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ECONOMIC EFFICIENCY AND PROFITABILITY OF PRODUCING HATCHING EGGS AND COMMERCIAL DAY-OLD CHICKS: A COMPARATIVE ANALYSIS OF THREE POULTRY BREEDING CENTERS IN BHUTAN

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ABSTRACT: *Poultry production plays an important role in rural livelihoods and food security in Bhutan, yet limited studies exist on its cost structures. The aim of this study was to investigate the financial efficiency and profitability of three regional poultry breeding centers in Bhutan namely Regional Poultry Breeding Center (Paro), National Poultry Development Center (Sarpang), and Regional Pig and Poultry Breeding Center (Lingmithang) to understand their economic performance and financial viability. Through comparative cost analysis and financial indicators such as Return on Investment (ROI), Break-even Point (BEP), and Benefit-Cost Ratio (BCR), the research identified key cost drivers and performance disparities among the centers. Feed emerged as the highest cost contributor, comprising over 56% of the total cost of production across all the centers, followed by labor cost, which ranged from 25.79% to 34.74%. The cost of producing a hatching egg varied from Nu. 19 at RPBC to Nu. 31 at RPPBC, while the cost per DOC ranged from Nu. 49 to Nu. 70. Despite these operations, all centers operated at a loss during the production cycle of 2023-2024, with ROI figures falling between – 68.05% and – 76.16%. The current subsidized DOC selling price of Nu. 30 is insufficient, with break-even prices estimated at Nu. 93.30 (RPBC), Nu. 125.84 (NPDC), and Nu. 135.31 (RPPBC). The findings point to inefficiencies rooted in cost management and infrastructure, underscoring the need for region-specific strategies, such as improved feed utilization and labor productivity, to strengthen the long-term viability of Bhutan's poultry breeding centers.*

Keywords: Benefit-Cost Ratio; Cost of production; Day-Old Chick (DOC); Hatching eggs; Return on Investment.

1. INTRODUCTION

In Bhutan, modern poultry production took root during the First Five-Year Plan in 1961, transitioning from traditional indigenous chicken rearing to structured farming systems with introduced breeds like Rhode Island Red and Australop in government-run farms in Paro and Samtse (Tashi et al. 2022). Today, poultry holds the highest livestock population share, with 819,335 birds and an annual production of 85 million eggs as of 2023 (NSB, 2023). The three regional poultry breeding farms - RPBC (Paro), NPDC (Sarpang), and RPPBC (Lingmithang) are the backbone of Bhutan's DOCs supply system(Gyeltshen 2011). DOCs, especially the Hy-line Brown breed, are sold to farmers at a subsidized rate of Nu. 30 per chick. However, limited research exists on the cost of producing hatching eggs and DOC production in these centers.

Understanding the cost of production (COP) is crucial, as it directly affects profitability. Previous studies indicated that 17% of variable costs in broiler farms were spent on DOCs, with feed accounting the highest portion (Jamtsho et al. 2021). Yet, there remains a gap in updated data and cost analysis specific to the country's poultry breeding farms. This research therefore, seeks to address this gap by identifying the primary cost components involved in hatching egg and DOC production. The findings aim to assist in optimizing resource use, forecasting future costs, and enhancing the operational

efficiency and economic sustainability of Bhutan's poultry breeding sector.

2. MATERIALS AND METHOD

2.1.Study area

This study was carried out at three major government poultry breeding centers located in Paro, Sarpang, and Lingmithang. These sites were selected based on their critical roles in Bhutan's poultry sector, particularly in the nationwide distribution of day-old chicks (DOCs).

The Regional Poultry Breeding Center (RPBC) is located in Wangchang gewog, Paro, at an altitude of 2,225 meters above sea level, and lies at 27.407630º N and 89.417378º E. The region experiences a total annual rainfall of approximately 376.60 mm, with mean maximum and minimum temperatures of 20.46℃ and 5.62 ℃, respectively.

The National Poultry Development Center (NPDC), located in Gakidling gewog under Sarpang district, lies at 26.5248º N and 90.1530º E, with an elevation of 369 meters above sea level. The region records the highest annual maximum temperature among the three centers, at about 5,376.20 mm. The average annual maximum and minimum temperatures are 29.65℃ and 20.92℃, respectively.

