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Financial Efficiency of Closed House and Open House Systems in Small and Medium Scale Broiler Production in West Sumatra

Henggi Apedro[1*] & Afiza Wulandari[1]
[1] Animal Science Department, Faculty of Agriculture,
Lambung Mangkurat University
Jl. Jenderal Achmad Yani Km. 35,5, Banjarbaru, Kalimantan Selatan, Indonesia
* Email Correspondence: henggi@ulm.ac.id

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ABSTRACT. *Broiler producers must decide whether production scale or housing type is the main driver of financial performance. This study quantifies the relative effects of enterprise scale and housing system on broiler farm feasibility in West Sumatra using a structured comparative case study of four farms representing a 2×2 matrix of housing (closed vs open) and scale (about 5,000 vs 15,000 birds). Cycle-level production and financial records were analyzed using standard farm-management indicators, including profit and loss per cycle (annualized to five cycles), the revenue-to-cost ratio (R/C), break-even price, cost composition, and a capital-expenditure profile, with outcomes standardized to rupiah per kilogram of liveweight. The results show that scale is the dominant determinant of economic outcomes, as medium-scale units outperform small-scale units across profitability and efficiency indicators regardless of housing type. Within the medium scale, closed housing further improves performance by lowering unit costs and producing the highest R/C ratio and the lowest break-even price, despite higher depreciation and electricity shares. Feed and day-old chicks dominate total cost across systems, while CAPEX is concentrated in buildings and equipment for closed houses and in backup power for small open houses. Sensitivity scenarios (price −10%, feed +10%, and a combined shock) indicate that small-scale operations are more exposed to downside risk, whereas medium-scale units provide greater buffering capacity. These findings suggest that scale consolidation should be prioritized before adopting high-capital closed-house technology, and that closed housing acts as a performance amplifier when throughput is sufficiently large and stable.*

Keywords: Broiler production, cost efficiency, housing systems; profitability; scale economies

INTRODUCTION

Broiler chicken is the main source of affordable animal protein in Indonesia, so the financial health of broiler farms matters for household food budgets and rural livelihoods. The industry has expanded and modernized while moving toward tighter coordination with integrators and contract farming (Nugroho, 2020; Setiadi et al., 2022a). Prior research has examined broiler performance and farm feasibility under tropical conditions by discussing the managerial implications of housing systems and enterprise size. Open-house facilities remain common among smallholders because they require lower initial capital, yet their exposure to tropical heat, humidity, and pathogen loads can undermine survival, growth, and feed conversion efficiency.

Closed-house designs, in contrast, allow tighter control of temperature, humidity, and ventilation and are often associated with improved technical performance, but they demand higher capital investment and greater reliance on electricity and mechanical systems (Farida et al., 2022; Honig et al., 2024; Lara & Rostagno, 2013; Susanti, 2023). Studies in tropical climates highlight how closed houses can reduce heat stress and stabilize production outcomes, and Indonesian evidence likewise reports better growth parameters and lower mortality relative to open designs (Farida et al., 2022; Susanti, 2023).

At the same time, enterprise size shapes economic trade-offs: small flocks face fixed and operating costs more acutely, whereas medium-scale operations can benefit from economies of scale but require larger working capital and may depend more on external finance. In Indonesia, vertical integration and partnerships can improve efficiency and incomes, although outcomes vary with scale, cost structure, feed price volatility, and financing constraints (Ismanto et al., 2024; Setiadi et al., 2022; Wantasen et al., 2021). Financial feasibility is commonly assessed through farm-management benchmarks such as profit and loss statements, revenue-to-cost (R/C) ratios, break-even points (BEP), payback periods, and cost composition, which together translate biological performance and input prices into decision-relevant indicators (Fikrianti dkkl., 2023; Santoso et al., 2018a; Sari et al., 2021a; Tafsin et al., 2023)

However, an important analytical gap remains. Although multiple studies suggest financial advantages of closed poultry houses, many empirical comparisons either do not segment results by enterprise size or focus only on closed-house superstructures, leaving guidance coarse and insufficiently tailored to the scale-specific contexts faced by producers (Farida et al., 2022; Honig et al., 2024; Susanti, 2023). This limitation matters because the financial justification for adopting a higher-capital closed house is inherently scale-dependent: the same technology can produce different cost structures, risk exposure, and cash-flow recovery profiles between small and medium farms. To address this gap, this study evaluates open and closed housing at two enterprise sizes (about 5,000 and 15,000 birds) in West Sumatra, Indonesia.

