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Research article

Technical-Economic Evaluation of Contract Broiler Production through the Integration of Daily Production Data and Partnership Harvest and Production Report

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Abstract

The efficiency of contract broiler production is commonly assessed using the feed conversion ratio, average daily gain, depletion rate, harvest weight, and performance index, whereas the associated economic consequences are often interpreted separately. This case study evaluated the relationship between technical and economic indicators across three production periods of contract broiler rearing in Demak Regency by integrating daily production records and the Partnership Harvest and Production Report (PHPR). Secondary data were analyzed descriptively using variables including the number of birds harvested, harvest weight, harvest age, depletion, feed intake, FCR, ADG, PI, total sales, gross profit/loss, final farmer income, and total nucleus-company profit. Period 1 showed the best technical performance, with an FCR of 1.464, ADG of 66 g/day, average body weight of 2.31 kg/bird, and PI of 433. Period 2 had a lower PI, namely 396, but generated the highest total nucleus-company profit of IDR 78,145,293. Period 3 showed the greatest technical decline, with an FCR of 1.586, ADG of 50 g/day, average body weight of 1.51 kg/bird, PI of 303, a negative gross profit/loss of IDR 5,300,447, and final farmer income of IDR 0. These findings indicate that technical indicators and economic outcomes do not always move linearly. The integration of daily production data and PHPR can be used as a technical-economic audit instrument to improve harvest decisions, FCR evaluation, and transparency in contract broiler production.

Keywords: Contract broilers, FCR, Performance index, PHPR, Economic efficiency

INTRODUCTION

Broiler productivity is determined by the relationship among body-weight gain, feed intake, feed conversion efficiency, depletion, and harvest age. In commercial rearing practices, the feed conversion ratio (FCR), average daily gain (ADG), and performance index (PI) are frequently used to assess the ability of chickens to convert feed into live weight efficiently. Patterns of feed intake are also closely related to growth and feed-use efficiency; therefore, even small changes in feed intake or feed conversion may affect final broiler performance (Jie et al., 2024).

In contract broiler systems, technical indicators do not stand alone because production outcomes are directly linked to the cost structure of livestock production inputs, live-bird selling prices, and payment mechanisms for farmers. Techno-economic studies of broiler production show that profitability is influenced by feed costs, payments to farmers, and revenue from

the sale of live birds (Beal et al., 2023). In Indonesia, contract systems also position technical efficiency as an important issue because production contracts regulate input use, output sales, and risk distribution between the nucleus company and plasma farmers (Junaidi et al., 2023).

Tropical conditions add further complexity to broiler management. Broiler production in tropical regions faces challenges related to ambient temperature, feed availability and prices, as well as health and housing-environment pressures (Kpomasse et al., 2021). Heat stress can reduce feed intake and body-weight gain while increasing FCR and broiler mortality (Liu et al., 2020). Accordingly, the interpretation of production performance in contract systems needs to consider daily technical dynamics and the economic consequences that emerge at the end of the rearing period.

Previous studies have largely discussed broiler technical efficiency, production performance, or economic feasibility separately. The main research gap arises because studies that place daily recording and PHPR from the same flock within a single inter-period technical-economic audit framework remain limited. As a result, daily biological dynamics are often disconnected from the final financial consequences received by farmers and the nucleus company. Daily records reveal changes in feed intake, depletion, body weight, and production scores during rearing, whereas PHPR shows the actual economic outcomes of production outputs.

The novelty of this study lies in its technical-economic audit approach based on the integration of daily recording data and PHPR. This approach compares FCR, ADG, PI, depletion, and harvest weight, and then evaluates the movement of these technical indicators in relation to gross profit/loss, final farmer income, and total nucleus-company profit. This study aimed to evaluate changes in production performance and economic outcomes across three contract broiler rearing periods and to identify points of mismatch between biological and financial indicators.

MATERIALS AND METHODS

Research Design and Data Sources

This study employed a descriptive case-study design based on secondary data from three contract broiler production periods in one flock in Demak Regency, Central Java. The data analyzed included daily records and the Farmer Rearing Performance Recapitulation (PHPR). In this study, PHPR refers to the final recapitulation document issued by the nucleus company, which contains production performance, livestock production input components, live-bird sales, profit/loss, farmer income, and nucleus-company profit. Daily records were used to trace day-old chick (DOC) placement dates, final harvest dates, total harvest, feed used, DOC type, depletion, and internal production scores. PHPR was used as the final data source for production and financial performance.

No experimental treatment was applied because this study used operational data that were already available. Therefore, the analytical units were treated as three consecutive production cycles within the same flock rather than as an experimental design with treatment groups and biological replications.