The Regional Pig and Poultry Breeding Center (RPPBC) is based in Lingmithang, Saling gewog, under Mongar district. It is located at 27.2605º E and 91.17785º E, standing at 1,600 meters above sea level. The region receives 695.30 mm of annual rainfall, with average maximum and minimum temperatures of 22.30℃ and 13.76℃, respectively. These centers are instrumental to Bhutan's poultry production system, as they serve as the primary suppliers of DOCs to poultry farmers across the country. Their comprehensive production records and geographic diversity make them ideal for assessing regional differences in cost structure and economic performance within the sector.

2.2. Data collection

Primary data were collected from the three regional poultry breeding centers, focusing on the production period from 2023 to 2024. The data comprises official financial and operational records maintained at each center, including detailed documentation on inputs, production volumes, costs, and outputs related to hatching egg and DOC production. To ensure consistency and comparability, only verified and up-to-date records were used. These included feed consumption records, labor records, utility expenses, medication and vaccination costs, and sales revenues based on the data received from the government farms.

2.3. Estimation of production cost for hatching eggs and DOCs

To determine the cost of production for hatching eggs and DOCs, both fixed and variable costs were considered. Fixed costs included expenditures such as depreciation on infrastructure and equipment, as well as staff wages. Variable costs encompass recurring operational expenses such as feed, medication, utilities, and transportation. The total cost of production was calculated by adding the fixed costs to the variable cost.

2.3.1 Depreciation of assets

Depreciation was calculated using the straight-line method for capital assets such as buildings, incubators, and poultry equipment. The annual depreciation was calculated by subtracting the estimated salvage value from the initial cost of the asset and then dividing the result by the asset's useful lifespan in years.

2.3.2 Unit cost of production

The cost per hatching egg and DOC was calculated by dividing the total cost of production by the total number of units produced during the production period as

adopted from the methods used by (Altahat et al. 2012) and (Aganga et al. 2003).

2.4 Profitability analysis

Profitability analysis aimed to determine whether the breeding centers generated sufficient revenue to exceed production costs. Several key financial metrics were used, consistent with methodologies presented by Firth (2002) and Opoku (2016).

2.4.1 Net profit

Net profit represents the actual financial gain or loss after accounting for both variable and fixed costs. It was calculated by subtracting the sum of the variable and fixed costs from the total revenue.

2.4.2 Return on Investment (ROI)

To evaluate financial sustainability and investment returns, the ROI was calculated by dividing the net profit by the total investment and then multiplying the results by 100 to express it as a percentage, as outlined by Zamfir et al. (2016). The total investment comprised capital, operational, and administrative expenses.

2.4.3 Profit margin

The profit margin helped determine the percentage of revenue that remained as profit after deducting all costs. Following the method described by Sumon et al. (2021), the profit margin was determined by subtracting the total cost from the total revenue, dividing the result by the total revenue, and then multiplying by 100 to express it as a percentage.

2.4.4 Benefit Cost Ratio (BCR)

The BCR was used to evaluate the cost-effectiveness of the breeding centers by dividing the total benefits by the total production costs. A BCR > 1 indicated a viable investment, while a BCR < 1 suggested financial loss, by the analysis methods employed by Memon et al. 2015.

2.4.5 Break-Even Point (BEP)

The break-even point represents the production level at which total revenue equals total cost. The contribution margin method was used, following the guidelines of Kampf et al. (2016) and Chen and Koebel (2017). It determines the number of DOCs that must be sold to cover fixed costs:

The break-even point in terms of DOC was calculated by dividing the total fixed costs by the difference between the selling price per DOC and the variable cost per DOC. This provides insights into the minimum output required for financial sustainability (Sasu, 2016).

2.5 Data analysis

The data collected from the three poultry breeding centers were analyzed using a combination of cost component analysis and economic evaluation methods. The cost component analysis focused on breaking down individual cost contributor such as feed, labor, medicines, and utilities to determine their proportional contribution to the total cost of production in each center. This provided insights into the dominant cost drivers that influence economic performance and helped compare production efficiency across the centers.

To evaluate financial performance, the study conducted a profitability assessment, which included calculating profit margins, ROI, and BCR for each breeding center. These economic indicators were used to compare the revenue generated from DOC sales with the corresponding cost of production. Additionally, a break-even analysis was carried out to estimate the minimum DOC sales required to recover production costs and achieve profitability.