Using standard farm-management indicators (profit and loss, revenue-to-cost (R/C) ratio, break-even price and volume, and payback period), we quantify the financial effects of each housing system by scale. The study contributes by clarifying when the higher capital requirements of closed houses are financially justified, by reporting decision-relevant metrics aligned with farm budgeting and lender appraisal, and by providing region-specific evidence to guide modernization choices for small and medium producers (Nugroho, 2020; Setiadi et al., 2022).

MATERIALS AND METHODS

Study Area and Case Selection

This study was conducted in West Sumatra, Indonesia, a broiler-producing region where production has increasingly shifted toward tighter coordination with integrators and contract farming (Nugroho, 2020; Setiadi et al., 2022). The research applied a comparative case study design structured around a 2×2 analytical matrix defined by housing system (closed versus open) and enterprise scale (approximately 5,000 versus 15,000 birds). Four farms were purposely selected to represent each housing-by-scale combination to support a most-comparable and contrast logic that clarifies whether observed financial differences are more strongly associated with housing technology or enterprise scale. Case selection was justified on the basis that each farm had clear system classification, maintained cycle-level production and financial records that could be verified for calculation, operated under comparable market and partnership conditions so that the analysis is not dominated by differences in procurement or marketing channels, and represented scale levels that reflect realistic decision thresholds faced by producers when considering modernization. This design aims to produce decision-oriented evidence about capital–performance trade-offs under realistic farm conditions, rather than statistically generalizable estimates.

Data Collection

Data were collected at the production-cycle level for each farm and then annualized to facilitate comparison. Primary data included farm production logs documenting starting population, harvested population, mortality, harvested liveweight, and supporting notes on cycle performance, together with cost records covering feed, day-old chicks, utilities, hired labor, and routine operating inputs. Revenue data were obtained from recorded total liveweight sold and realized selling price in rupiah per kilogram. Information on capital assets and investment outlays was also compiled to calculate depreciation and total capital expenditure for each housing system. Key informant interviews with farm operators and technicians were used to confirm operational practices and validate the consistency of recorded cost components. Where possible, figures were cross-checked against supporting documents such as invoices, receipts, and internal records, and internal consistency checks were applied to ensure coherence across output, price, and cost variables.

Figure 1. Research design and analytical workflow. The study was conducted in West Sumatra and applied a 2×2 housing-by-scale matrix to purposely select four representative farms. Cycle-level production and financial records, supported by interviews and documentary checks, were compiled and standardized to common units and annualized using five cycles per year. Financial indicators were then calculated, including profit and loss, R/C ratio, break-even price and output, payback period, and cost composition, followed by cross-case comparison to interpret technology–scale trade-offs and to state analytical limitations.