Animals and Rearing Periods

The animals observed were commercial broilers under a contract scale of 14,000 birds per period. Period 1 used CP VAK DOC, with DOC placement on 31 December 2023 and closing on 08 February 2024. Period 2 used MBAI VAK DOC, with DOC placement on 24 February 2024 and closing on 03 April 2024. Period 3 used SPC VAK DOC, with DOC placement on 17 April 2024 and closing on 21 May 2024. Initial DOC weight was not reported in the operational documents and was therefore not included as an analytical variable.

The farmer's identity, flock name, bank account number, and detailed address were anonymized in this manuscript to maintain the confidentiality of operational data. The average harvest ages analyzed were derived from the final PHPR, namely 34.8 days in Period 1, 33.8 days in Period 2, and 30.2 days in Period 3.

Feed, Livestock Production Inputs, and Data Materials

Feed and livestock production inputs were recorded based on PHPR documents. Period 1 used feed recorded as BR0-NH, BR1-NH, B11 MTK, and B12 MTK. Period 2 used BR0-NH, BR1-NH, 8202TG, 9203GNT, and B12MTK WD. Period 3 used BR0-NH, BR1-NH, BR2-NH, and B12 MTK. The nutritional composition of the feeds was not included in the documents and was therefore not analyzed as a separate variable.

The data materials consisted of daily recording documents and PHPR generated by the production administration system of the nucleus company. No laboratory equipment or housing intervention was used in this study because all analyses were conducted on secondary data.

Research Variables

The technical variables included harvest (birds), harvest weight (kg), average body weight, average harvest age, depletion, feed used, feed intake per bird, actual FCR, standard FCR, FCR difference, ADG, PI,

and CL production score. The economic variables included total livestock production inputs, total live-bird sales, gross profit/loss, gross profit/loss per bird, final farmer income, total nucleus-company profit, profit/loss per bird, and profit/loss per kg. In this study, total nucleus-company profit refers to the profit of the nucleus company recorded in the PHPR after accounting for input-output components according to the contract scheme. This value is not interpreted as the aggregate profit of the entire contract system because farmer income is read as a separate economic indicator.

Statistical Analysis

Data were analyzed descriptively by comparing values across periods. Means and standard deviations (SD) were calculated to describe inter-period variation. Inferential testing and statistical significance levels were not used because the number of observation units consisted of only three production cycles; thus, the data were insufficient for drawing population-level statistical conclusions. The novelty analysis was conducted by interpreting the alignment and mismatch between technical and economic indicators.

RESULTS

To illustrate the technical position of each period, Table 1 summarizes the main production indicators across the three rearing periods. Period 1 showed the best technical performance, with an average body weight of 2.31 kg/bird, actual FCR of 1.464, ADG of 66 g/day, and PI of 433. Period 2 showed intermediate performance, with an FCR of 1.510, ADG of 62 g/day, and PI of 396. Period 3 had the lowest performance, with an average body weight of 1.51 kg/bird, FCR of 1.586, ADG of 50 g/day, and PI of 303.

Table 1. Summary of production performance across three contract broiler periods

Variable	Period 1	Period 2	Period 3	Mean ± SD
Harvest (birds)	13,282	13,427	13,536	13,415 ± 127
Harvest weight (kg)	30,696	28,345	20,398	26,480 ± 5,396
Average body weight (kg/bird)	2.31	2.11	1.51	1.98 ± 0.42
Average age (days)	34.80	33.80	30.20	32.93 ± 2.42
Depletion (%)	4.60	4.20	4.00	4.27 ± 0.31
Feed used (kg)	44,950	42,800	32,350	40,033 ± 6,740
Feed intake/bird (kg)	3.38	3.19	2.39	2.99 ± 0.53
Actual FCR	1.464	1.510	1.586	1.520 ± 0.062
Standard FCR	1.515	1.482	1.362	1.453 ± 0.081
FCR difference	-0.051	0.028	0.224	0.067 ± 0.142
ADG (g/day)	66	62	50	59 ± 8
PI	433	396	303	377 ± 67
CL production score	90	95	83	89 ± 6

Note: FCR = feed conversion ratio; ADG = average daily gain; PI = performance index; SD = standard deviation. The CL production score is an internal indicator recorded in the daily production records.

The FCR difference shows a shift in efficiency across periods. Period 1 had an actual FCR lower than the standard FCR, as indicated by an FCR difference of -0.051. Conversely, Period 3 had an FCR difference of 0.224, meaning that actual efficiency was poorer than the standard. This pattern moved in line with the decline in ADG from 66 g/day in Period 1 to 50 g/day in Period 3 and the decline in PI from 433 to 303.

