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Full-Costing Analysis of Layer Egg Production Costs and Price Adequacy: A Case Study of Denis Farm, Maros Regency, Indonesia

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A B S T R A C T

This case study analyzed production cost and price adequacy at Denis Farm, Maros Regency, Indonesia, using a full-costing approach. Data were collected through farm observation, owner interviews, and monthly operational records for January–December 2024. Costs were classified into direct inputs, direct labor, variable overhead, and fixed overhead. Denis Farm produced 166,775 trays at an audited annual cost of Rp3,550,915,530, or Rp21,292 per tray. All egg categories sold above full cost, indicating that 2024 selling prices were adequate at the annual level

INTRODUCTION

Layer egg farming is an important agribusiness activity because eggs provide an affordable and widely consumed source of animal protein, and eggs have been highlighted as a cost-efficient nutrient source for food-insecure populations (Walker & Baum, 2022). In many Indonesian rural economies, layer farms also function as commercial enterprises that connect feed suppliers, pullet producers, farm labor, traders, and household consumers. Smallholder poultry production also contributes to income generation, poverty reduction, and food security in low-resource settings (Birhanu *et al*., 2023). The economic sustainability of these farms depends not only on biological productivity but also on the farm manager's ability to identify the full cost of production and translate that information into realistic selling prices. Eggs are perishable products sold in competitive local markets; therefore, pricing decisions that rely only on prevailing market prices may conceal cost escalation, especially when feed or replacement pullet prices increase.

Denis Farm is a layer egg enterprise located in Bontomanai Village, Tompobulu District, Maros Regency, South Sulawesi. The farm was established in 2021 with approximately 3,500 hens in one cage unit and expanded to 10,500 birds in three cage units by 2024. This growth indicates a transition from an initial small-scale business to a more structured medium-scale layer operation. The farm produces three sales categories: mixed eggs, cracked eggs, and jumbo eggs. Each category has a different selling price, making it necessary to evaluate whether the average cost per tray is covered by each category's market price.

The practical issue addressed in this article is that the farm's product prices must be evaluated against a defensible cost baseline. A producer may observe positive cash receipts from sales but still lack an accurate unit-cost estimate if the calculation excludes pullets, depreciation, fixed support labor, or veterinary expenditure. Conversely, an annual cost calculation may appear high if a large pullet investment is charged entirely to the first month rather than allocated across its useful laying period. A transparent full-costing analysis is therefore needed to distinguish between short-term monthly cash pressure and annual cost coverage.

This study uses the Denis Farm case to answer two specific questions. First, what is the audited production cost per tray of layer eggs when all identifiable direct and overhead costs are included? Second, can the selling prices of mixed, cracked, and jumbo eggs cover the full production cost incurred during the 2024 operating year? The novelty of the case lies in combining detailed monthly production and sales records with itemized cost components from a growing layer enterprise in Maros Regency. The article contributes practical evidence for farm-level cost accounting and provides a structured example of how full costing can support pricing decisions in poultry agribusiness.

LITERATURE REVIEW

Full-Costing Theory and Layer-Farm Cost Structure

The production cost of layer eggs is multidimensional. It includes the purchase or rearing of pullets, compound feed or feed ingredients, wages for workers directly handling flock management, veterinary and preventive health

inputs, utilities, indirect labor, and depreciation of cages and equipment. Recent layer-farm studies similarly treat seed or pullet cost, feed, labor, electricity, vaccines, vitamins, and medicine as income-relevant production-cost variables (Afandi *et al*., 2020; Haruna *et al*., 2025; Priyono *et al*., 2024). Standard cost-accounting theory separates these elements into direct materials, direct labor, and manufacturing overhead so that the unit cost of output can be estimated consistently (Siregar *et al*., 2016; Mulyadi, 2015). Under absorption or full costing, both variable and fixed production overheads are assigned to products, a logic that is consistent with the principle that inventory cost includes purchase costs, conversion costs, and other costs necessary to bring products to their present condition (IFRS Foundation, 2024).