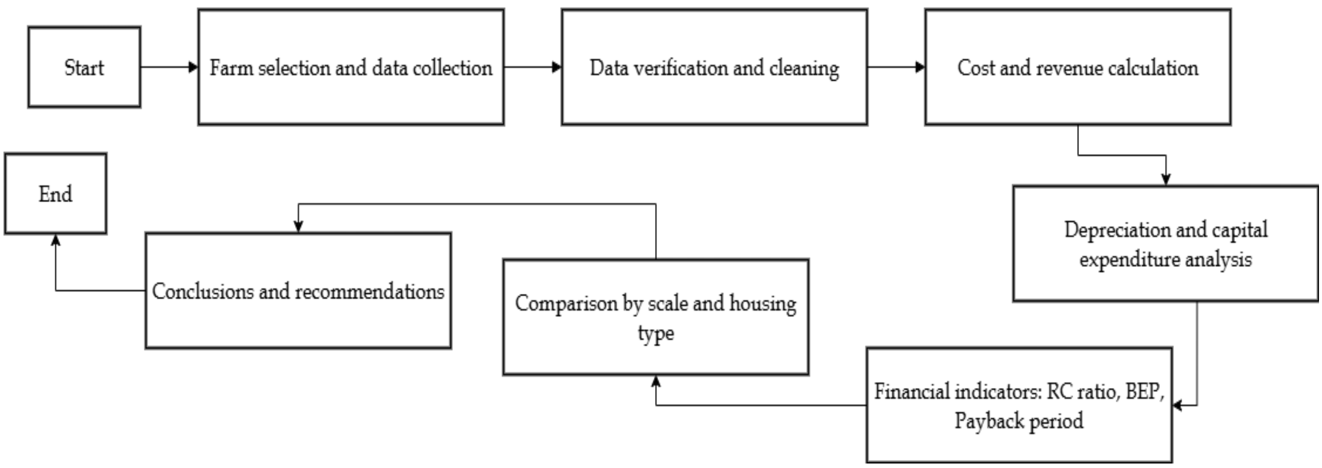

Figure 1. Flowchart of Data Collection and Analysis

Financial Indicators and Formulas

This study used a structured comparative case study design with quantitative financial calculations to characterize performance across the 2×2 housing-by-scale matrix. All values are in Indonesian rupiah (Rp). Financial feasibility was assessed using standard farm-management indicators calculated per cycle and then annualized. For sensitivity analysis, we simulated liveweight price (P) −10%, feed cost +10%, and a combined shock, then recalculated profit, R/C, and BEP price using the baseline formulas.

Total revenue

$$TR = P \times Q$$

Profit and loss per cycle

$$TC = TVC + TFC + DEP$$

$$\pi = TR - TC$$

Annual net profit:

$$\pi\_ann = \pi \times N\_c$$

Revenue-to-cost ratio (R/C)

$$R/C = \frac{TR}{TC}$$

Break-even point

$$BEP\ price = \frac{TC}{Q}$$

$$BEP\ volume = \frac{F}{(P - v)}$$

Payback period (PP)

$$Payback\ (years) = \frac{CAPEX}{CF\ ann}$$

$$CF\ ann \approx (\pi + DEP) \times N\_c$$

Cost composition

$$Share\_i\ (\%) = \frac{Cost\_i}{TC} \times 100$$

Notation:
P = live weight price (Rp/kg); Q = total liveweight sold (kg); TVC = total variable cost (Rp); TFC = total fixed cost (Rp); DEP = depreciation (Rp); TR = total revenue (Rp); TC = total cost (Rp); π = net profit per cycle (Rp); v=TVC/ Q = variable cost per kg (Rp/kg); F=TFC+ DEP = fixed cost per cycle (Rp); Nc = 5 = cycles per year; CFann = annual net cash flow (Rp/year).

Depreciation Note:

Depreciation was calculated using the straight-line method based on recorded service lives and residual values. For per-cycle reporting, house depreciation may be expressed as a fixed share per cycle (for example, 2 percent) if consistent with farm records.

RESULT AND DISCUSSION

Capital Allocation and Financing Structure

Across all cases, fixed assets constitute the largest share of total capital, and the fixed-asset share rises with both technology level and operational scale (Table 1). This pattern reflects the fact that housing upgrades and scale expansion are primarily realized through higher mechanically increased capital intensity per bird. The capital-per-bird ratio in closed, medium-scale farms is 324,807 rupiah compared with 150,575 rupiah in open, medium-scale farms. The difference of 174,232 rupiah per bird represents a 115.7 percent increase, confirming that closed-house adoption is fundamentally a capital-deepening decision. Consistently, the fixed-asset share reaches 89.75 percent in closed, medium-scale farms and 83.51 percent in open, medium-scale farms, while it remains lower in small-scale operations at 64.99 percent in closed, small-scale farms and 57.16 percent in open, small-scale farms. These capital allocation differences align with technical studies emphasizing that closed-house production depends on insulated buildings, tunnel ventilation, evaporative cooling, and automated controllers to stabilize microclimate conditions and performance in tropical environments (Teles et al., 2020; Yani et al., 2014).