Table 2. Summary of economic performance across three contract broiler periods

Variable	Period 1	Period 2	Period 3	Mean ± SD
Total livestock production inputs	556,220,979	547,378,947	446,707,747	516,769,224 ± 60,835,872
Total live-bird sales	647,501,370	603,133,550	441,407,300	564,014,073 ± 108,473,229
Gross profit/loss	91,280,391	55,754,603	-5,300,447	47,244,849 ± 48,849,529
Gross profit/loss/bird	6,520	3,982	-379	3,374 ± 3,489
Final farmer income	77,952,352	50,000,000	0	42,650,784 ± 39,492,411
Total nucleus-company profit	62,577,763	78,145,293	50,029,298	63,584,118 ± 14,084,987
Profit/loss/bird	4,470	5,582	3,574	4,542 ± 1,006
Profit/loss/kg	2,039	2,757	2,453	2,416 ± 360

Note: Rupiah values are presented based on PHPR recapitulation results; negative values indicate losses in the relevant component.

To interpret the financial consequences of production performance, Table 2 presents the economic summary based on PHPR documents. Period 1 generated the highest gross profit/loss of IDR 91,280,391 and the highest final farmer income of IDR 77,952,352. However, the highest total nucleus-company profit occurred in Period 2, namely IDR 78,145,293, although the PI of Period 2 was lower than that of Period 1. Period 3 was the weakest period from the farmer's perspective because the gross profit/loss was negative at IDR 5,300,447 and final farmer income was IDR 0, although total nucleus-company profit remained positive at IDR 50,029,298.

To clarify the relationship among indicators, Table 3 presents an inter-period technical-economic mismatch matrix. Period 1 had the highest PI and the highest final farmer income, but the highest total nucleus-company profit occurred in Period 2. Period 3 showed the strongest technical decline and ended with final farmer income of IDR 0, while total nucleus-company profit remained positive.

Table 3. Inter-period technical-economic mismatch matrix

Period	PI rank	Total profit rank	Final farmer income rank	Interpretation
Period 1	1	2	1	Best technical performance and highest farmer income, but nucleus-company profit was not the highest.
Period 2	2	1	2	PI was lower than in Period 1, but total nucleus-company profit was the highest.
Period 3	3	3	3	Lowest technical performance, negative gross profit, and final farmer income of IDR 0.

DISCUSSION

Period 1 showed the strongest combination of harvest weight, harvest age, FCR, ADG, and PI. The actual FCR of 1.464, which was lower than the standard FCR of 1.515, indicates that feed was converted into live weight more efficiently than the standard reference. This condition explains the achievement of an average body weight of 2.31 kg/bird and a PI of 433. Biologically, this finding is consistent with the concept that feed intake and its utilization are important determinants of broiler growth (Jie et al., 2024). Commercial data on broilers reared under tropical conditions also show that body weight, feed intake, weight gain, FCR, and mortality should be interpreted as a set of interrelated growth indicators; therefore, periodic recording can support management decisions before harvest age (Quintana-Ospina et al., 2023).

Period 3 showed the clearest decline in performance. The average body weight was only 1.51 kg/bird at an average age of 30.2 days, with an actual FCR of 1.586, ADG of 50 g/day, and PI of 303. The CL production score in Period 3 was also lower than in the previous two periods. This condition indicates that performance decline was not only evident in the PHPR but was also reflected in the internal indicators recorded in the daily production records. Reading daily indicators is important because changes in body weight, feed intake, and feed efficiency can provide early signals of final body weight and FCR at harvest age (Quintana-Ospina et al., 2023).

The biological causes of the decline in Period 3 cannot be concluded causally from the available data. The dataset did not include temperature, humidity, stocking density, disease status, litter quality, ventilation, or detailed feed-nutrient composition. Therefore, the possible effects of heat stress, housing management, or health status should be positioned as assumptions that require further testing in subsequent research. The literature shows that tropical conditions and heat stress can reduce feed intake and growth, worsen FCR, and increase the risk of broiler mortality (Kpomasse et al., 2021; Liu et al., 2020). The absence of environmental variables in the operational dataset also limits the ability of the analysis to separate biological, managerial, and economic effects on final performance (Quintana-Ospina et al., 2023).

The most important aspect of the findings is the misalignment between technical performance and economic outcomes. Period 1 had the best biological performance and the highest final farmer income, but the highest total nucleus-company profit occurred in Period 2. This mismatch emerged because technical indicators measure biological efficiency, whereas economic indicators are driven by live-bird prices, the price and volume of livestock production inputs, DOC purchase costs, feed margins, medication and vaccine margins, risk-sharing arrangements, and payment mechanisms within the contract. Under different cost and price structures across periods, a lower PI may still produce higher nucleus-company profit when the input-output margin of the nucleus company is larger. This

finding is consistent with techno-economic analyses of broiler production that identify feed costs, farmer payments, and revenue from live-bird sales as key determinants of profitability (Beal et al., 2023). Studies of broiler profitability also emphasize that feed prices, DOC prices, labor costs, medicines, vaccines, and veterinary services can affect farmers' business margins (Phiri et al., 2023).

