p-ISSN 2615-787X e-ISSN 2615-790X
Accredited by Directorate General of Higher Education, Research, and Technology, Republic of Indonesia, No. 225/E/KPT/2022

Tropical Animal Science Journal, September 2024, 47(3):402-408
DOI: https://doi.org/10.5398/tasj.2024.47.3.402
Available online at https://journal.ipb.ac.id/index.php/tasj

Cost Efficiency Analysis of Broiler Production in Peninsular Malaysia

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(Received 18-04-2024; Revised 22-06-2024; Accepted 09-07-2024)

ABSTRACT

The broiler industry is crucial in Malaysia's agricultural sector, contributing significantly to meat production and the economy. However, the industry faces significant challenges, primarily stemming from high production costs, with feed costs constituting a substantial portion. Therefore, there is a need to improve domestic farm performance and competitiveness by optimizing resources and minimizing expenses to enhance overall productivity. This study aims to estimate the extent of cost efficiency in broiler farming in Peninsular Malaysia and identify key determinants influencing the inefficiency cost. A comprehensive survey involving 241 broiler farms in Peninsular Malaysia was conducted using structured questionnaires and a stratified random sampling technique. Employing the Stochastic Cost Frontier model revealed an operational inefficiency of approximately 5.7% above optimal costs among the surveyed farms, indicating substantial potential for a 5.7% reduction in production costs through enhanced management strategies. Factors such as feed prices, day-old chick prices, price of miscellaneous inputs, production output levels, and capital investment prices emerged as prominent influencers in the broiler cost function. Furthermore, the study indicated that socio-economic factors such as housing system, extension visits, credit access and contract farming are associated with lower inefficiencies, thereby enhancing cost efficiency in broiler farming operations. Conversely, higher bird mortality rates are associated with the increased inefficiency. Gaining insights into these factors is crucial for stakeholders to allocate resources wisely, plan strategically, and enhance competitiveness in broiler farming.

Keywords: cost function; inefficiency; stochastic frontier

INTRODUCTION

Broilers are a crucial protein source in Malaysia, with per capita consumption reaching 48 kilograms in 2022, reflecting its significance in the national diet (Department of Statistics Malaysia, 2024). The rapid expansion of the broiler industry significantly contributes to Malaysia's economy, with production reaching 1.543 million metric tons in 2022 and an ex-farm value of USD 272,790.66 (MYR13,031.21 million). This value represents 56.39% of Malaysia's total livestock ex-farm value (Malaysian Department of Veterinary Services, 2023). Moreover, Malaysia has achieved a self-sufficiency ratio (SSR) for broilers consistently exceeding 100% since 1981, indicating a production rate sufficient to meet domestic demands.

Despite its historical resilience, the industry struggles with high production costs due to price fluctuations and high input costs, primarily attributed to expensive feed raw materials such as grain corn and soybean (Azizi *et al.*, 2021; Shaban & Alabboodi, 2019; Abdurofi *et al.*, 2017; Gabdo *et al.*, 2017a). Feed prices alone constitute about 70% of total production costs, exacerbated by Malaysia's heavy reliance on the imported feeds, which heightens vulnerability to global market volatility (Shaban & Alabboodi, 2019). The COVID-19 pandemic further exacerbated these challenges by disrupting supply chains and causing economic instability (Ijaz *et al.*, 2021), directly impacting operational costs and reducing profitability, especially for small-scale farmers (Abro *et al.*, 2020; Md. Isa *et al.*, 2019).

In light of the challenges faced by the broiler industry, enhancing cost efficiency is crucial for ensuring its long-term sustainability and competitiveness. While existing studies on technical efficiency in Peninsular Malaysia have identified inefficiencies in resource utilization among broiler farms (Yunus, 2012; Gabdo *et al.*, 2017a, 2017b), there is a notable gap in research specifically assessing the cost inefficiencies of broiler production in Malaysia. Solely focusing on technical efficiency risks overlooking critical aspects of cost management within the industry (Etuah *et al.*, 2020). Aji *et al*. (2023) emphasize that evaluating farmer performance and addressing cost inefficiencies enables farmers to optimize profits by identifying areas where costs can be reduced. This approach enhances financial outcomes and establishes a more sustainable business model (Aji *et al*., 2023; Hansen *et al.,* 2019). Furthermore, monitoring farmer performance and cost inefficiency aids in identifying and proactively managing potential risks, ensuring efficient risk management, as highlighted by Aji *et al*. (2023) and Kayikci *et al*. (2022).

