. In Farm A, the fluctuating environmental temperature caused birds to expend more energy to maintain normal body temperature. There is higher mortality in Farm A particularly during the later stage of production. The incidence of high mortality directly relates to poor FCR. The feeds consumed by the lost birds were also included in the computation of the total feed consumed, thereby raising further the FCR value in Farm A.

Table 5. Cumulative FCR of broilers from 1 to 5 weeks old by type of housing

	Mean Cumulative Feed Conversion Ratio							
AGE (wks)	Farm A		SEM	Farm B		SEM	P-value	
1	0.9951	±	0.0153	1.0014	±	0.0170	0.3929	ns
2	1.3385	±	0.0112	1.3147	±	0.0310	0.2415	ns
3	1.5397	±	0.0274	1.4400	±	0.0312	0.0130	*
4	1.6777	±	0.0303	1.5842	±	0.0221	0.0108	*
5	1.8952	±	0.0266	1.7764	±	0.0175	0.0007	**

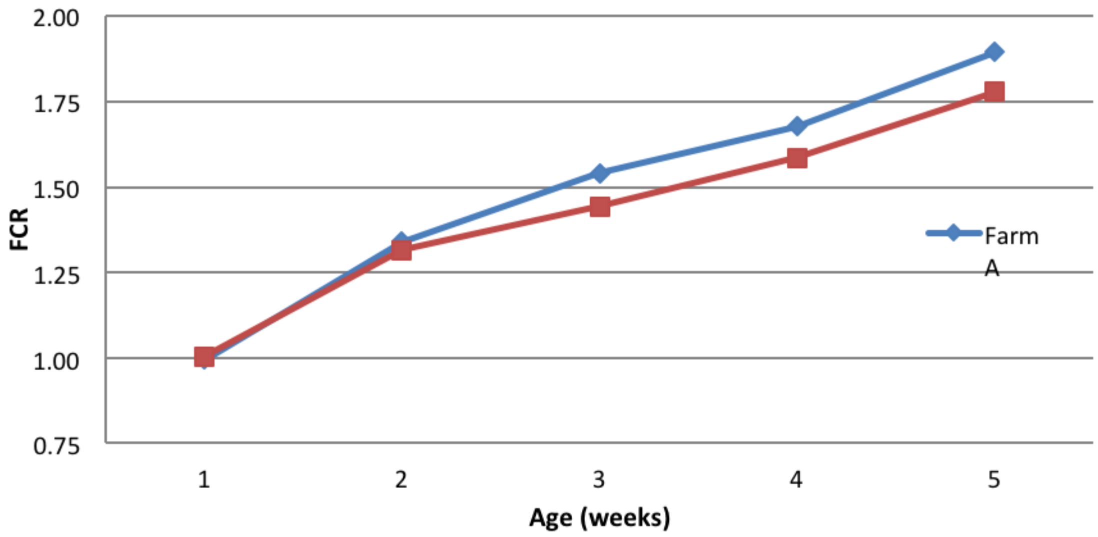

Figure 5. Cumulative FCR of broilers in Farm A and Farm B from 1 to 5 weeks old

Financial performance

Grower's fee per bird**.** As discussed previously, the grower's fee was adjusted to 35-day production period. The fee earned by Farm B amounted to PHP 14.69±0.73 which was significantly higher(P<0.05) than what Farm A earned at PHP 11.96±1.12 (Table 6). Farm A had higher total operating expenses of PHP 6.22 per bird while Farm B had PHP 5.72. In Farm A, the highest expense was on labor at PHP3.04, representing 49% of the total operating expenses. This was about 120% higher than the labor cost for Farm B which was only PHP1.38. Operation in Farm A is more labor intensive than in Farm B. Each conventional house in Farm A with about 6,000 birds has one full time laborer, whereas Farm B with 25,000 birds has only two laborers. Moreover, Farm A spent more for LPG for brooding and materials for repair at PHP 1.08 and PHP 0.58, respectively. On the other hand, in Farm B the highest expense was on electricity and fuel amounting to PHP 3.24 per bird. This was needed to ensure uninterrupted power supply to run the automated ventilation, feeding and water systems to keep the internal condition of the house within the ideal range of the birds' comfort zone. The expense for power of Farm B accounts to 57% of its total operating expense as compared to only 11% in Farm A. All other miscellaneous expenses were lower in Farm B than in Farm A.