Full costing is particularly relevant for poultry agribusiness because many production costs are not visible in daily cash transactions. Feed is purchased repeatedly and is easily recognized as a cost, and empirical evidence shows that feed often accounts for the largest portion of layer production costs and profitability variation (Afandi *et al*., 2020; Clark *et al*., 2019). However, depreciation of cages, water systems, batteries, scales, and other equipment is frequently overlooked in small and medium farms. Similarly, indirect labor or fixed support activities may be treated as general household expenses rather than production costs. When such costs are omitted, the calculated cost per tray can be understated and selling prices may appear profitable even when long-term asset replacement and labor requirements have not been fully covered.

Previous studies on production cost calculation emphasize that full costing can provide a more complete basis for price determination than partial or variable-cost approaches because it captures direct inputs, labor, and overhead components (Bustami & Nurlela, 2013; Mulyadi, 2015). In farm-level applications, full costing can help owners estimate price floors, assess monthly profitability, evaluate the contribution of major cost drivers, and identify areas where efficiency improvements are possible. Recent Scopus-indexed poultry studies also show that production-cost management, particularly feed, labor, seed or pullet, electricity, vaccine, and vitamin costs, is closely related to layer-farm income and resilience (Afandi *et al*., 2020; Haruna *et al*., 2025; Priyono *et al*., 2024). Indonesian studies on egg and food-product enterprises have similarly used full costing to evaluate whether selling prices reflect actual production expenditure (Lesmana & Saputri, 2019; Resiada, 2024; Zahro, 2022).

In this case study, production cost is interpreted as the sum of direct production inputs, direct labor, variable overhead, and fixed overhead, while price adequacy is assessed by comparing the full production cost per tray with the weighted average selling price of each egg category.

METHODOLOGY

Research Design and Study Site

This research used a descriptive quantitative case-study design. The case-study approach was selected because the objective was not to generalize statistically across all layer farms but to examine the complete cost structure of one operating enterprise in detail. The study site was Denis Farm, located in

Bontomanai Village, Tompobulu District, Maros Regency, South Sulawesi, Indonesia. Field data collection was conducted in May 2025, while the financial and production records analyzed covered the period from January to December 2024.

Denis Farm was suitable for this case because it had already passed its initial establishment phase and had expanded its productive capacity. The farm began operations in 2021 with one cage unit containing approximately 3,500 layer hens. By 2024, the operation had three cage units with 10,500 pullets of the Isa Brown strain. This production scale generated sufficient monthly records to analyze cost behavior, production volume, revenue, and unit cost over a full operating year.

Data Sources and Data Collection

Data were obtained from three sources: direct observation of the farm, interviews with the farm owner, and review of the farm's operational records. Observation was used to verify the general farm setting, cage system, equipment, and production process. Interviews were used to obtain explanations about the history of the enterprise, flock capacity, feed formulation, labor arrangement, vaccination and medication practices, and the way eggs were sorted and sold.

The quantitative records consisted of monthly production volumes, monthly selling prices, sales revenue, direct input costs, wage costs, veterinary costs, utility expenses, indirect labor, and depreciation estimates. Production was recorded in trays, locally referred to as rak, and classified into mixed eggs, cracked eggs, and jumbo eggs. Cost records included pullet purchase, concentrate, corn, rice bran, direct labor, vaccines, medicines and vitamins, electricity and water, indirect labor, cage depreciation, and equipment depreciation.

Full-Costing Classification and Calculation

The analytical method followed a full-costing framework, in which all production-related costs were assigned to the cost of eggs. Direct production inputs included pullet purchase and feed ingredients. Feed consisted of concentrate, corn, and rice bran. Direct labor consisted of wages paid to workers who were directly involved in operational cage activities, including feeding, watering, cleaning, egg collection, and flock health routines.