In the context of Indonesian partnership and contract frameworks, the financial advantage of closed-house systems is typically realized through performance stability and improved income per unit output, but this advantage requires higher initial investment and is recovered only through repeated cycles. The observed dominance of fixed capital in closed, medium-scale units is consistent with evidence that technology-based modernization can raise profitability while shifting the enterprise toward a more capital-intensive cost structure (Santoso et al., 2018; Setiadi et al., 2022). Because closed-house assets are long-lived and recovery occurs over multiple cycles, financing structure becomes part of feasibility rather than a background assumption. Matching loan tenure to the economic life of facilities and machinery and adopting a financing mix such as 60 percent equity and 40 percent debt helps align repayment schedules with asset productivity, which is consistent with broader finance-based feasibility logic in agricultural investment contexts (Kamruzzaman et al., 2021; Mendes et al., 2014).

Table 1. Capital Allocation and Financing Structure

Description	Close House		Open House	
	Small	Medium	Small	Medium
A. Allocation of Business Capital				
Fixed Capital (Rp)	200.700.000	5.247.000.000	130.800.000	2.187.500.000
Non-Fixed Capital (Rp)	108.104.135	599.520.245	98.150.018	432.542.073
Total Capital (Rp/farm)	308.804.135	5.846.520.245	228.950.018	2.620.042.073
Total Capital (Rp/bird)	88.230	324.807	65.414	150.575
Fixed Capital (%)	64,99%	89,75%	57,16%	83,51%
Non-Fixed Capital (%)	35,01%	10,25%	42,84%	16,49%
B. Capital Structure by Source (60% Equity / 40% Debt)				
Equity (Own)	185.282.481	3.507.912.147	137.370.011	1.572.025.244
Debt (External)	123.521.654	2.338.608.098	91.580.007	1.048.016.829
Total Capital	308.804.135	5.846.520.245	228.950.018	2.620.042.073

Income Statement and Cost Composition

The income statement results show that closed, medium-scale operations achieve the highest gross profit and the lowest total cost per kilogram among the four groups (Table 2), which directly answers the modernization question posed in the research gap: closed-house advantages become financially meaningful when they operate at a scale that can convert capital investment into lower unit costs. For closed, medium-scale farms, the unit cost is 17,985 rupiah per kilogram, compared with 19,237 rupiah per kilogram in open, medium-

Table 2. Income Statement and Cost Composition

Description	Close House		Open House	
	Small	Medium	Small	Medium
A. Income Statement – Per Cycle				
Live weight (kg/cycle)	5.653	36.457	4.508	24.534
Price (Rp/kg)	20.500	19.800	20.000	20.500
Revenue (Rp/cycle)	115.886.500	721.848.600	90.160.000	502.947.000
Variable Cost (Rp)	108.104.135	599.520.245	85.709.420	433.047.624
Depreciation (Rp)	2.417.778	56.158.333	1.120.000	38.911.111
Total Cost (Rp/cycle)	110.521.913	655.678.578	86.829.420	471.958.735
Gross Profit (Rp/cycle)	5.354.337	66.173.982	3.330.580	30.988.265
B. Income Statement – Annual				
Cycles/year	5	5	5	5
Live weight (kg/year)	28.265	182.285	22.54	122.67
Revenue (Rp/year)	579.381.250	3.609.262.800	450.800.000	2.514.735.000
Total Cost (Rp/year)	552.609.565	3.278.392.890	434.147.100	2.359.793.675
Gross Profit (Rp/year)	26.771.685	330.869.910	16.652.900	154.941.325
C. Cost Composition per Cycle				
Feed (%)	71,67%	68,30%	69,37%	65,69%
DOC (%)	19,00%	16,47%	24,19%	22,12%
Electricity (%)	4,88%	4,83%	2,26%	2,36%
Labor (%)	2,26%	1,83%	2,88%	1,59%
Depreciation (%)	2,19%	8,56%	1,29%	8,25%