This study aims to address this gap by shifting the focus to examine cost efficiency within Peninsular Malaysia's broiler industry comprehensively. Unlike previous studies primarily concentrating on technical efficiencies, this research endeavours to estimate the extent of cost efficiency and identify the determinants of inefficiencies within the broiler industry in Peninsular Malaysia. By doing so, the study seeks to offer fresh insights into practical strategies for enhancing industry competitiveness and effectively addressing critical challenges faced by broiler farmers.

METHODS

Data

This study employed structured questionnaires to gather data on broiler operations across 10 states in Peninsular Malaysia during the 2023 production cycle. A stratified random sampling approach was employed, stratifying farms based on geographic regions encompassing the states of Johor, Kedah, Kelantan, Terengganu, Melaka, Negeri Sembilan, Pahang, Perak, Pulau Pinang, and Selangor. Within each state, farms were categorized by size into small (<10,000 birds per cycle), medium (10,000-49,999 birds per cycle), and large (50,000 birds or more per cycle). This stratification ensured proportional representation from each state and farm size category. Subsequently, a simple random sampling method was employed to select 241 broiler farms for the survey. Questionnaire administration was conducted through personal visits in English, with provisions for Malay translation for respondents requiring assistance. Ethical approval (ID No. JKEUPM-2023-1167) was obtained from the Ethics Committee at University Putra Malaysia to ensure compliance with ethical standards throughout the study.

Theoretical Framework of Stochastic Frontier Modelling

The stochastic frontier approach (SFA) provides a robust framework for analyzing efficiency in production processes, incorporating both random effects beyond the producer's control and inefficiency components. Musaba & Mseteka (2014) emphasize a unique error structure in SFA, characterized by two-sided symmetry and a one-sided component. This structure accommodates inefficiency while capturing random effects such as measurement errors and other statistical noise common in empirical analyses.

According to Khumbakar & Lovell (2000), the stochastic cost frontier function model is formulated as follows:

$$C_i = f(y_i, x_i; \beta).exp\ (v_i + u_i)$$

where, i is 1,2,3…. n farms, C_i represents the total production cost, x_i denotes the output level of the i-th farm, y_i is the vector of input prices utilized by the i-th farm to produce y, and β represents the vector of unknown cost function parameters to be estimated.

The term v_i signifies random effects attributed to factors outside the farmer's control, following an independent and identically distributed normal distribution with a mean of zero and a variance of σ_v^2. This accounts for measurement error and other variables beyond the farmer's control. Meanwhile, u_i represents the level of cost inefficiency, assumed to be independent and identically distributed half-normal random variables. Notably, v_i is symmetric while u_i is asymmetric (non-symmetric) (Etuah *et al*., 2020).

The estimation of the stochastic frontier cost function is conducted using the maximum-likelihood Estimation (MLE) method. The process aims to maximize the log-likelihood function to determine the values of β, σ^2, and γ, which are crucial for understanding the parameters and evaluating the variance of both v_i and u_i. The assumption about the error terms entails estimating two variance parameters, σ_v^2 and σ_u^2, along with the elements of the parameter vector β. These variances are parameterized as $\sigma^2 = \sigma_v^2 + \sigma_u^2$ and $\gamma = \sigma_u^2/\sigma_v^2 + \sigma_u^2$. The resulting value of γ lies between zero and one ($0 \leq \gamma \leq 1$), where a value of 0 indicates the absence of cost inefficiency effects (Etuah *et al.,* 2020).

Furthermore, a generalized likelihood ratio test is conducted to assess whether the null hypotheses suggest non-stochastic inefficiency effects (i.e., can be accepted or rejected. These tests aim to evaluate whether farms operate efficiently on their cost frontier with zero inefficiency effects. If it fails to reject the null hypothesis (the likelihood ratio test is equal to zero), then the variable is removed from the model. This elimination signifies the loss of the stochastic nature of the model, indicating the absence of inefficiency.

Cost efficiency (CE) of farm i is the ratio of the observed cost (C^{obs}) to the corresponding minimum cost (C^{min}) given the available technology. It can be stated as:

$$CE = \frac{C^{obs}}{C^{min}} = \frac{f(y_i, x_i; \beta).exp\ (v_i + u_i)}{f(y_i, x_i; \beta).exp\ (v_i)} = \exp\ (u_i)$$

Cost efficiency (CE) values equal to one indicate a farm operating precisely on the efficiency frontier, signifying optimal performance. Conversely, CE values greater than one imply that the farm operates less efficiently and is positioned above the cost frontier. This interpretation is consistent with studies conducted by Etuah *et al*. (2020) and Sadiq & Samuel (2016).