Production overhead was divided into variable and fixed components. Variable overhead consisted of vaccines, medicines and vitamins, electricity, and water. Fixed overhead consisted of indirect labor and depreciation of cages and equipment. Depreciation was taken from the farm's straight-line depreciation schedule, which was based on acquisition value, estimated residual value, and economic life as recorded in the thesis data. This classification follows the principle that production cost should incorporate direct material, direct labor, and overhead components (Mulyadi, 2015; Siregar *et al*., 2016), and it is consistent with empirical layer-farm cost studies that incorporate feed, seed or pullet, health inputs, labor, utilities, and other operating costs when evaluating income or profitability (Afandi *et al*., 2020; Haruna *et al*., 2025; Priyono *et al*., 2024).

The total production cost was calculated as the sum of direct production inputs, direct labor, variable overhead, and fixed overhead. The average production cost per tray, hereafter referred to as HPPr, was calculated by dividing total annual production cost by total annual egg production in trays. Revenue was calculated by multiplying monthly production quantity by the corresponding selling price for each egg category. Profitability was assessed by comparing annual revenue with full production cost and by comparing the weighted average selling price of each product category with the annual HPPr.

Data Validation and Audit Procedure

A numerical audit was conducted before drafting the article because the source thesis contained several internal inconsistencies among its summary, monthly, and annual tables. The abstract reported an annual production cost of Rp3,637,794,500 and HPPr of Rp21,812 per tray, whereas the final annual cost table reported Rp3,626,315,530 and HPPr of Rp21,743 per tray. A direct summation of the itemized annual cost components yielded Rp3,550,915,530 and HPPr of Rp21,292 per tray. In addition, the September production subtotal in the source table was inconsistent with the sum of the three egg categories.

To maintain analytical traceability, this manuscript prioritizes itemized cost and production data over conflicting summary totals. The audited annual production volume was calculated from the sum of the three product categories: 99,020 mixed trays, 1,755 cracked trays, and 66,000 jumbo trays, giving 166,775 trays. The audited production cost was calculated directly from the listed cost components. This approach preserves the original farm records while preventing arithmetic inconsistencies from affecting the final cost and profitability estimates.

RESEARCH RESULT

Farm Profile and Production Volume

Denis Farm is located away from dense settlement areas, with vacant land on the northern and eastern sides, a river on the southern side, and PT Catur Pangan Makmur on the western side. The location supports poultry operations because it reduces direct disturbance to surrounding communities. The farm was founded by Ir. Muhammad Arsyad, S.Pi., who had more than 20 years of experience in livestock-related work, including approximately 25 years in an animal feed company. This background shaped the farm's technical and managerial orientation.

In 2024, Denis Farm operated three cage units and maintained 10,500 Isa Brown pullets. The farm produced eggs in three market categories: mixed eggs, cracked eggs, and jumbo eggs. Total annual production reached 166,775 trays. Mixed eggs accounted for 99,020 trays or 59.37% of annual output, jumbo eggs accounted for 66,000 trays or 39.57%, and cracked eggs accounted for 1,755 trays or 1.05%. Monthly production declined from 15,700 trays in January to 11,585 trays in December, reflecting variation in laying performance and production conditions across the year.

Table 1. Monthly layer egg production by product category at Denis Farm in 2024

Month	Mixed eggs (trays)	Cracked eggs (trays)	Jumbo eggs (trays)	Total production (trays)
January	9.000	200	6.500	15.700
February	8.900	190	6.300	15.390
March	8.800	175	6.000	14.975
April	8.500	160	5.900	14.560
May	8.300	180	5.800	14.280
June	8.000	150	5.500	13.650
July	8.980	145	5.700	14.825
August	8.850	135	5.600	14.585
September	7.600	120	5.400	13.120
October	7.590	115	4.000	11.705
November	7.500	100	4.800	12.400
December	7.000	85	4.500	11.585
Total	99.020	1.755	66.000	166.775

