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TRIPLE BOTTOM LINE APPROACH FOR EVALUATING EFFICIENCY AND RESILIENCE OF NATIVE CHICKEN FARMING: CASE STUDY IN MEDAN CITY

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Abstract

This study applies the Triple Bottom Line (TBL) framework to comprehensively evaluate the efficiency and resilience of native chicken farming enterprises in Medan City, Indonesia. The research employed a mixed-methods approach by combining quantitative and qualitative data. Primary data were obtained from 30 farmers through structured surveys and in-depth interviews, while secondary information was collected from official reports and relevant literature. Economic efficiency was measured using Stochastic Frontier Analysis (SFA), and social as well as environmental dimensions were assessed through descriptive and qualitative analysis. The findings reveal that the average technical efficiency (TE) of the farmers is 0.72, allocative efficiency (AE) is 0.68, and economic efficiency (EE) is 0.65, indicating that nearly 75% of the sampled farmers remain economically inefficient. Socially, native chicken farming contributes to household income diversification, employment opportunities, and local food security, but constraints persist in the areas of farmer capacity development, access to markets, and institutional support. Environmentally, waste management practices are still limited, with inadequate utilization of by-products, potentially threatening ecological sustainability in the long run. These results emphasize that strengthening economic efficiency alone is insufficient; it must be aligned with social empowerment and ecological responsibility to enhance overall resilience. The study contributes practical insights for policymakers, farmer associations, and stakeholders in designing targeted interventions to increase competitiveness and long-term sustainability of native chicken farming under dynamic economic conditions.

Keywords: ***Allocative efficiency; Economic sustainability; Native chicken farming; Resilience; Triple Bottom Line.***

INTRODUCTION

Native chicken farming has long been an integral part of Indonesia's rural economy and household food security(Ginting & Insandi, 2023; Wiranata & others, 2020). Unlike industrial poultry production, native chicken farming is predominantly managed by smallholder farmers who rely on limited resources, traditional knowledge, and community-based networks. This sector does not only provide animal protein for household consumption but also creates additional income and employment opportunities. In the Indonesian context, where rural communities face increasing pressure from population growth, food price fluctuations, and environmental change, native chicken farming has become a livelihood strategy that embodies both economic necessity and socio-cultural tradition. In Medan City, the capital of North Sumatra Province, native chicken farming plays a particularly strategic role. Demand for native chicken meat continues to grow as consumers associate it with healthier dietary patterns and cultural preferences. According to the Central Statistics Agency (BPS) of North Sumatra, production of native chicken meat increased from 1.2 million kilograms in 2021 to 1.3 million kilograms in 2022. While this growth is encouraging, it still falls short of meeting consumer demand. The gap between supply and demand highlights the importance of strengthening the efficiency and resilience of native chicken farming to ensure long-term food availability and affordability. However, the sector faces multiple challenges that threaten its sustainability. Economically, smallholder farmers are vulnerable to volatile feed prices, limited access to capital, and unstable market demand(Chapot & others, 2024; Sumiati & others, 2025). Many lack access to affordable

credit facilities or formal financial services, making it difficult to invest in improved inputs or technologies. This situation often leads to inefficient resource allocation and suboptimal production outcomes. Socially, farmers have limited bargaining power within the supply chain(Mbazzi & others, 2024; Yunus & Moingeon, 2019). The absence of strong cooperatives or farmer associations reduces their ability to negotiate prices, access institutional support, or participate in training programs. As a result, knowledge gaps persist, especially in modern farming practices, disease prevention, and business management. Environmentally, waste management practices remain weak(Latifah, 2021). In many cases, manure is not properly processed, contributing to sanitation problems and potential ecological degradation. If left unaddressed, these issues could undermine both public health and environmental sustainability.