3 RESULTS AND DISCUSSION

3.1 Cost of producing for hatching eggs

The cost of producing a single hatching egg (HE) showed notable difference across the three poultry breeding centers. The regional Poultry Breeding Center (RPBC) in Paro reported the lowest cost per egg at

Nu. 19, while the National Poultry Development Center (NPDC) in Sarpang and the Regional Pig and Poultry Breeding Center (RPPBC) in Lingmithang recorded higher costs of Nu. 29 and Nu. 31, respectively. These differences suggest variations in input utilization and production efficiency.

RPPC's relatively lower cost may be attributed to efficient feed and labor management, coupled with favorable infrastructure and logistical advantages due to its proximity to urban markets. This aligns with observations by Migose et al. (2018), who indicated that proximity to urban centers can enhance efficiency by improving market access and reducing transportation costs.

3.2. Cost of production for day-old chicks

A similar trend was observed in the cost of producing DOCs. RPBC incurred the lowest cost at Nu. 49, followed by NPDC at Nu. 65 and RPPBC at Nu. 70. The difference in DOC production costs likely stem from variations in feed consumption, labor efficiency, and fixed overheads. Despite having similar output, RPPBC incurred significantly higher costs, largely due to elevated labor expenses and less efficient production systems.

Economies of scale appeared to favor RPBC, as its higher volume of DOC output allowed for the dilution of fixed costs. Garval and Shaikh (2020) similarly found that large-scale poultry operations in India benefited from cost savings through optimized resource allocation and greater operational scale.

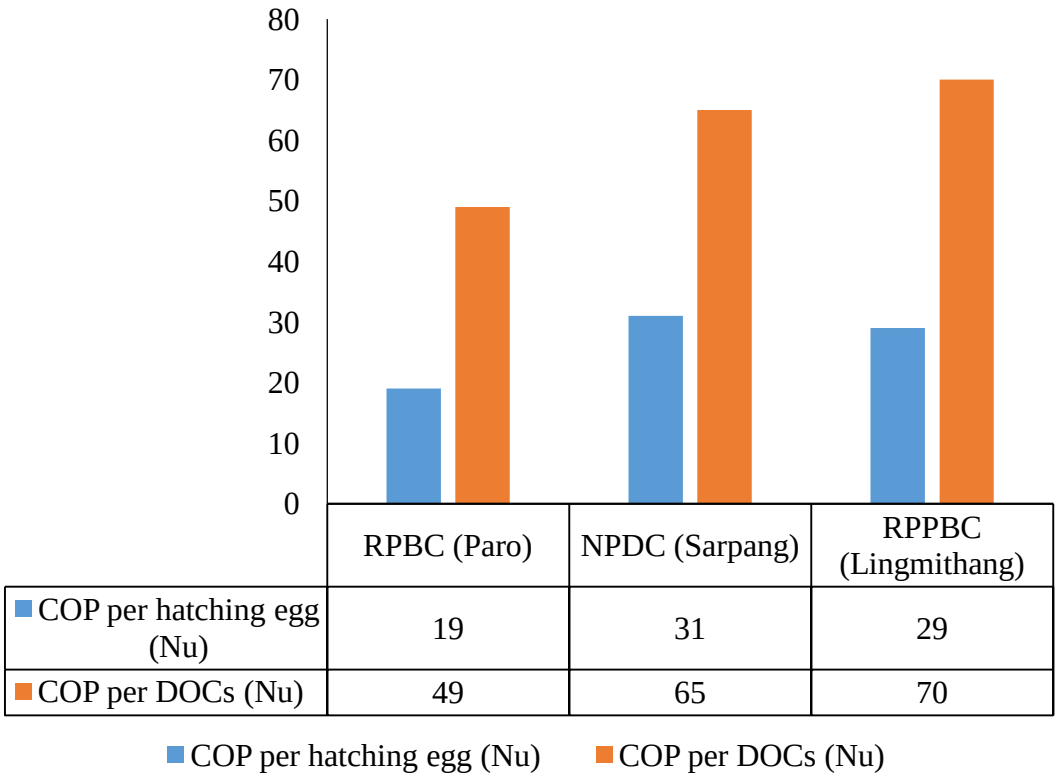
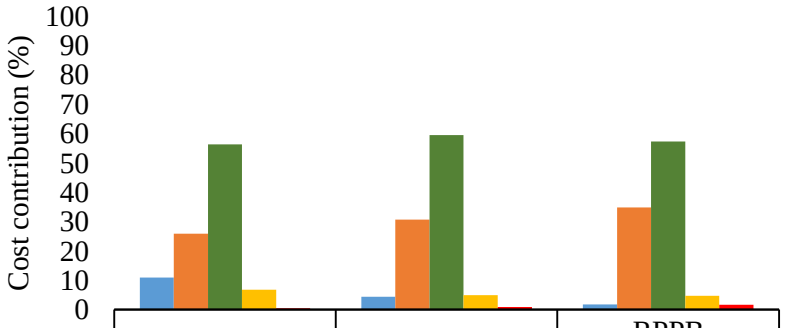