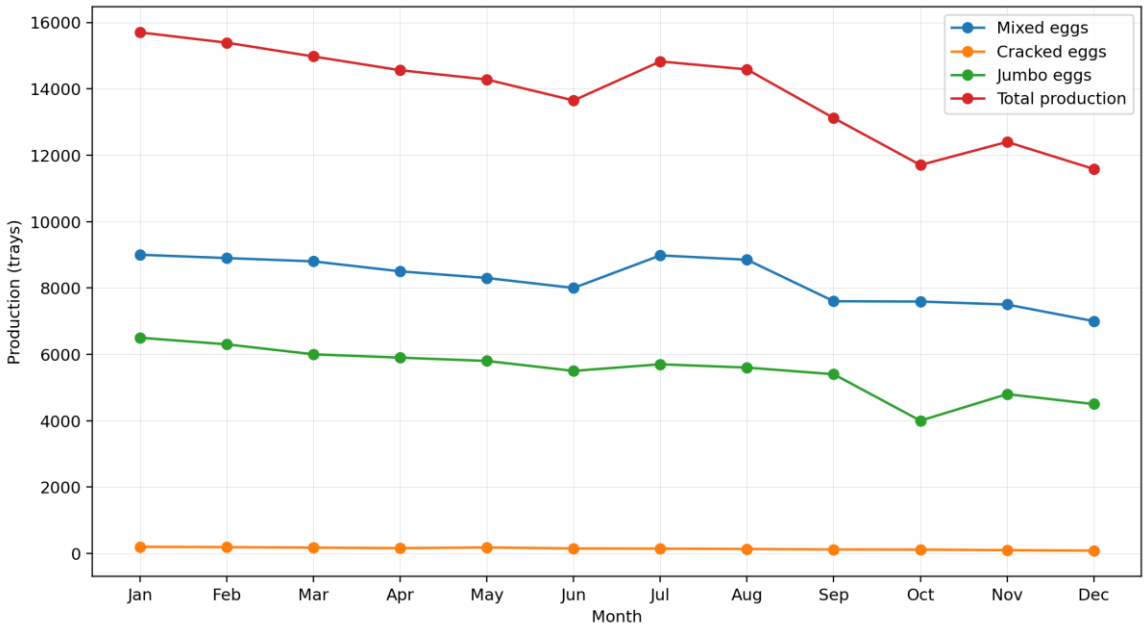

Figure 1. Monthly layer egg production by product category at Denis Farm in 2024

Figure 1 illustrates that monthly egg production generally declined during the 2024 observation period, from 15,700 trays in January to 11,585 trays in December. Mixed eggs consistently formed the largest output category, while jumbo eggs made a substantial secondary contribution and cracked eggs remained a small fraction of total production. This pattern suggests that the farm maintained

a commercially favorable product composition, although the downward movement in total output indicates the need to monitor flock performance, feed efficiency, and production-cycle effects over time.

Annual Production Cost Structure

The audited annual production cost of Denis Farm was Rp3,550,915,530. The cost structure was highly concentrated in direct production inputs, particularly feed and pullet purchase. Feed ingredients consisting of concentrate, corn, and rice bran totaled Rp2,676,984,000, equal to 75.39% of total cost. Pullet purchase amounted to Rp630,000,000, representing 17.74% of total cost. Together, feed and pullets accounted for 93.13% of full production cost, indicating that the farm's cost performance was primarily determined by biological inputs and feed procurement.

Labor and overhead costs were smaller but still essential for a complete unit-cost estimate. Direct labor reached Rp84,000,000, while indirect labor was Rp24,000,000. Variable overhead consisted of vaccines worth Rp13,750,000, medicines and vitamins worth Rp8,760,000, and electricity and water worth Rp33,300,000. Cage and equipment depreciation was Rp80,121,530. Although depreciation represented only 2.26% of audited annual cost, excluding it would understate the long-term cost of maintaining productive capacity.