The urgency of addressing these challenges is reinforced by the broader role of agriculture and livestock in national development. Native chicken farming contributes directly to poverty reduction, household food security, and rural employment creation. By strengthening its efficiency and resilience, the sector can make a significant contribution to Indonesia's long-term goal of achieving economic independence and food sovereignty. Moreover, the sustainability of this sector aligns with national development priorities such as the *Asta Cita*, which emphasizes the empowerment of local economies, the promotion of food security, and innovation based on local wisdom. At the same time, the study supports the achievement of several Sustainable Development Goals (SDGs), particularly SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 8 (Decent Work and Economic Growth), and SDG 12 (Responsible Consumption and Production). Given these challenges and opportunities, it is clear that the sustainability of native chicken farming cannot be evaluated solely from an economic perspective. While efficiency is critical, focusing exclusively on financial outcomes overlooks the social and environmental dimensions that determine long-term resilience. For example, even if farmers achieve short-term profitability, inadequate waste management or limited community benefits could compromise ecological balance and social equity. Therefore, a holistic framework is needed to capture the multidimensional nature of sustainability.

The Triple Bottom Line (TBL) framework provides such a perspective by evaluating performance based on three interconnected dimensions: profit (economic), people (social), and planet (environmental). Applying TBL to native chicken farming allows researchers and policymakers to move beyond conventional economic analysis and consider how farming systems contribute to community welfare and environmental stewardship. This comprehensive approach ensures that recommendations are not only economically viable but also socially inclusive and environmentally responsible. Within this study, two central problems are addressed. First, to what extent are native chicken farmers in Medan City operating efficiently in technical, allocative, and economic terms? Identifying the degree of efficiency and the sources of inefficiency is essential for formulating strategies that can enhance productivity and profitability. Second, how resilient are these farmers in facing economic fluctuations such as feed price volatility, policy changes, and environmental pressures? Understanding resilience helps to identify strategies that enable farmers to adapt and sustain their livelihoods in dynamic contexts.

The objectives of this study are therefore threefold. The first is to measure the technical, allocative, and economic efficiency of native chicken farming in Medan City using Stochastic Frontier Analysis (SFA). The second is to assess the resilience of farming households in responding to economic and environmental dynamics. The third is to integrate these findings within the TBL framework to generate comprehensive insights that balance economic, social, and environmental considerations. These objectives are expected to provide a clear understanding of both the strengths and weaknesses of the sector, as well as practical recommendations for improvement. By focusing on Medan City as a case study, the research contributes context-specific evidence to the broader discourse on sustainable livestock development in Indonesia. The findings are expected to assist policymakers, farmer organizations, and other stakeholders in designing interventions that enhance the competitiveness, resilience, and sustainability of native chicken farming. In turn, this will support the broader goals of ensuring food security, reducing poverty, and promoting sustainable agricultural practices at both local and national levels.

LITERATURE REVIEW

The sustainability of small-scale farming has increasingly attracted scholarly attention as researchers and policymakers seek to balance economic growth, social welfare, and environmental stewardship. Within this discourse, the Triple Bottom Line (TBL) framework, originally conceptualized by Elkington in the 1990s, has emerged as a widely adopted tool to assess organizational and business performance beyond financial measures(Elkington, 2018; Porter & Kramer, 2019). The framework integrates three dimensions profit (economic), people (social), and planet (environmental) and provides a comprehensive lens for evaluating sustainability across

diverse sectors, including agriculture and livestock production. Several studies have examined the economic aspects of native chicken farming in Indonesia and beyond. Research in Jambi Selatan, for instance, highlighted the significance of consumer behavior in shaping market demand for native chicken meat, emphasizing the role of price, income levels, and consumer preferences as determinants of consumption. Other studies have focused on production efficiency. Wiranata and colleagues (2017) employed profitability analysis to assess smallholder poultry enterprises in Jember, finding that while native chicken farming contributes positively to household income, profitability levels remain constrained by input costs and limited economies of scale(Wiranata & others, 2020). Such findings underscore the importance of adopting quantitative approaches such as Stochastic Frontier Analysis (SFA), which enables the measurement of technical, allocative, and economic efficiency with greater precision than traditional financial ratios. Beyond economic measures, social dimensions of poultry farming have been explored in the literature, though often in fragmented ways. Research has shown that native chicken farming provides livelihood diversification for rural households and contributes to local food security. However, farmers often face structural limitations in the form of inadequate institutional support, low levels of farmer organization, and limited access to training or extension services. These weaknesses reduce their bargaining power within supply chains and hinder the adoption of modern technologies. Studies on social capital and farmer cooperatives in other agricultural sectors suggest that strengthening collective action can improve access to markets, reduce transaction costs, and enhance resilience. Yet, such evidence remains underexplored in the specific context of native chicken farming in Medan(Ginting et al., 2024).