Figure 1: COP per HE and DOC across the center.



	RPBC	NPDC	RPPBC
Depreciation cost	10.84	4.3	1.7
Labor cost	25.79	30.65	34.74
Feed cost	56.18	59.33	57.23
Utilities cost	6.74	4.88	4.7
Medicine and vaccination cost	0.45	0.84	1.62

Figure 2: Cost contributors across the centers.

3.3. Cost breakdown analysis

Feed costs were consistently the largest contributor to total production expenses, ranging from 56% to 59% across all centers. Labor costs were the second most significant component, with RPPBC allocating over one-third of its total is in line with the previous findings by Afandi et al. (2018), who emphasized feed as the most critical and volatile cost factor in poultry farming, often accounting more than half of the total expenditures.

While all centers relied on similar breeds and feeding protocols, the variations in feed intake per bird and feed conversion efficiency contributed to the observed cost disparities. Labor inefficiency was also more pronounced at RPPBC, contributing to its high production cost per unit.

3.4. Revenue and economic returns

Despite efforts to optimize operations, none of the centers achieved profitability during the 2023-2024 production cycle. Total revenue generated from the sales of DOC sales was highest at NPDC, owing to its larger sales volume. However, RPBC achieved the highest total benefit when including ancillary income from spent hens, second-grade eggs, and manure sales. These findings highlight the value of diversified income streams in reducing overall financial risk. RPBC's ability to generate supplementary income significantly enhanced its revenue profile compared to NPDC and RPPBC, whose earnings were almost exclusively dependent on DOC sales.

3.5. Net profit and profit margin

All three centers recorded negative net profits, with RPBC experiencing the least loss (Nu. 7.94 million), followed by NPDC (Nu. 12.4 million), and RPPBC (Nu. 12.7 million). The results indicated that total operational costs outweighed revenue from DOC sales, primarily due to high feed and labor costs.

Profit margins were similarly negative across the centers, with RPPBC showing the least performance (-351.04%), followed by NPDC (-319.48%) and RPBC (-212.99%). The particularly poor outcome for RPPBC can be attributed to outdated infrastructure, high overhead and limited production scale, which prevented the realization of economies of scale.