Table 2. Audited annual full-costing structure of Denis Farm in 2024

Cost component	Cost classification	Amount (Rp)	Share of total cost
Pullet purchase	Direct production input	630.000.000	17.74%
Feed ingredients: concentrate, corn, and rice bran	Direct production input	2.676.984.000	75.39%
Direct labor	Direct labor	84.000.000	2.37%
Vaccines	Variable overhead	13.750.000	0.39%
Medicines and vitamins	Variable overhead	8.760.000	0.25%
Electricity and water	Variable overhead	33.300.000	0.94%
Indirect labor	Fixed overhead	24.000.000	0.68%
Cage and equipment depreciation	Fixed overhead	80.121.530	2.26%
Total production cost		3.550.915.530	100.00%

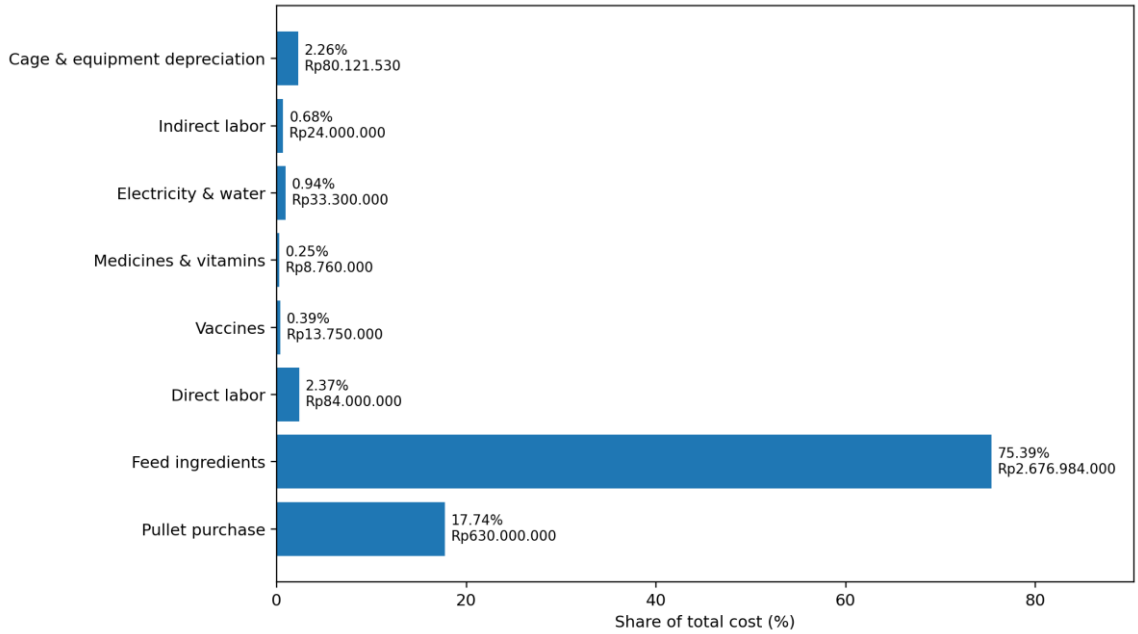

Figure 2. Cost structure of layer egg production at Denis Farm in 2024

Figure 2 confirms that Denis Farm had a highly concentrated cost structure. Feed ingredients accounted for 75.39% of total production cost, while pullet purchase contributed 17.74%; together, these two components represented 93.13% of audited full cost. This cost profile indicates that changes in feed prices, feed formulation, pullet procurement, and biological productivity would have a much larger effect on HPPr than changes in relatively small overhead components. Therefore, cost control should prioritize feed management and pullet-cost allocation without ignoring depreciation and support labor.

Revenue by egg category

Annual sales revenue was Rp7,963,560,000. Mixed eggs generated Rp4,534,910,000 or 56.94% of total revenue, jumbo eggs generated Rp3,371,600,000 or 42.34%, and cracked eggs generated Rp57,050,000 or 0.72%. The revenue pattern was therefore consistent with the production pattern: mixed eggs dominated total output and revenue, while jumbo eggs contributed a large share of revenue because they were sold at higher prices per tray.

Selling prices varied by category and month. Mixed eggs were sold between Rp45,000 and Rp47,000 per tray. Cracked eggs were sold between Rp30,000 and Rp35,000 per tray, reflecting their lower quality and reduced market value. Jumbo eggs were sold between Rp48,000 and Rp55,000 per tray, providing the highest price premium. The weighted average selling prices were Rp45,798 for mixed eggs, Rp32,507 for cracked eggs, and Rp51,085 for jumbo eggs.