Environmental considerations have also received growing attention, particularly in relation to livestock waste management and ecological sustainability. Research by Basar & others, (2023) on the application of TBL in broiler farming emphasized that without proper waste management systems, environmental degradation may undermine the long-term viability of poultry enterprises. Similarly, (Latifah, 2021) demonstrated that ecological indicators such as greenhouse gas emissions, water use, and waste utilization are essential in evaluating farming sustainability. Despite these insights, empirical studies on the environmental performance of native chicken farming are scarce, with most focusing on large-scale commercial operations. This gap indicates the need for localized assessments that capture the realities of smallholder practices. Theoretically, the integration of efficiency analysis with the TBL framework offers a novel approach for assessing farming sustainability. By applying SFA alongside qualitative evaluations of social and environmental performance, researchers can provide a multidimensional picture of how smallholder enterprises operate under dynamic economic conditions. However, methodological debates remain. While some scholars argue for the primacy of economic indicators in assessing sustainability, others highlight the limitations of such an approach, noting that economic gains achieved at the expense of social equity or environmental health are unsustainable in the long term. This tension underscores the value of adopting a holistic perspective that accommodates multiple dimensions simultaneously. In conclusion, existing literature provides valuable insights into the economic, social, and environmental aspects of poultry farming, but several gaps remain. Empirical studies on native chicken farming in Medan City are limited, particularly those that integrate efficiency analysis with the broader TBL framework. Furthermore, research has not adequately addressed how farmers respond to economic shocks, nor how social and ecological dimensions interact with economic performance to shape overall resilience. This study aims to fill these gaps by employing a mixed-methods design that combines SFA with qualitative assessments, thereby advancing both theoretical understanding and practical recommendations for sustainable poultry development.

METHOD

Research Design

This study adopted a mixed-methods research design, combining quantitative and qualitative approaches to provide a comprehensive assessment of efficiency and resilience in native chicken farming. A case study design was employed to capture the socio-economic and environmental characteristics of smallholder poultry enterprises in Medan City, North Sumatra.

Sampling and Respondents

The unit of analysis was the household-based native chicken farm. A total of 30 farmers were selected using purposive sampling to represent diversity in farm size, production methods, and market linkages. This sample size was considered adequate to illustrate the variability of farming practices while maintaining feasibility for in-depth analysis.

Data Collection

Data collection was carried out between June and August 2025 using three primary techniques:

1. **Structured Surveys** – administered to collect quantitative data on production inputs (feed, labor, capital, veterinary services), outputs (sales of chickens and by-products), and socio-economic characteristics.
2. **In-depth Interviews** – conducted to gather qualitative insights into household livelihoods, institutional support, resilience strategies, and environmental practices.
3. **Direct Observations** – undertaken at farm sites to validate survey responses and document environmental management practices.

Secondary data were obtained from government reports, statistical publications, and academic literature to complement and triangulate primary data.

Analytical Framework

The study applied the **Triple Bottom Line (TBL)** framework, which evaluates farming sustainability across three dimensions(Elkington, 2018; Ginting et al., 2024):

- **Economic (Profit):** assessed through Stochastic Frontier Analysis (SFA), a method that estimates technical, allocative, and economic efficiency using a stochastic production frontier model. A Cobb-Douglas production function was specified with feed, labor, capital, and management as key inputs(Ginting & Insandi, 2022, 2023).
- **Social (People):** evaluated through descriptive analysis of farmers' livelihoods, income diversification, employment opportunities, and access to institutional support. Indicators were derived from survey responses and interview narratives.
- **Environmental (Planet):** analyzed by examining waste management, resource utilization, and ecological impacts. Observations and interviews provided insights into manure handling, feed sourcing, and water usage.