Notes: Panel B annualizes Panel A at 5 cycles per year. Gross margin = gross profit / revenue. Cost per kg excludes finance costs. DOC = day-old chick.

scale farms, representing a reduction of 1,252 rupiah or 6.5 percent. At the same time, gross profit per cycle is 66,173,982 rupiah in closed, medium-scale farms versus 30,988,265 rupiah in open, medium-scale farms, an improvement of 35,185,717 rupiah or 113.5 percent. These patterns are consistent with Indonesian evidence that closed houses can improve feed conversion, survivability, and resulting income performance compared with open houses, especially under tropical stress conditions (Laili et al., 2022; Sari et al., 2021b; Susanto & Nursita, 2024).

Why Scale Dominates Housing in Financial Feasibility?

The results indicate that scale exerts a stronger influence than housing because scale reshapes the unit-economics architecture of the enterprise, whereas housing primarily affects biological performance and operational stability. First, scale dilutes fixed and quasi-fixed costs over a larger output base. Depreciation, maintenance, supervisory labor, and some utilities are not perfectly proportional to bird numbers, so medium-scale operations can spread these costs across more kilograms of output, lowering cost per kilogram and reducing the break-even threshold even when the housing system is unchanged. Second, scale increases throughput and improves capacity utilization. Closed-house systems are designed to operate efficiently when stocking levels and production cycles are stable, so the benefits of microclimate control translate more reliably into financial outcomes at medium scale than at small scale. Third, because feed and DOC dominate total cost, small improvements in technical efficiency must be applied to sufficiently large output volumes to become large enough in rupiah terms to offset the higher electricity and depreciation burden associated with closed houses (Teles et al., 2020; Yani et al., 2014). This explains why closed-house benefits are most visible in the medium-scale case: scale enables both the amortization of capital and the conversion of biological stability into consistently lower unit costs and higher margins, which is consistent with Indonesian closed-house performance findings (Laili et al., 2022; Susanto & Nursita, 2024).

R/C Ratio and Break-Even Analysis

All groups are profitable based on benefit-to-cost ratios above one, but the ranking reinforces the central answer to the research gap: scale creates the primary separation in feasibility, while housing refines performance within scale. The closed, medium-scale operation has the highest R/C ratio at 1.10, followed by open, medium-scale at 1.07, closed, small-scale at 1.05, and open, small-scale at 1.04. Break-even price per kilogram mirrors observed unit cost and is lowest for closed, medium-scale farms at 17,985 rupiah, followed by open, medium-scale at 19,237, open, small-scale at 19,261, and closed, small-scale at 19,553. Closed houses have been shown to improve break-even performance because better feed conversion and lower mortality reduce the cost required to produce each kilogram, while a more stable microclimate reduces performance variance across cycles (Mendes et al., 2014; Setiadi et al., 2022), with supportive evidence from heat-stress comparisons (Hamed et al., 2025). However, the small open-house group remains the most vulnerable because its margins are thin and thus highly sensitive to feed and output price fluctuations, which is consistent with broader evidence that financial strain and price volatility disproportionately threaten smaller operations (Kamruzzaman et al., 2021).

Sensitivity Analysis and Robustness to Price and Feed Shocks

Table 4 assesses whether the baseline feasibility conclusions remain consistent under plausible downside shocks. The scenarios show that profitability deteriorates quickly when selling prices fall and feed costs rise, which is consistent with prior evidence that feed dominates broiler cost structure and strongly drives margins in both closed-house and open-house systems (Pakage dkk., 2018; Sari et al., 2021). The results also indicate that small-scale cases turn negative more rapidly, while medium-scale operations provide greater buffering capacity, aligning with Indonesian findings that profitability and performance tend to improve with scale and better cost control under commercial conditions (Santoso et al., 2023). This pattern is also consistent with contract-farming evidence showing that operational efficiency and cost inefficiency factors shape farmer performance and vulnerability, particularly among smaller producers (Aji et al., 2023; Setiadi et al., 2022). Overall, the sensitivity results reinforce the paper's decision message that scale is a key source of financial resilience under volatility, and housing upgrades are most viable when stable throughput and partnership conditions can be maintained (Sari et al., 2021; Setiadi et al., 2022).