Empirical Model Specification

The econometric analysis of cost efficiency is conducted using the stochastic cost frontier model based on the framework established by Kumbhakar & Lovell (2000) and adapted by Etuah *et al*. (2020). All parameters are estimated concurrently in one-step maximum likelihood estimation by using the program FRONTIER version 4.1d.

To initiate the assessment of the stochastic cost frontier model, the function must be specified. By adopting the Cobb-Douglas (log-linear) functional form, the stochastic cost frontier model can be expressed explicitly as follows;

$$\ln(C_i) = \beta_0 + \sum_{k=1}^{7} \beta_k lnP_{ki} + \alpha lny_i + (v_i + u_i)$$

where, C_i represents the total production cost incurred by each broiler farm within a production cycle, measured in Malaysian Ringgit (MYR). P_1 denotes the average price per kilogram of feed (MYR/kg), P_2 signifies the average price of acquiring a day-old chick (MYR/chick), P_3 represents the wage rate paid to labour (MYR/man-day), P_4 denotes the average price of medicine per chick (MYR/chick), chosen to accurately reflect the direct cost of medication per broiler over its lifecycle. This choice aligns with industry practices and data availability. P_5 quantifies the average price on capital inputs, calculated using the straight-line method to depreciate fixed-cost items (MYR). Additionally, P_6 reflects the average price on utilities per production cycle (MYR), encompassing costs related to essential services such as water, electricity, and genset oil. P_7 captures the average price of miscellaneous inputs such as transportation, bedding, maintenance, and catcher charges per production cycle. The output level y_i represents the output level which is the quantity of broilers produced by each farm during the production period, expressed in kilograms. The parameters β are subject to estimation within the analysis and are expected to exhibit positive signs, indicative of their role in influencing the relationship between input prices and the cost of broiler production. The index i denotes to the i-th farm within the sample, ranging from 1 to n (i=1,2…...n) where n represents the total number of farms included in the analysis.

Taking the natural logarithm of both sides of the implicit model is imperative to linearize the Cobb-Douglas functional form concerning the parameters. This transformation is crucial for simplifying the estimation process, as it eliminates the exponent and allows for the separation of the two error terms within the implicit stochastic cost frontier model's cost function.

Furthermore, alongside the generic stochastic cost frontier model, an inefficiency model (u_i) is necessitated to account for the influence of socio-economic factors on farmers and other variables affecting cost inefficiencies. The empirical specification of the inefficiency model is expressed as:

$$u_i = \alpha_0 + \sum_{n=1}^{7} \alpha_n Z_{ni}$$

In this formulation, the dependent variable is the cost inefficiency (u_i), while the explanatory variables are the factors that are thought to have an impact on cost inefficiency (Z_{ni}). These farm-specific explanatory variables consist of: Z_1 indicates participation in contract farming (dummy; 1= participates, 0= not participates); Z_2 corresponds to the farm operator's years of experience in broiler farming; Z_3 represents access to credit access (dummy; 1= have credit access, 0= no access); Z_4 signifies the frequency of extension visited, Z_5 denotes the housing system (dummy; 1= closed house system, 0= open house system); Z_6 indicates the average mortality rate in percentage and Z_7 denotes association membership (dummy; 1= member, 0= non-member). These variables were selected based on their established relevance in previous studies of broiler farm efficiency and productivity (e.g., Gabdo *et al.*, 2017a; Etuah *et al.*, 2020; Aji *et al.*, 2023).

RESULTS

Table 1 provides a comprehensive summary of key variables of broiler farming practices in Peninsular Malaysia based on survey data collected in 2023. The mean values illustrate various aspects of production costs, with the average total production cost being MYR 953,833.90, associated with producing 163,284.62 kg of broilers per cycle. The large standard deviation reflects the diverse scale of operations among farms, indicating significant variability in the dataset. The socio-economic characteristics of the farmers in the analysis revealed that the average age of the farmers was 46.89 years, indicating they were relatively middle-aged. On average, the farmers had 17.24 years of farming experience, showcasing a substantial amount of expertise in their field. Additionally, the extension visitation period averaged 3.63 times per year, suggesting that most farmers were visited by veterinary officers almost four times annually.