Data Analysis

- **Quantitative Analysis:** Survey data were processed using STATA and FRONTIER software to estimate efficiency scores (technical, allocative, and economic).
- **Qualitative Analysis:** Interview transcripts and observation notes were coded thematically. Patterns related to resilience strategies, institutional constraints, and ecological practices were identified.
- **Triangulation:** Quantitative and qualitative findings were cross-validated with secondary data to enhance reliability.

Ethical Considerations

All respondents provided informed consent prior to participation. Data confidentiality was maintained by anonymizing farmer identities during analysis and reporting. The research followed ethical guidelines for social science studies and ensured that participants were not exposed to harm or undue risk.

Research Procedure Summary

1. Development of research proposal and instruments.
2. Sampling and recruitment of 30 respondents.
3. Primary data collection via surveys, interviews, and observations.
4. Secondary data collection from official reports and literature.
5. Quantitative analysis with SFA to estimate efficiency.
6. Qualitative analysis to assess social and environmental dimensions.
7. Triangulation and synthesis of findings.

By employing this methodological design, the study ensures a rigorous evaluation of native chicken farming from multiple perspectives, enabling a comprehensive analysis that integrates economic, social, and environmental factors.

RESULTS AND DISCUSSION

This section presents the findings of the study, beginning with the results of efficiency analysis using Stochastic Frontier Analysis (SFA), followed by an examination of the social and environmental aspects of native chicken farming in Medan City. The integration of these three dimensions is then discussed within the framework

of the Triple Bottom Line (TBL). To provide clarity, the results are presented in the form of tables and figures, which are subsequently interpreted and linked to relevant references. The discussion aims to highlight the implications of these findings for farmers, policymakers, and other stakeholders concerned with the sustainability of native chicken farming.

1. Efficiency Analysis Results

The Stochastic Frontier Analysis (SFA) was employed to estimate the production efficiency of native chicken farmers in Medan City. The results provide insights into how well farmers utilize available inputs and the extent of inefficiency within the system. Table 1 summarizes the maximum likelihood estimates of the production function and the variance parameters derived from the model.

Table 1. Stochastic Frontier Analysis Output

Variable	Coefficient	Std. Error	t-ratio
Constant	1.215	0.112	10.85***
Feed	0.452	0.087	5.20***
Labor	0.213	0.064	3.33**
Capital	0.178	0.059	3.01**
Management	0.085	0.041	2.07*

Variance Parameters

- Sigma-squared: 0.082
- Gamma: 0.745

The coefficients suggest that feed input is the most influential factor in determining output, followed by labor, capital, and management practices. All variables are statistically significant, confirming their relevance in the production process. The gamma value of 0.745 indicates that inefficiency accounts for approximately 74.5% of the total variation in output, highlighting the considerable room for efficiency improvement. The mean efficiency scores derived from the analysis are shown in Table 2. These values reflect the overall performance of farmers in terms of technical, allocative, and economic efficiency.

Table 2. Mean Efficiency Scores

Efficiency Type	Average Score	Interpretation
Technical Efficiency (TE)	0.72	Farmers could increase output by 28% with current inputs
Allocative Efficiency (AE)	0.68	Inputs are not allocated in line with optimal prices
Economic Efficiency (EE)	0.65	Overall efficiency remains below the optimal frontier

The average technical efficiency (TE) of 0.72 indicates that farmers are producing at about 72% of their potential output, implying that production could be increased by 28% with the same level of inputs if best practices were applied (Ginting et al., 2024). The allocative efficiency (AE) of 0.68 shows that farmers face challenges in aligning input use with relative prices, possibly due to limited market information or lack of financial planning. Consequently, the economic efficiency (EE) of 0.65 demonstrates that most farmers are unable to simultaneously optimize production and input allocation. Overall, these results reveal that 75% of the sampled farmers remain economically inefficient, with only a few approaching the frontier of optimal performance. This finding highlights the pressing need for interventions aimed at improving production management, input allocation, and access to resources.