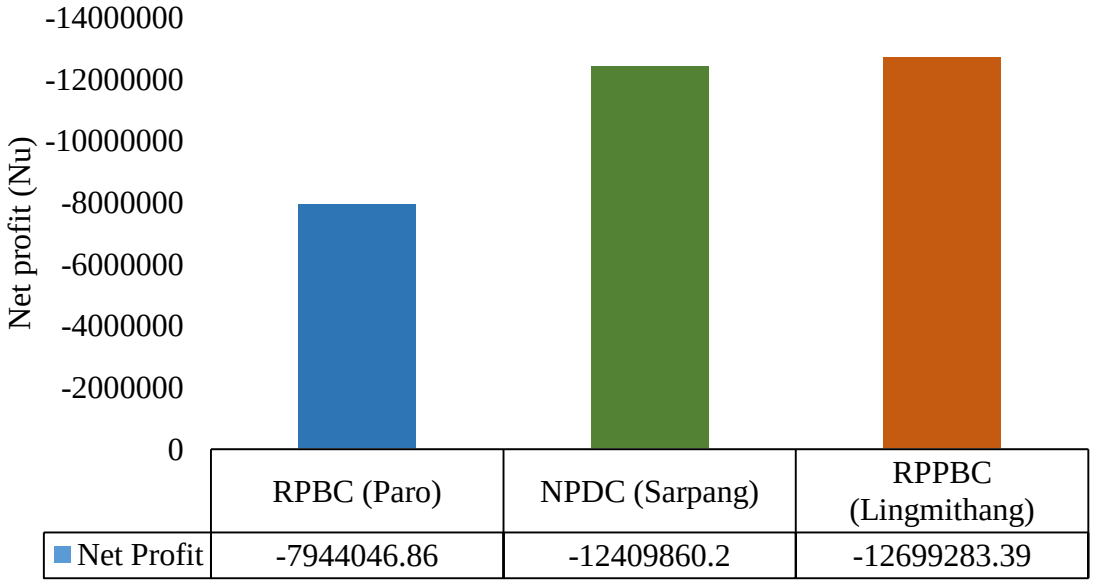


Figure 3: Net profit across the centers.

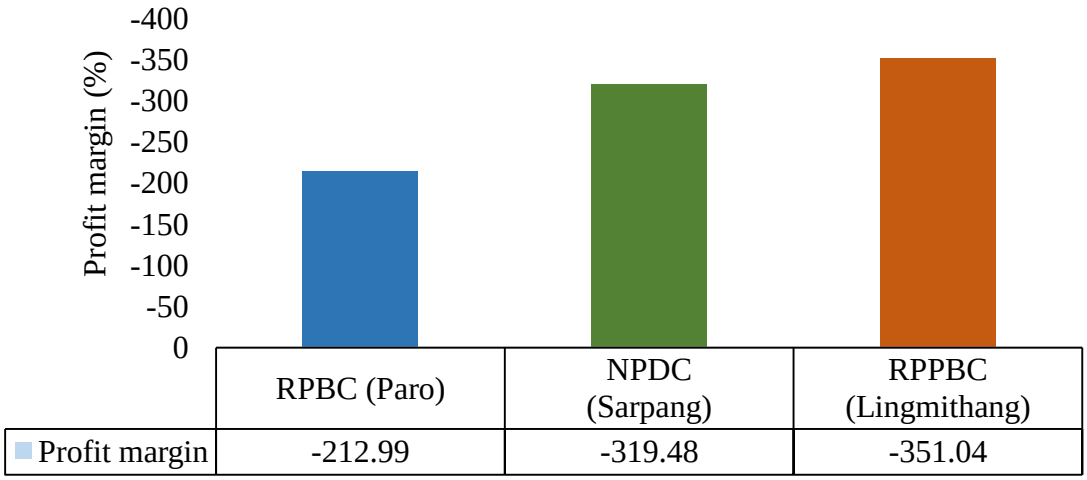


Figure 4: Net profit across the centers.

3.6. Return on Investment (ROI)

The ROI analysis reflected the same trend of financial underperformance. RPBC had an ROI of -68.05%, NPDC -76.16%, and RPPBC -77.83%. These figures underscore the systemic inefficiencies in government-managed poultry operations.

Similar studies in other regions (Szőllősi et al. 2021; Uddin et al. 2015) have shown that when proper cost management, infrastructure, and feed strategies are employed, positive ROI is achievable even in resource-constrained settings. The currents negative ROI in Bhutanese signals the need for strategic reforms aimed at improving feed utilization, updating physical infrastructure, and strengthening market linkages.