The novelty of this study lies in the interpretation of technical-economic mismatch within the same flock across three consecutive periods. In Period 3, the farmer did not receive final income because the gross result was negative, whereas total nucleus-company profit remained positive. This pattern demonstrates the difference between profit based on rearing performance and profit based on the input-output chain structure in contract farming. In Indonesia, broiler contract farming is related to farmer technical efficiency, productivity, and plasma-farmer satisfaction; therefore, economic analysis of contract systems needs to position contracts, inputs, technical assistance, and payment schemes as part of performance evaluation (Junaidi et al., 2023; Rondhi et al., 2023; Febrianto et al., 2024). Accordingly, PHPR functions not only as a payment document but also as an instrument for mapping the distribution of risks and economic benefits in contract broiler enterprises.

The practical implication is that contract broiler evaluation should not stop at PI or FCR values. The nucleus company and farmers need to interpret daily data together with PHPR to identify loss points early, particularly when the FCR difference widens, ADG declines, actual body weight falls behind the standard, or internal production scores decrease. This approach can improve the quality of technical assistance, refine harvest-timing decisions, and strengthen the transparency of business evaluation. Strengthening assistance and implementing best practices are relevant to findings on broiler plasma farmers in Indonesia, which show that technical efficiency and farmer satisfaction are associated with facilities, the role of field officers, and farmers' management capacity (Febrianto et al., 2024).

The integrative approach can also be developed as an early-warning system. Changes in actual body weight relative to the standard, widening FCR differences, declining ADG, and reduced CL production scores can be assigned evaluation thresholds before the harvest period ends. When these indicators are linked with projected harvest prices and livestock input costs, the nucleus company and farmers can obtain a more objective basis for deciding technical interventions, harvest scheduling, and loss-risk mitigation. The use of growth and FCR data at a commercial scale supports such decision models because performance data can help managers predict harvest outcomes and optimize production efficiency (Quintana-Ospina et al., 2023).

At the operational level, the mismatch indicates that harvest decisions need to be evaluated through two layers of indicators: biological indicators and financial indicators. A high PI remains important because it reflects technical efficiency, but this value does not fully explain profit distribution when live-bird prices, livestock input margins, and payment schemes change across periods. In contract systems, contract farming can improve technical efficiency, but its economic impact is still influenced by the incentive structure and risk-sharing arrangements in the contract (Rondhi et al., 2023; Junaidi et al., 2023). Thus, performance evaluation of contract broilers needs to place FCR, ADG, harvest weight, and depletion as the basis for technical assessment, while PHPR should be used to interpret the actual financial impact on farmers and the nucleus company.

This study was limited to three production periods from a single flock; therefore, the results cannot be generalized to all contract broiler systems. The available data also did not include temperature, humidity, stocking density, air quality, disease status, detailed vaccination programs, litter quality, or feed-nutrient composition. Consequently, the findings are more appropriately positioned as an exploratory case study that generates an initial analytical framework rather than causal evidence.

CONCLUSION

The integration of daily recording data and PHPR showed that the technical performance of contract broilers does not always move in parallel with final economic outcomes. Period 1 had the best technical performance, with an FCR of 1.464, ADG of 66 g/day, PI of 433, and the highest final farmer income of IDR 77,952,352. Period 2 had a lower PI but generated the highest total nucleus-company profit of IDR 78,145,293. Period 3 showed the greatest technical decline, with an FCR of 1.586, ADG of 50 g/day, PI of 303, negative gross profit/loss, and final farmer income of IDR 0. These findings confirm that contract broiler evaluation needs to use an integrated technical-economic approach rather than a single production indicator. In practical terms, the nucleus company and farmers can use PHPR as an instrument for performance auditing, contract transparency, and the establishment of evaluation thresholds for FCR, ADG, actual body weight, and projected margins before harvest.

AUTHOR CONTRIBUTIONS

Achmad Muzakky Dityana: conceptualization, data curation, data analysis, and writing of the original draft. Raditya Nandhirabrata, Nur Hafidzah Devi Kartika, and Sukmawati Utami: supervision, validation, review, and manuscript editing. These contribution details should be adjusted according to the actual role of each author before manuscript submission.

CONFLICT OF INTEREST

The authors declare no conflict of interest related to the preparation of this article. This statement should be revised if the authors have employment relationships, data ownership, or financial interests involving the nucleus company, farmers, or other parties related to the research data.

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