The maximum-likelihood estimates in Table 2 reveal significant coefficients in the Cobb-Douglas stochastic cost frontier model. Feed price (β1) and the price of day-old chicks (DOC) (β2) emerge as influential factors with statistical significance at the 1% level, exhibiting substantial impacts on overall production expenses. Specifically, a 1% increase in feed price corresponds to approximately a 0.53% increase in production expenses, while a similar increase in the price of day-old chicks results in a 0.26% increase. Moreover, miscellaneous inputs price (β7) and positive output levels (yi) demonstrate significant effects on production costs at a 5% significance level, while capital inputs price (β5) show less significant effects at a 10% significance level. In contrast, wage rates (β3), price of medicine (β4), and price of utilities (β6) show non-significant effects on total production costs. The Sigma squared parameter (σ^2 = 0.0225) represents unexplained variability in costs beyond specified determinants, while the Gamma parameter (γ = 0.1271) indicates the level of cost inefficiency in production.

Furthermore, the null hypothesis suggests no presence of cost-inefficiency effects within the models. Evaluation of cost inefficiency was carried out using the Likelihood Ratio (LR) test, yielding a test statistic of 52.66. This value surpasses the critical chi-square threshold of 31.353, indicating statistical significance. Consequently, the null hypothesis regarding cost inefficiency is rejected. This strong rejection offers compelling evidence for the existence of producer-specific cost inefficiencies within the model, as elaborated in Table 3.

Meanwhile, Table 4 presents the distribution of cost inefficiency scores among broiler farms in Peninsular Malaysia, providing insights into the industry's efficiency levels. The results indicate that only a small fraction, approximately 1.2%, achieve perfect efficiency with a score of 0.00, demonstrating precise operation at the cost frontier. This subset of farms reflects optimal resource utilization and effective cost-control practices. Moreover, the majority of farms, comprising about 64.3%, demonstrate an inefficiency score of less than 10%, with an additional 34.4% having a score between 10% and 19%. The overall inefficiency scores range from 0.000 to 0.1665, with an average score of 0.0570.

Table 5 presents the results of the determinants of cost inefficiency in broiler farming operations in Peninsular Malaysia. Significant coefficients are observed for several variables, indicating their importance in influencing cost inefficiency. Notably, the housing system ($\alpha5$) exhibits a highly negative coefficient of -0.4982 at the 1% significance level, suggesting that adopting a closed housing system significantly reduces cost inefficiency compared to an open housing system. Likewise, the mortality rate ($\alpha6$) assumes a pivotal role, with a highly positive coefficient of 0.0255 at the 1% significance level, indicating a robust correlation between elevated mortality rates and heightened cost inefficiency in broiler farming practices. Additionally, extension visits ($\alpha4$) emerge as particularly significant, displaying a highly negative coefficient of -0.0086 at the 1% significance level, indicating the crucial role of fre-

Table 1. Statistical summaries of the variables of frontier cost function analysis of broiler farming in Peninsular Malaysia in 2023

Variables		Mean	Std. deviation
Total production cost (MYR)	C_i	953,833.90	1,086,570.73
Price of feed per kg (MYR)	P_1	2.64	0.15
Price of a day-old chick (DOC) (MYR)	P_2	2.47	0.63
Wage rate per man-day (MYR)	P_3	78.35	29.99
Price of medicine per chick (MYR)	P_4	0.24	0.44
Price of capital inputs (MYR per cycle)	P_5	100.59	157.21
Price of utilities (MYR per cycle)	P_6	3,175.55	5,499.45
Price of miscellaneous input (MYR per cycle)	P_7	4,891.48	14,899.24
Output level (kilograms of birds produced)	y_i	163,284.62	202,418.93
Contract farming (1= Participates, 0= Not participates)	Z_1	0.66	0.48
Experience (Years)	Z_2	17.24	9.77
Credit access (1= Have access, 0= No access)	Z_3	0.55	0.50
Extension visits (Number of visits per year)	Z_4	3.63	4.27
Housing system (1= Closed house, 0= Open house)	Z_5	0.46	0.50
Average mortality rate (%)	Z_6	6.06	3.84
Association membership (1= Member, 0= Non-member)	Z_7	0.31	0.46

Note: Source: Survey data (2023).