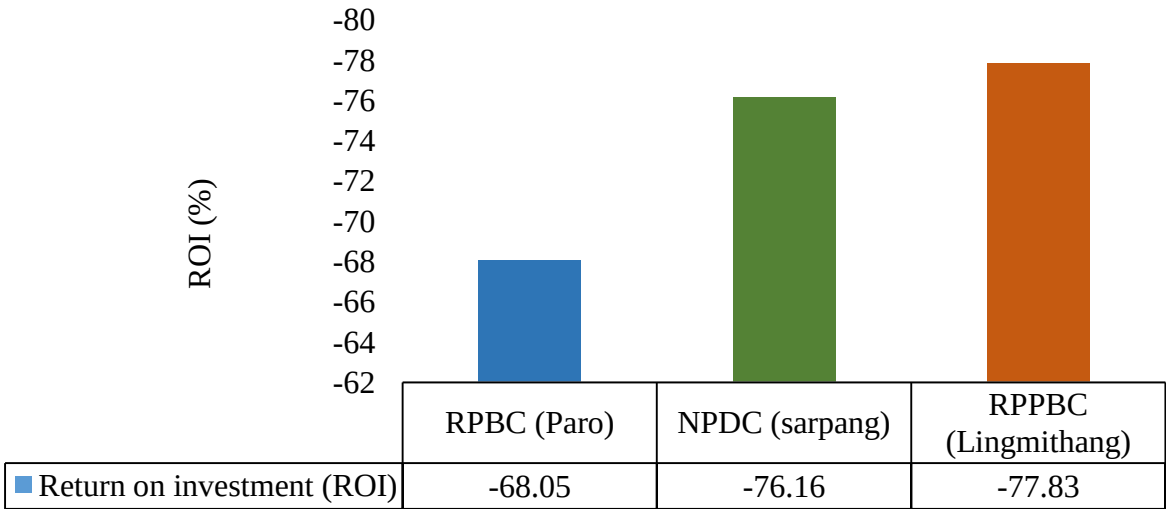


Figure 5: ROI across the centers.

3.7. Benefit-Cost Ratio (BCR)

The BCR values further confirm the economic unsustainability of the centers under existing conditions. All three centers reported BCRs below 1- 0.42 for RPBC, 0.27 for NPDC, and 0.23 for RPPBC – indicating that for every Ngultrum spent, less than one unit was recovered. While RPBC performed comparatively better, it still fell short of the break-even point. Studies from India (Soumya & Reddy, 2021) have demonstrated that hatcheries can achieve BCRs above 1 with effective operational planning and cost control.

3.8. Break-Even analysis

At the current subsidized price of Nu. 30 per DOC, none of the centers were able to cover even their variable costs. The contribution margin was negative across all centers, rendering break-even operations financially unviable. To attain break-even, the required selling price per DOC was Nu. 93.90 for RPBC, Nu. 125.84 for NPDC, and Nu.135.31 for RPPBC, which are significantly higher than the prevailing market price.

This reveals the critical gap between production costs and pricing, and emphasizes the unsustainability of current subsidy levels. Without restructuring the current cost or the pricing strategy, these breeding centers will continue to operate at a deficit.

4. CONCLUSION

This research offered a comparative analysis of the cost efficiency and financial performance of three breeding centers in Bhutan, focusing on the production of hatching eggs and day-old chicks. Across all centers, feed and labor were identified as the primary cost contributors, with utility expenses further amplifying costs. Despite differences in total revenue, all centers operated at a financial loss during the 2023-2024 production cycle, with RPBC showing relatively better performance in terms of benefit generation yet still failing to achieve profitability.

The negative profit margins, return on investment (ROI), and benefit-cost ratios (BCRs) observed in all centers underscore a critical imbalance between cost structures and revenue streams. Break-even analysis further revealed that the current subsidized price for DOCs is substantially below the actual cost of production, making financial sustainability unattainable under existing conditions. RPBC's comparative advantage appears to stem from more efficient feed utilization, better infrastructure, and stronger market linkages, while systemic issues such as reliance on imported inputs, outdated infrastructure, and inefficient labor

deployment continue to constrain the economic viability of all centers.

This study thus emphasizes the importance of targeted interventions to improve cost control, infrastructure, and productivity, ultimately contributing to greater financial sustainability and food security within Bhutan's poultry sector.

Recommendation

To enhance the financial viability of Bhutan's poultry breeding centers, several interventions are recommended. First, improving feed efficiency should be a priority by adopting more precise feeding strategies and incorporating cost-effective nutritional supplements. Streamlining labor operations and enhancing staff productivity through training and incentive systems could help reduce high labor costs.

Infrastructure modernization is also important with investments in automated systems and bio-secure housing would support better disease management and reduce long-term operational costs. Furthermore, adjusting the current pricing model for DOCs is essential to align revenue more closely with production costs.

Expanding revenue streams through the sale of by-products such as spent hens, manure, and lower-grade eggs may also ease financial pressure. Strengthening technical capacity among the staff and improving access to data-driven decision-making tools can support more efficient farm management. Finally, regular performance monitoring and adaptive policy support from relevant institutions will be key to ensuring long-term sustainability and resilience in the poultry sector.