Table 3. R/C Ratio & Break-Even Point (BEP)

Description	Close House		Open House	
	Small	Medium	Small	Medium
R/C Ratio	1,05	1,10	1,04	1,07
BEP Price (Rp/kg)	19.553	17.985	19.261	19.237
BEP kg/year (5 cycles)	8.79	83.68	5.67	68.285
BEP birds/year (5 cycles)	5.17	40.82	4.05	45.525
BEP kg/cycle	1.758	16.736	1.134	13.657
BEP birds/cycle	1.034	8.164	810	9.105

Table 4. Sensitivity scenarios (per cycle, baseline omitted)

Case	Scenario	Profit (Rp/cycle)	R/C	BEP price (Rp/kg)
Closed–Small	Price −10%	−6.224.063	0,943	19.551
Closed–Small	Feed +10%	−2.556.519	0,978	20.952
Closed–Small	Price −10% & Feed +10%	−14.145.169	0,880	20.952
Closed–Medium	Price −10%	−6.014.838	0,990	17.985
Closed–Medium	Feed +10%	21.387.175	103,146	19.213
Closed–Medium	Price −10% & Feed +10%	−50.797.685	0,927	19.213
Open–Small	Price −10%	−5.685.420	0,935	19.261
Open–Small	Feed +10%	−2.692.777	0,970	20.597
Open–Small	Price −10% & Feed +10%	−11.708.777	0,873	20.597
Open–Medium	Price −10%	−19.306.435	0,959	19.237
Open–Medium	Feed +10%	−14.704	0,999	20.501
Open–Medium	Price −10% & Feed +10%	−50.309.404	0,899	20.501

Note: Profit and R/C are recalculated under the stated shocks using the same cost definitions as the baseline analysis; BEP price is computed as TC/Q.

Investment in Capital Expenditure (CAPEX)

CAPEX rises sharply when farms shift from open to closed housing and when they scale from small to medium operations, with investment concentrated in construction and equipment (Table 5). In closed, medium-scale farms, the CAPEX shares are 57.5 percent for buildings, 35.4 percent for equipment, 6.7 percent for generators, and 0.3 percent for licensing. By contrast, the generator share in open, small-scale farms reaches 48.9 percent, indicating a heavier dependence on backup power and a different risk posture in which reliability is managed through generator investment rather than through fully integrated microclimate infrastructure. This investment structure reflects the equipment and facility requirements needed to keep broilers within the thermally neutral zone in wet tropical conditions. In Indonesia, such investment partnerships can raise incomes but may imply a longer simple payback period at medium scale because the absolute capital base is larger, even when unit costs improve (Santoso et al., 2018; Wantasen et al., 2021). Studies focused on climate-specific control investments likewise show that investments targeting heat-stress mitigation can reduce mortality, lower unit costs, and strengthen returns, which is consistent with the superior cost-performance profile observed in closed, medium-scale units (Benalywa et al., 2019; Sari et al., 2021).

Tabel 5. Investment of Capital Expenditure (CAPEX)

Description (Rp)	Close House		Open House	
	Small	Medium	Small	Medium
Building	112.000.000	3.019.000.000	49.200.000	1.112.000.000
Equipment	70.400.000	1.860.000.000	13.100.000	704.000.000
Generator	13.800.000	353.000.000	64.000.000	291.500.000
Licensing	4.500.000	15.000.000	4.500.000	80.000.000
Total CAPEX	200.700.000	5.247.000.000	130.800.000	2.187.500.000

Note: Data processed (2025). CAPEX = Capital Expenditure. Rp = Indonesian Rupiah.