Table 3. Annual production, revenue, and weighted average selling price by egg category

Egg category	Production (trays)	Revenue (Rp)	Share of revenue	Weighted average price (Rp/tray)
Mixed eggs	99.020	4.534.910.000	56.95%	45.798
Cracked eggs	1.755	57.050.000	0.72%	32.507
Jumbo eggs	66.000	3.371.600.000	42.34%	51.085
Total/average	166.775	7.963.560.000	100.00%	47.750

Production Cost Per Tray and Price Adequacy

The audited annual HPPr was Rp21,292 per tray, calculated by dividing Rp3,550,915,530 in full production cost by 166,775 trays. This value represents the average full cost of producing one tray of eggs across all categories during the 2024 production year. Because the calculation incorporates pullets, feed, direct labor, variable overhead, fixed overhead, and depreciation, it provides a more comprehensive cost floor than a cash-based or feed-only calculation. This is important because feed-only or partial-cost indicators can overlook other income-relevant expenses, including labor, electricity, vaccines, vitamins, and pullet or seed costs (Haruna *et al*., 2025; Priyono *et al*., 2024).

All weighted average selling prices were above the audited HPPr. Mixed eggs generated an average margin of Rp24,506 per tray, cracked eggs generated Rp11,215 per tray, and jumbo eggs generated Rp29,793 per tray. At the annual level, total revenue exceeded audited production cost by Rp4,412,644,470, equivalent to a sales margin of 55.41%. These results indicate that Denis Farm's 2024 selling prices were sufficient to cover full production costs when evaluated over the complete annual period.

The monthly data also show the importance of cost allocation. If the full pullet purchase is charged to January, the January HPPr becomes substantially higher than prices in that month, generating a short-term accounting loss in all categories. However, this pattern reflects the timing of a major biological input purchase rather than a persistent inability of selling prices to cover operating costs. After the initial month, monthly selling prices were generally above monthly unit-cost estimates. This reinforces the need for farm managers to distinguish between investment-timing effects and recurring cost-price relationships.

Table 4. Annual price adequacy based on audited HPPr

Egg category	Weighted average price (Rp/tray)	Audited HPPr (Rp/tray)	Margin (Rp/tray)	Price covers full cost?
Mixed eggs	45.798	21.292	24.506	Yes
Cracked eggs	32.507	21.292	11.215	Yes
Jumbo eggs	51.085	21.292	29.793	Yes
Overall average	47.750	21.292	26.459	Yes