Table 6. Comparative cost and return analysis of Farm A and Farm B of the CLSU Broiler Project

	Farm A	**Farm B**
Revenue per bird		
Grower's Fee[a]	11.96	14.69
Total Revenue	**11.96**	**14.69**
Operating Expenses per bird[b]		
Wages	3.04	1.38
Electricity	0.48	2.19
LPG	1.08	0.74
Vet. drugs/biologics	0.27	0.22
Repair materials	0.58	0.00
Laminated sack	0.05	0.00
Old newspapers	0.12	0.02
Rice hull	0.05	0.00
Gasoline/diesel	0.23	1.05
Other farm supplies	0.13	0.00
Tube feeders	0.05	0.00
Other MOE	0.14	0.12
Total Operating Expenses	**6.44**	**5.88**
Net Income (NI) over OE	**5.52**	**8.81**
Capital Outlay per Bird	**250.00[c]**	**382.00[d]**
Interest on Capital	**0.18**	**0.20**
Depreciation Cost	**2.70**	**3.09**
NI Over Total Expenses	**2.82**	**5.09**

[a] Computed Grower's Fee per Bird
[b] Based on the production year July 2012-June 2013
[c] De Asis, R. (2011)
[d] Actual cost of CCS establishment & other facilities/equipments
[e] Batches per Year = 6.18

Net Income. Net income over operating expenses was higher in Farm B than in Farm A by PHP 3.23 per bird. This is attributed to higher grower's fee and lower operating cost in Farm B. Depreciation cost and interest on capital are higher for Farm B due to higher cost of investment. Nevertheless, net income over total expenses was still higher in Farm B at PHP 5.68 than in Farm A at PHP 2.86 per bird. In essence, investing in CCS to raise broiler under contract scheme is profitable and could generate higher income than in conventional housing system. On a per farm basis, the average net income per year is PHP 399, 396.10 for Farm A and PHP 724, 750.85 for Farm B. Figure 6 shows the difference in profitability of Farm A vs. Farm B.

The key to profitability is to attain the desired harvest weight at the shortest possible time when birds are still efficient in utilizing feed for gain in weight. Practically, this means attaining the genetic potential for efficient growth in the most favorable environment. The most feasible way to attain this is through climate controlled system. As in Farm B, the critical environmental factors such as ventilation, temperature, and air quality are all provided appropriately from day one up to harvest.