CONCLUSION

This study provides a decision-oriented message for broiler modernization in West Sumatra based on a structured comparative case analysis of four farms operating under similar partnership conditions. The evidence suggests that technology upgrades translate into more reliable cash flow when implemented through a scale-aware pathway rather than as a standalone housing switch, and the sensitivity scenarios indicate that small-scale operations are less able to absorb adverse feed and price shocks. For smaller producers, priority actions with low capital burden include collective purchasing for feed and DOC, standardized recordkeeping and budgeting, and extension support focused on consistent cycle management to reduce preventable losses. Closed-house adoption is more viable when supported through partnerships or farmer-group aggregation that stabilizes utilization, combined with financing aligned to production cycles and asset life, and maintenance planning that prevents downtime from eroding returns. For government and integrators, enabling conditions such as power reliability, access to service and spare parts, and transparent contract arrangements can reduce input and output uncertainty so modernization performs as intended.

CONFLICT OF INTEREST

We certify that there is no conflict of interest with any financial, personal, or other relationships with other people or organizations related to the material discussed in the manuscript. Conflicts of Interest should be stated in the manuscript.

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REFERENCES

Aji, J. M. M., Rondhi, M., Suwandari, A., Hapsari, T. D., Januar, J., Yanuarti, R., & Rokhani. (2023). Determinants of cost inefficiency and farmer performance in broiler contract farming. *Tropical Animal Science Journal, 46*(3), 382–388. https://doi.org/10.5398/tasj. 2023.46.3.382

Benalywa, Z. A., Ismail, M. M., Shamsudin, M. N., & Yusop, Z. (2019). Impact of technology and government incentives on the performance of broiler contract farming in Johor. *Advances in Animal and Veterinary Sciences, 7*(8), 641–647. https://doi.org/10.17582/journal. aavs/2019/7.8.641.647

Farida, T. E., Hanafi, N. D., & Tafsin, M. (2022). Comparative study of broiler chicken performance in closed house and conventional system in North Sumatera. *IOP Conference Series: Earth and Environmental Science, 977*(1), 012138. https://doi.org/10. 1088/1755-1315/ 977/1/012138

Fikrianti, Y., Priyanto, B., & Aini, F. N. (2023). Perbandingan analisis finansial sistem kandang closed house semi otomatis dan otomatis di peternakan ayam Dekem Tengah Sawah. *Jurnal Agribisnis Indonesia, 11*(2), 422–431. https://doi.org/10.29244/jai.2023. 11.2.422-431

Hamed, A., Gamil, Z., Elbarbary, N. K., Ghania, A. A., Fotouh, A., & Darweish, M. (2025). A comparative study of performance and profitability measures for broilers raised in open and closed systems: Investigating the histopathological effects of heat stress during summer in Egypt. *Open Veterinary Journal, 15*(5), 2039. https://doi.org/10.5455/ovj. 2025. v15.i5.20

Hamiyanti, A. A., Nurgiartiningsih, V. M. A., Muharlien, M., & Suyadi, S. (2023). Production performance of the broiler under open, semi-closed, and closed house systems during the rainy season. *Conference proceedings*, 411–419. https://doi.org/10. 2991/978-94-6463-116-6_51

Honig, H., Haron, A., Plitman, L., Lokshtanov, D., Shinder, D., Nagar, S., Goshen, T., & Druyan, S. (2024). Comparative analysis of broiler housing systems: Implications for production and wellbeing. *Animals, 14*(11), 1665. https://doi.org/10.3390/ani14111665

Ismanto, H., Atmaji, A., & Suhari, E. (2024). Determinants of MSMEs' credit access: Evidence from Indonesian banks. *Banks and Bank Systems, 19*(3), 230–241. https://doi. org/10.21511/bbs.19(3).2024.19

Kamruzzaman, M., Islam, S., & Rana, M. J. (2021). Financial and factor demand analysis of broiler production in Bangladesh. *Heliyon, 7*(5), e07152. https://doi.org/10.1016/j. heliyon.2021.e07152