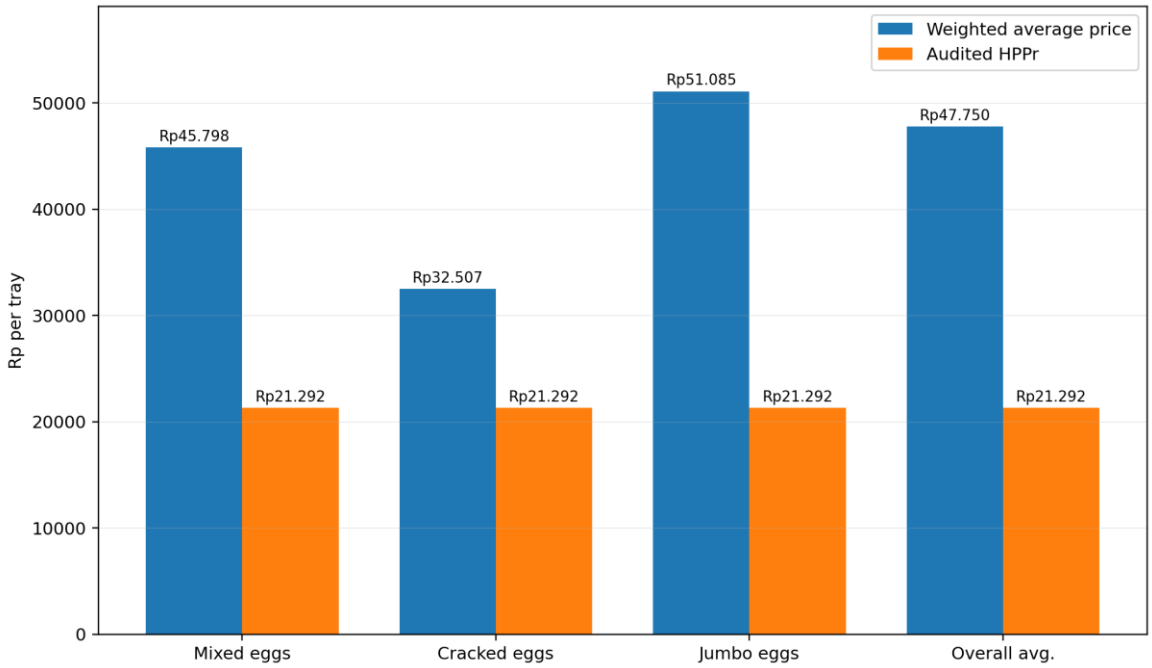

Figure 3. Comparison between weighted average selling price and audited production cost per tray

Figure 3 shows that the weighted average selling price of every egg category was above the audited HPPr of Rp21,292 per tray. Jumbo eggs generated the widest margin, followed by mixed eggs, while cracked eggs remained profitable but had the narrowest margin. The comparison supports the conclusion that the farm's 2024 selling prices were adequate to cover full production costs at the annual level. However, the smaller margin for cracked eggs highlights the importance of reducing egg damage and maintaining a higher proportion of market-preferred egg grades.

DISCUSSION

Implications of a Feed-Dominated Cost Structure

The results show that Denis Farm's cost structure was overwhelmingly dominated by feed and pullet purchase. This finding is consistent with the biological nature of layer farming, where feed intake is the primary recurring input required to sustain egg production. In the audited calculation, feed alone represented 75.39% of full production cost. This proportion is comparable with layer-farm evidence from Blitar, East Java, where feed was reported to contribute 60%-80% of total production costs (Afandi *et al.*, 2020), and with experimental evidence that feed accounts for the largest share of egg production cost while feed conversion ratio varies substantially among hens (Clark *et al.*, 2019). Such a cost profile implies that the farm's profitability is highly sensitive to feed ingredient prices, ration formulation, procurement timing, and feed conversion efficiency. Even small percentage changes in concentrate, corn, or rice bran prices can materially alter the HPPr because these inputs form the largest cost pool.

The large pullet cost also affects interpretation of monthly profitability. Pullet purchase is a biological investment that enables future egg production. When charged entirely to the first month, it creates an artificially high monthly unit cost at the start of the production cycle. A farm may therefore appear to lose money in the first month even when the annual production cycle is profitable. For management purposes, the farm should track both cash expenditure and cost allocation. Cash records help identify liquidity needs, whereas allocated cost records provide a more stable estimate of production cost across the laying period. This distinction is supported by Indonesian layer-farm studies showing that operational costs may rise while farms can still maintain or recover profitability when cost management and production performance are controlled over the production period (Priyono *et al*., 2024).

Full Costing as a Pricing and Managerial Tool

Full costing produced an annual HPPr of Rp21,292 per tray, which can function as a minimum cost benchmark for pricing decisions. This benchmark is especially useful because the farm sells three categories of eggs at different prices. Cracked eggs have the lowest selling price and therefore the smallest margin above cost, while jumbo eggs provide the largest margin. Without a full-costing calculation, the farm could underestimate the importance of maintaining the share of higher-valued egg categories and reducing the proportion of cracked eggs. The small share of cracked eggs in annual output, 1.05%, limited its negative effect on total revenue.