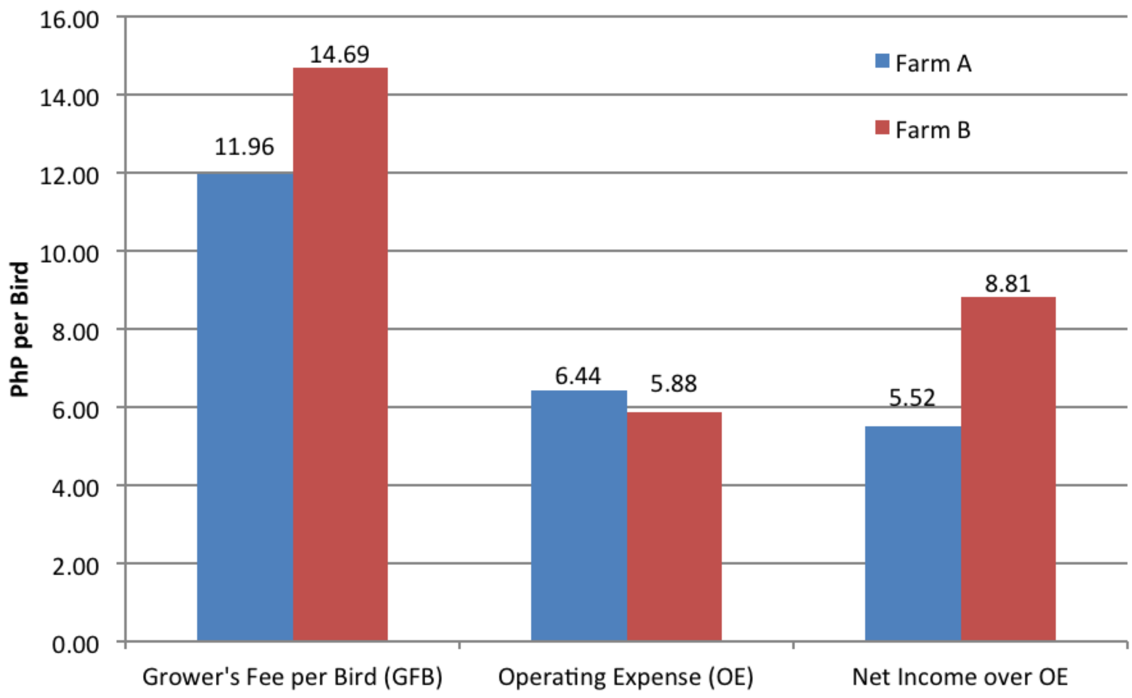

Figure 6. Grower's fee, operating expenses, and net income per bird adjusted at 35-day production period

Regression analysis

Regression analysis was done to further analyze the effects of the type of housing on the performance of the broiler project during the period under study. Results in the previous sections are confirmed in Table 7. Among the indicators of performance, FCR is the most affected by the type of housing. There is better FCR in Farm B brought about by higher livability as a result of better growing environment. The R squared is 0.4108 which indicates that the variation in FCR is explained by the type of housing at 41.08%. Livability and grower's fee per bird were also positively influenced by the type of housing with R squared value of .2824 and .1706, respectively.

The analysis further proved that the type of housing has no effect on the birds' ALW. In summary, the estimated regression models are:

$Y_{ALW} = 1631.9089 + 18.8509$ Farm type

$Y_{FCR} = 1.8952 - 0.1188$ Farm type

$Y_{Livability}$ = 93.4982 + 2.5019 Farm type
Y_{GFB} = 11.9644 + 2.7237 Farm type

Table 7. Regression analysis showing the effects of type of housing on broiler production performance

	Dependent Variables (Y_i)			
	Y_1 = ALW	Y_2 = FCR	Y_3 = Livability	Y_4 = Grower's Fee/ Bird
Constant	16.31.9089	1.8952	93.4982	111.9644
Coefficient	18.8509	-0.1188	2.5018	2.7297
P-value	0.7883	0.0013	0.0109	0.0560
R^2	0.0036	0.4108	0.2824	0.1706
F stat	0.0741	13.99450	7.8712	4.1632
F significance	0.7783	0.0013	0.109	0.056
SEE	162.4168	0.0746	2.0913	3.1495

CONCLUSION AND RECOMMENDATION

Conventional and climate controlled systems can produce broilers with comparable ALW performance within the 35-day growing period. Under CLSU conditions, the broilers in the two different farms are of the same genetics, nutrition, and management. CCS improved the performance of birds as indicated by better feed efficiency and livability. It provides birds with the ideal range of temperature, relative humidity, and air quality throughout the entire growing period. The favorable condition under CCS provided the birds lower stress, thereby enabling them to utilize energy intake more efficiently for growth.

Investment for CCS is relatively higher than in conventional housing. But production under CCS was found to be more profitable. The high cost of investment was offset by lower total operating cost. Under CCS, the major cost was on power while for conventional housing, labor accounted for the major cost.

The farm productivity determines its profitability. The higher efficiency and livability under CCS contributed to higher income over operating and total expenses.

Power cost is the most expensive component in operating a climate controlled broiler house. However, biogas production from the manure could be the source of power, thus reducing its cost. Moreover, a distant alarm system for changes in temperature and relative humidity inside the system could be very helpful to the management to ensure sustained performance.

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