Laili, A. R., Damayanti, R., Setiawan, B., & Hidanah, S. (2022). Comparison of broiler performance in closed house and open house systems in Trenggalek. *Journal of Applied Veterinary Science and Technology, 3*(1), 6–11. https://doi.org/10.20473/javest.v3.i1.2022.6-11

Lara, L. J. C., & Rostagno, M. H. (2013). Impact of heat stress on poultry production. *Animals, 3*(2), 356–369. https://doi.org/10.3390/ ani3020356

Mendes, A. S., Gudoski, D. C., Cargnelutti, A. F., Silva, E. J., Carvalho, E. H., & Morello, G. M. (2014). Factors that impact the financial performance of broiler production in southern states of Paraná, Brazil. *Brazilian Journal of Poultry Science, 16*(1), 113–119. https://doi.org/10.1590/s1516-635x2014000100016

Nugroho, B. A. (2020). Indonesia's broilers business facing oversupply difficulties. *IOP Conference Series: Earth and Environmental Science, 478*(1), 012010. https://doi.org/10.1088/1755-1315/ 478/1/012010

Pakage, S., Hartono, B., Nugroho, B. A., & Iyai, D. A. (2018). Analisis struktur biaya dan pendapatan usaha peternakan ayam pedaging dengan menggunakan closed house system dan open house system. *Jurnal Peternakan Indonesia, 20*(3), 193–200. https://doi.org/10.25077/jpi.20.3.193-200.2018

Santoso, S. I., Sarjana, T. A., & Setiadi, A. (2018). Income analysis of closed house broiler farm with partnership business model. *Buletin Peternakan, 42*(2). https://doi.org/10.21059/ buletinpeternak.v42i2.33222

Sari, I. A. P. L., Susrusa, K. B., & Dewi, I. D. A. A. L. (2021). The income comparison of broiler farming that used closed house system and an open house system. *Soca: Jurnal Sosial Ekonomi Pertanian, 15*(2), 370. https://doi.org/10.24843/soca.2021.v15.i02.p12

Setiadi, A., Santoso, S. I., Mukson, M., & Roessali, W. (2022). Contract broiler farming as an effective pathway to improve rural prosperity in Indonesia. *International Social Science Journal, 72*(244), 461–473. https://doi.org/10.1111/issj.12330

Susanti, H. I. (2023). Study of closed-house systems in broiler production. *JIA (Jurnal Ilmiah Agribisnis): Jurnal Agribisnis dan Ilmu Sosial Ekonomi Pertanian, 8*(3), 214–219. https://doi.org/10.37149/jia.v8i3.188

Susanto, E., & Nursita, I. W. (2024). The effect of closed house cage type on broiler rearing on production performance of plasma farms at PT Mustika Jaya Lestari Madiun. *BIO Web of Conferences, 88*, 00013. https://doi.org/10.1051/bioconf/20248800013

Tafsin, M., Hanafi, N. D., Sadeli, A., & Farida, T. E. (2023). Analysis of biosecurity application in broiler chicken farms in North Sumatra. *Indonesian Journal of Agricultural Research, 6*(1), 51–56. https://doi.org/10.32734/injar.v6i01.8762

Teles, C. G. S., Gates, R. S., Souza, C. D. F., Tinôco, I. de F. F., & Vilela, M. d. O. (2020). Characterization of the thermal environment in broiler houses with different climate control systems. *Engenharia Agrícola, 40*(5), 571–580. https://doi.org/10.1590/1809-4430 - eng.agric.v40n5p571-580/2020

Wantasen, E., Umboh, S. J., & Leke, J. R. (2021). Investment advantages of broiler production using the partnership system: A study in Indonesia. *Journal of Agricultural Sciences – Sri Lanka, 16*(2), 215–225. https://doi.org/10.4038/jas.v16i2.9325

Yani, A., Suhardiyanto, H., Erizal, E., & Purwanto, B. P. (2014). Analysis of air temperature distribution in a closed house for broiler in wet tropical climate. Media Peternakan, 37(2), 87–94. https://doi.org/10.5398/medpet.2014.37.2.87