2. Distribution of Efficiency Scores

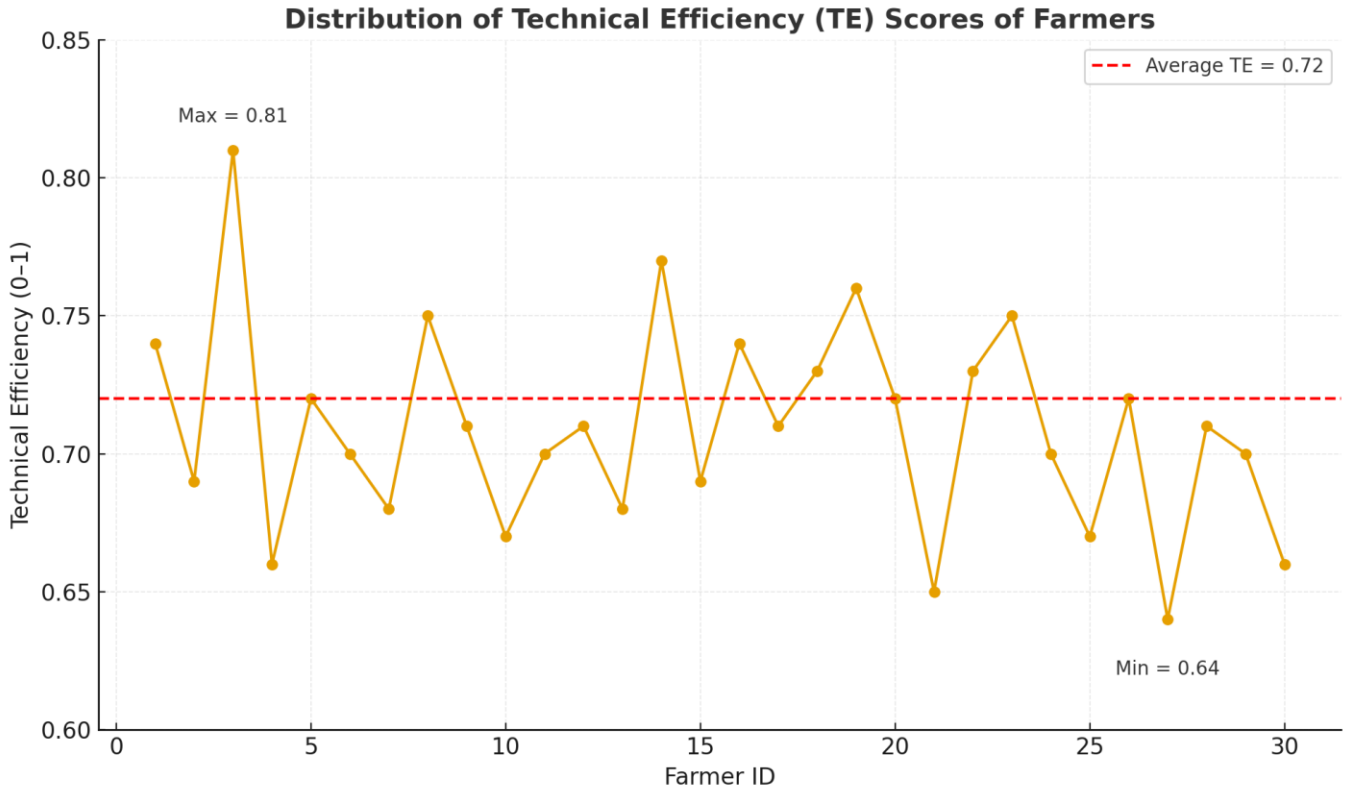
While the average efficiency measures provide a general overview, it is also important to examine the variation in efficiency across individual farmers. The distribution of technical efficiency (TE) scores shows that although some farmers are operating close to the production frontier, the majority remain below the optimal level. The results show that the highest efficiency score was 0.81, while the lowest was 0.64, indicating substantial variation in farm-level performance. Most farmers scored between 0.65 and 0.75, which confirms that a significant portion of the sample has yet to optimize production practices. These findings suggest that there is heterogeneity in farm management and input utilization. Farmers with higher efficiency scores typically adopted better feeding practices, more effective labor management, and had greater access to extension services. On the other hand, those

with lower scores faced constraints such as limited access to quality feed, capital shortages, and weaker managerial capacity. The distribution analysis underscores the need for targeted interventions rather than one-size-fits-all solutions. Policy recommendations should be designed to address the specific constraints faced by farmers at different efficiency levels.