Table 2. Maximum likelihood estimates of the Cobb-Douglas stochastic cost frontier models of broiler farming in Peninsular Malaysia in 2023

Cost frontier determinants	Parameter	Coefficient	Standard-error	T-ratio
Price of feed per kg	β_1	0.5265***	0.176	29.988
Price of day-old-chic (DOC)	β_2	0.2638***	0.047	55.943
Wage rate per man-day	β_3	0.036	0.031	11.395
Price of medicine per chick	β_4	0.014	0.012	11.770
Price of capital inputs	β_5	0.0167*	0.009	17.878
Price of utilities	β_6	0.007	0.013	0.518
Price of miscellaneous inputs	β_7	0.1030**	0.012	82.851
Output level	y_i	0.8610**	0.019	449.721
Constant	β_0	1.3269***	0.245	54.141
Sigma squared	$\sigma^2 = \sigma^2 v + \sigma^2 u$	0.0225***	0.002	111.044
Gamma	$\gamma = \sigma^2 u / \sigma^2$	0.1271***	0.022	57.508

Note: Source: Survey data (2023). Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Table 3. Generalized likelihood ratio test for parameter hypotheses of the stochastic cost function of broiler farming in Peninsular Malaysia in 2023

Null hypothesis	Log-likelihood	Test statistic (λ)	Critical value (α=0.01)	Decision
H_0:γ=0	1.303.834	526.567	31.353	Reject H_0

Note: Source: Survey data (2023).

Table 4. Distribution of cost inefficiency levels of the respondents of broiler farming in Peninsular Malaysia in 2023

Cost efficiency estimates	Level of cost inefficiency	Relative frequency (%)
1.00	0.00	1.20
1.01-1.09	0.01-0.09	64.30
1.10-1.19	0.10-0.19	34.40
Total		100
Minimum	0.00	
Maximum	0.167	
Mean	0.057	
Standard deviation	0.051	

Note: Source: Survey data (2023).

Table 5. Determinant of cost inefficiency of broiler farming in Peninsular Malaysia in 2023

Variables	Parameter	Coefficient	Standard-error	T-ratio
Contract farming	α_1	-0.0247*	0.015	-16.912
Experience	α_2	0.001	0.001	12.066
Credit access	α_3	-0.0194*	0.010	-19.115
Extension visits	α_4	-0.0086***	0.001	-92.862
Housing system	α_5	-0.4982***	0.048	-104.608
Mortality rate	α_6	0.0255***	0.003	93.387
Association membership	α_7	0.014	0.012	11.498
Constant	α_0	0.046	0.035	12.994

Note: Source: Survey data (2023). Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

quent extension visits in curbing cost inefficiency within broiler farming operations.

On the other hand, contract farming ($\alpha1$) and credit access ($\alpha3$) demonstrate a notable negative coefficient at the 10% significance level, suggesting potential contributions to diminishing cost inefficiency. Conversely, experience ($\alpha2$) and association membership ($\alpha7$) exhibit positive coefficients, indicating a minimal positive association with cost inefficiency, although these effects are not statistically significant.

DISCUSSION

The maximum-likelihood estimates reveal anticipated positive signs for the coefficients of all variables, indicating that increases in input or output levels correspond to the increase in broiler production costs. This outcome is consistent with prior research, such as Aji *et al*. (2023) and Etuah *et al*. (2020), who also found similar patterns in their studies. The significant coefficients obtained for feed costs and the price of day-old chicks underscore their pivotal roles in determining production costs in broiler farming. These findings emphasize the importance of effective cost management strategies targeting feed procurement and chick acquisition to mitigate potential cost escalations and anticipate financial implications. Similarly, the substantial effect of miscellaneous inputs and positive output levels sheds light on economies of scale and comprehensive cost optimization strategies.

The Sigma squared parameter ($\sigma2 = 0.0225$) denotes unexplained variability in production costs beyond specified determinants, suggesting the presence of additional factors influencing costs not captured by the model. Concurrently, the significant Gamma parameter ($\gamma = 0.1271$) indicates the level of cost inefficiency in production among broiler farms, highlighting areas where operational practices can be improved to enhance cost efficiency and profitability.

Moreover, the rejection of the null hypothesis regarding cost inefficiency underscores the importance of targeted interventions aimed at enhancing cost efficiency and profitability in broiler farming operations. This rejection provides compelling evidence for the existence of producer-specific cost inefficiencies within the model, emphasizing the need for tailored strategies to address these inefficiencies effectively.

In terms of inefficiency level, the range of inefficiency scores suggests that, on average, broiler farms in Peninsular Malaysia operate with a cost inefficiency of 5.7%. This indicates that approximately 5.7% of the production costs incurred by these farms are considered avoidable, highlighting opportunities for enhancing cost management. This observation emphasizes the importance of optimizing operational practices to reduce unnecessary expenses and enhance overall profitability in broiler farming.