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References

Afandi R, Hartono B, and Djunaidi IH. (2018). Characterisation two types of feed on production performances of laying hen in Blitar Regency, East Java. Buletin Peternakan, 42(1): 26–30.

Aganga AA, Omphile UJ, Thema T, and Nyathi I. (2003). Poultry farming in Botswana: The importance of cost analysis. International Journal of Poultry Science. https://doi.org/10.3923/ijps.2003.291.294.

Altahat E, Sharafat A, and Altarawneh M. (2012). Factors affecting the profitability of layer hens enterprise. Science Publications.

Chen X, and Koebel BM. (2017). Fixed cost, variable cost, markups and returns to scale. Annals of Economics and Statistics, 127: 61–94.

Firth C. (2002). The use of gross and net margins in the economic analysis of organic farms.

Garval AS, and Shaikh AS. (2020). An economic analysis of production of layers in Anand district of Gujarat. Agricultural Research Journal, 57(5): 763. https://doi.org/10.5958/2395-146X.2020.00111.8.

Gyeltshen T. (2011). MSc Thesis Understanding Village Poultry Systems and Exploring Improvement Options in Yoeseltse and Denchhukha Geogs, Samtse, Bhutan. https://doi.org/10.13140/2.1.1454.5288.

Jamtsho T, Sharma A, Dema K, and Rai SBC. (2021). Profitability of broiler farms in four southern districts in Bhutan. Bhutan Journal of Animal Science, 5(1): Article 1.

Kampf R, Majerčák P, and Švagr P. (2016). Application of Break-Even Point Analysis. Naše More, 63(3): 126–128. https://doi.org/10.17818/NM/2016/SI9.

Memon MIN, Noonari S, Asif M, and Pathan M. (2015). Economic Analysis of Poultry Egg Production in Quetta District Balochistan Pakistan. Economic Analysis, 14. https://www.academia.edu/download/104291894/25459.pdf.

Migose SA, Bebe BO, de Boer IJM, and Oosting SJ. (2018). Influence of distance to urban markets on smallholder dairy farming systems in Kenya. Tropical Animal Health and Production, 50(7): 1417–1426. https://doi.org/10.1007/s11250-018-1575-x.

NSB. (2023). National Statistics Bureau. https://www.nsb.gov.bt/.

Opoku S. (2016). Performance and efficiency measures of layer production enterprises in the Ashanti region of Ghana, 14(4).

Sasu D. (2016). CVP and Sensitive analysis of Ntow Poultry farm: Layer Production. https://www.theseus.fi/handle/10024/114479.

Soumya P, and Reddy BP. (2021). Financial Feasibility of Poultry Layer Farms in Chittoor District, India. Asian Journal of Agricultural Extension, Economics & Sociology, 39: 120–145. https://doi.org/10.9734/ajaees/2021/v39i530584.

Sumon SM, Hosen MZ, Hossain MS, Arifin Z, and Hasan AT. (2021). Profitability analysis of poultry business in some selected areas of Patuakhali districts in Bangladesh, 11(1).

Szőllősi L, Béres E, and Szűcs I. (2021). Effects of modern technology on broiler chicken performance and economic indicators – a Hungarian case study. Italian Journal of Animal Science, 20(1): 188–194. https://doi.org/10.1080/1828051X.2021.1877575.

Tashi S, Yangchen U, Dahal Y, Gurung D, Wangmo C, Wangmo S, Jambay J, Wangdi K, Gurung T, Tshering K, Dendup T, Dorji J, Tenzin J, Tshering S, Dorji C, Chhetri S, Sonam T, Rinzin P, Dorji T, and Gyeltshen W. (2022). Case Studies of Successful Farmers, Agri-enterprises and Farmers' Groups and Cooperatives in Bhutan.

Uddin T, Rahman H, and Saleque A. (2015). Comparative performance of Sonali chickens, commercial broilers, layers and local non-descript (deshi) chickens in selected areas of Bangladesh.

Zamfir M, Manea MD, and Ionescu L. (2016). Return on Investment – Indicator for Measuring the Profitability of Invested Capital, 7(2). https://doi.org/10.1515/vjes-2016-0010