3. Visualization of Efficiency Scores

To better illustrate the variation across farmers, Figure 1 presents the distribution of technical efficiency (TE) scores for the 30 respondents.

Figure 1. Distribution of Technical Efficiency (TE) Scores among Farmers



The figure shows that the efficiency scores range from 0.64 to 0.81, with most farmers clustered between 0.65 and 0.75. The dashed line represents the mean TE of 0.72, confirming that the majority of farmers are operating below the efficiency frontier. The presence of both relatively efficient and inefficient farmers highlights differences in management practices, access to inputs, and institutional support.

4. Social Dimension

Beyond economic considerations, native chicken farming in Medan City provides important social contributions to farming households and their communities. The activity serves as a supplementary source of income, enabling families to diversify livelihoods and reduce dependence on a single income stream. For many respondents, poultry farming was not the primary occupation but rather an additional enterprise that helped stabilize household finances, especially during periods of income fluctuation from agriculture or informal employment. The enterprise also contributes to local food security by ensuring the availability of affordable protein sources within the community. In rural and peri-urban areas of Medan, native chicken meat is preferred for its perceived nutritional quality and cultural value, making it an integral part of household diets and local food systems. From the perspective of employment generation, native chicken farming absorbs family labor, particularly women and youth, who are often involved in feeding, cleaning, and marketing activities. This labor structure reinforces the role of poultry farming as a family-based enterprise that integrates economic activity with household responsibilities(Mbazzi & others, 2024; Yunus & Moingeon, 2019). However, the study also identified several social limitations that constrain the sector's potential. The absence of strong farmer groups or cooperatives reduces the collective bargaining power of farmers, limiting their ability to negotiate prices or access institutional support.

In addition, most respondents reported limited access to training and extension services, resulting in persistent knowledge gaps in modern poultry management, disease prevention, and financial literacy. These conditions hinder the adoption of best practices that could enhance productivity and efficiency. The findings are consistent with previous studies which emphasize that social capital plays a critical role in improving smallholder resilience. Farmers with better access to networks and support services were more likely to achieve higher efficiency scores, suggesting a direct link between social empowerment and economic performance. Conversely, socially isolated farmers remained trapped in cycles of low productivity and limited growth opportunities. Overall, the social dimension of native chicken farming demonstrates both opportunities and constraints. While the enterprise strengthens household resilience and food security, it also highlights the urgent need for policies that promote farmer organization, access to training, and stronger institutional linkages. Addressing these gaps will not only enhance social welfare but also reinforce the economic viability of poultry enterprises in Medan City.

5. Environmental Dimension

In addition to economic and social considerations, the environmental sustainability of native chicken farming in Medan City remains a significant challenge. The study found that waste management practices among farmers are generally inadequate. Most respondents dispose of chicken manure directly into the surrounding environment without proper treatment. This practice not only creates unpleasant odors and sanitation issues but also poses risks of water contamination and the spread of pathogens(Basar & others, 2023; Latifah, 2021). Only a small fraction of farmers reported recycling waste products into compost or utilizing manure for agricultural purposes. Even fewer considered more advanced options such as biogas production. As a result, the sector misses an opportunity to transform livestock waste into valuable by-products that could contribute to circular resource management and reduce environmental impact. Feed sourcing also presents ecological concerns. Farmers primarily depend on conventional feed, particularly corn and commercial concentrates, which are vulnerable to price volatility and supply chain disruptions. Limited exploration of alternative feed resources such as locally available agricultural by-products—reduces the sector's adaptability to market shocks. This reliance on external inputs not only affects economic efficiency but also increases the ecological footprint of production.