In examining the determinants of cost inefficiencies, the highly significant negative coefficient associated with the housing system ($\alpha5$) underscores its role in reducing cost inefficiencies, consistent with findings by Gabdo *et al*. (2017a). Research indicates that farmers adopting closed-house systems benefit from the enhanced efficiency driven by the advanced technology integration and the improved management practices. Empirical evidence suggests that broiler farmers in Peninsular Malaysia who utilize closed-house systems achieve higher efficiencies, primarily due to the optimized resource utilization and reduced wastage facilitated by features such as automated climate control and precise feed management.

Conversely, the positive coefficient for the mortality rate ($\alpha 6$) underscores the adverse impact of elevated mortality rates on cost inefficiency, aligning with the conclusions drawn by Aji *et al*. (2023), Nguyen *et al.* (2018) and Myeki *et al*. (2022). The empirical findings further elucidate that broiler farms in Peninsular Malaysia experiencing higher mortality rates incur the decreased output per cycle, resulting in higher costs per unit of production and wastage of resources. Elevated mortality rates necessitate additional expenses for preventive measures, such as the enhanced biosecurity and health management practices, which add to production costs.

Additionally, the highly negative coefficient observed for extension visits ($\alpha 4$) signifies the pivotal role of frequent extension visits in reducing cost inefficiency within broiler farming operations. This finding resonates with the research of Etuah *et al*. (2020) and Olorunfemi *et al.* (2020), which highlight the significance of agricultural extension services in disseminating knowledge and improving efficiency. Empirical evidence further elucidates that broiler farmers in Peninsular Malaysia benefiting from frequent extension visits demonstrate the improved cost efficiency through the enhanced adoption of best practices in feed management, disease prevention, and overall farm management techniques.

Furthermore, empirical evidence underscores the pivotal role of credit access ($\alpha 3$) in reducing cost inefficiency within broiler farming operations. According to Duy *et al*. (2015), both formal and informal credit significantly enhance farm production and efficiency. Farmers with access to credit typically invest in essential resources and technology, optimize input procurement, and manage risks effectively. These practices contribute to the increased cost efficiency in agricultural operations. Similarly, Agyemang *et al*. (2020) highlight the positive correlation between credit access and the enhanced efficiency, productivity, and profitability in farms, emphasizing its critical role in determining cost efficiency in broiler farming.

Moreover, the marginally significant negative coefficient associated with contract farming ($\alpha 1$) suggests a potential decrease in cost inefficiency with engagement in such practices. This may be attributed to the structured support provided by contractual agreements, which helps minimize inefficiencies in broiler farming operations. Contract farming plays a pivotal role in promoting efficiency, as evidenced by Gabdo *et al.* (2017a), who found that it leads to the increased production, market efficiency, and value-added potential at lower costs. Furthermore, Harianto *et al*. (2019) highlight that contract farmers tend to operate more efficiently with the reduced risk and higher returns. Access to inputs such as feed and day-old chicks (DOC) at lower, stable prices is a significant benefit of contract farming agreements (Malaysian Department of Veterinary Services, 2015). These contracts typically stipulate fixed rates for inputs, providing farmers with cost savings compared to the open market. Additionally, the contractual nature of the agreement offers farmers predictability regarding input costs, shielding them from market fluctuations (Baluch *et al.*, 2017). This consistent availability of crucial inputs at favourable rates enables farmers to streamline operations and better manage production costs, ultimately enhancing overall efficiency.

CONCLUSION

The study findings underscore that the broiler cost function is significantly influenced by feed prices, day-old chick prices, miscellaneous inputs prices, production output levels, and capital inputs prices. The results also highlight a significant opportunity for improvement in broiler farming operations in Peninsular Malaysia, with an average cost inefficiency of 5.7%. Factors such as extension visits, housing systems, contract farming, and credit access are associated with lower inefficiencies, thereby enhancing cost efficiency in broiler farming operations. Conversely, higher bird mortality rates are associated with the increased inefficiency. These findings emphasize the importance of effective management practices and targeted interventions to enhance cost efficiency in the broiler farming sector. Addressing these inefficiencies necessitates targeted policy interventions, including support for contract farming, improved access to credit facilities, strengthened extension services, and incentives for closed housing systems adoption. Such measures can foster a more efficient broiler farming sector.

CONFLICT OF INTEREST

There are no conflicts of interest, whether financial, personal, or relational with individuals or organizations connected to the subject matter discussed in the manuscript.

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