The weighted average selling price of Rp47,750 per tray was more than double the audited HPPr. This produced a strong annual operating surplus. However, this outcome should not be interpreted as a guarantee of future profitability. Egg prices are market-dependent and can decline, while feed prices may rise. The main managerial value of full costing is therefore not only to confirm that the 2024 prices were adequate but also to create an early-warning system. If the HPPr approaches the lower selling price of cracked eggs or mixed eggs, the farm would need to revise its pricing strategy, improve feed efficiency, or reduce controllable overheads. This recommendation is consistent with evidence that production cost management and farmer experience are key determinants of layer-farm income in South Sulawesi (Haruna *et al*., 2025).

Record Quality and Cost-Accounting Discipline

The numerical audit revealed inconsistencies among several summary figures in the source data. Such inconsistencies are common when farms maintain records primarily for operational use rather than formal managerial accounting. In this case, the annual total in the abstract, the annual total in the summary table, the sum of monthly cost records, and the sum of itemized annual cost components did not fully match. Production subtotals also required checking against product-category quantities. This does not invalidate the case study, but it highlights the importance of reconciliation before cost data are used for pricing decisions or publication.

Improved record discipline would increase the reliability of future analyses. The farm should maintain a standardized monthly cost ledger that separates cash outflows from allocated costs. Pullet purchase should be recorded as a biological production investment and allocated systematically over the relevant laying cycle. Depreciation schedules should be reviewed annually, and all equipment items should be reconciled with acquisition cost, residual value, and useful life. Production records should be checked so that category subtotals match monthly totals. These improvements would allow the owner to calculate monthly HPPr more accurately and to compare performance across production cycles.

Practical Implications for Layer Egg Farms

For comparable layer farms, the Denis Farm case demonstrates that price adequacy should be evaluated against the full cost of production rather than only against feed cost or cash expenditure. Full costing makes the economic role of fixed assets visible and helps ensure that cage and equipment replacement is financially planned. It also supports more rational decisions about product grading. Because jumbo eggs produced the highest margin per tray, maintaining flock health, nutrition, and production conditions that support premium egg categories can strengthen revenue performance. This is aligned with evidence that feed, vaccine, vitamin, electricity, labor, and pullet or seed costs affect layer-farm income and should be monitored as managerial variables (Afandi *et al*., 2020; Haruna *et al*., 2025). At the same time, preventing cracked eggs remains important because cracked eggs receive a much lower price.

The analysis also shows that annual profitability can coexist with monthly cost pressure. Farms that purchase pullets at the start of a production cycle may need working capital even when the full-year business is profitable. Therefore, pricing policy should be accompanied by cash-flow planning. A farm owner can use the HPPr as a cost floor, the weighted average selling price as a market indicator, and the product-grade margin as a guide for operational improvement. This integrated view is more useful than a single annual profit figure because it links accounting information to daily management decisions and supports the broader role of poultry enterprises in household income and food-security resilience (Birhanu *et al*., 2023; Priyono *et al*., 2024).

CONCLUSIONS AND RECOMMENDATIONS

The full-costing analysis shows that Denis Farm produced 166,775 trays of layer eggs during 2024 and incurred an audited annual production cost of Rp3,550,915,530. The average production cost was Rp21,292 per tray. The cost structure was dominated by feed inputs, which accounted for 75.39% of total cost, followed by pullet purchase at 17.74%. Annual revenue reached Rp7,963,560,000, producing an estimated operating surplus of Rp4,412,644,470 and a sales margin of 55.41%. The weighted average selling prices of mixed eggs, cracked eggs, and jumbo eggs were all higher than the audited HPPr, indicating that the farm's 2024 prices were sufficient to cover full production costs at the annual level. However, the results also show that profitability interpretation depends on cost allocation, particularly for pullet purchase at the beginning of the production cycle. This

study contributes a practical full-costing model for layer egg agribusiness by demonstrating how itemized cost records, production volume, product grading, and selling prices can be integrated into a transparent unit-cost estimate.

ADVANCED RESEARCH

In line with recent layer-farm literature, future studies should compare full costing with variable costing, allocate pullet cost across the laying cycle, and evaluate sensitivity to feed-price changes so that farm managers can strengthen pricing decisions under volatile market conditions (Afandi *et al*., 2020; Clark *et al*., 2019; Haruna *et al*., 2025).

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