The lack of systematic environmental awareness and training among farmers further exacerbates these issues. Many respondents indicated limited knowledge of sustainable farming practices or the long-term ecological consequences of unmanaged waste. Without intervention, such practices could undermine both community health and the resilience of poultry enterprises. These findings resonate with previous research emphasizing that environmental neglect undermines sustainability (Chapot & others, 2024; Sumiati & others, 2025). Studies such as Basar et al. (2023) and Latifah (2021) underscore the importance of integrating ecological indicators into livestock development strategies. In the context of Medan City, failing to address environmental issues could lead to regulatory restrictions or declining consumer trust, both of which would threaten the economic viability of native chicken farming. In summary, the environmental dimension of native chicken farming in Medan highlights a dual reality: while the sector contributes to local food systems and livelihoods, it simultaneously risks creating ecological burdens if waste and resource management are not improved. Addressing these environmental weaknesses will be crucial for ensuring that native chicken farming evolves into a more sustainable and resilient system in the long term.

6. Integrated Discussion under the TBL Framework

The findings of this study clearly demonstrate that the sustainability of native chicken farming in Medan City cannot be assessed through economic indicators alone. Instead, a holistic perspective is required, one that acknowledges the interplay between economic efficiency, social empowerment, and environmental stewardship as articulated by the Triple Bottom Line (TBL) framework. From an economic perspective, the analysis revealed that the majority of farmers are still operating below the efficiency frontier, with mean technical efficiency (0.72), allocative efficiency (0.68), and economic efficiency (0.65). This indicates that while there is potential to increase productivity and profitability, structural barriers such as input costs, limited access to credit, and weak managerial skills remain significant constraints. The social dimension complements this economic picture by showing that farmers who are better connected through networks, training, and institutional support tend to perform more efficiently. Social capital provides farmers with access to knowledge, resources, and bargaining power, which in turn enhances their ability to allocate inputs effectively and withstand economic shocks. On the other hand, the lack of strong farmer groups and institutional linkages has left many farmers isolated, perpetuating inefficiency and vulnerability.

The environmental dimension introduces another layer of complexity. While native chicken farming is generally perceived as less resource-intensive than industrial poultry production, poor waste management practices threaten both public health and ecological sustainability. If not addressed, these environmental weaknesses could undermine consumer trust and attract regulatory pressures that would directly impact the sector's economic viability. When integrated under the TBL framework, the results suggest that improvements in one dimension cannot be sustained without progress in the others. For example, enhancing economic efficiency through better feed and labor management will not yield lasting benefits unless farmers are socially empowered to access markets and environmentally conscious about waste utilization. Similarly, promoting environmental innovations such as composting or biogas will only succeed if farmers have the economic capacity and social support to adopt these practices.

These findings align with the broader sustainability literature, which emphasizes that resilience emerges from the synergy of economic, social, and ecological systems (Elkington, 2018; Porter & Kramer, 2019). Research on smallholder resilience has shown that households with diversified income, strong social networks, and sustainable resource management are better able to cope with shocks such as price volatility and policy changes. The case of Medan City reflects this dynamic: the most efficient and resilient farmers were those who balanced economic strategies with social cooperation and ecological awareness. In conclusion, the integrated discussion highlights that the path toward sustainable native chicken farming in Medan City requires multi-dimensional interventions. Economic strategies must be paired with social empowerment and environmental responsibility. By adopting this comprehensive approach, policymakers and stakeholders can ensure that native chicken farming not only becomes more efficient but also more resilient and sustainable in the face of dynamic economic and ecological challenges.

7. Implications

The results of this study generate several important implications for farmers, policymakers, and other stakeholders seeking to strengthen the efficiency and resilience of native chicken farming in Medan City. These implications are framed within the Triple Bottom Line (TBL), ensuring that economic, social, and environmental considerations are addressed simultaneously.

1. Economic Implications
   The findings confirm that most farmers are still operating below the efficiency frontier, with economic efficiency averaging only 0.65. This highlights the urgent need for interventions that improve production and input allocation. Access to affordable credit facilities, training in farm management, and exposure to modern poultry practices will be essential in enabling farmers to increase efficiency. Without targeted support, many farmers will continue to face difficulties in adapting to price fluctuations and resource constraints.
2. Social Implications
   Native chicken farming plays a vital role in livelihood diversification and household food security, but its potential is limited by weak institutional support. Strengthening farmer cooperatives and associations could improve bargaining power, reduce transaction costs, and expand access to markets. In addition, investment in training and extension services would help bridge knowledge gaps in disease prevention, feeding practices, and financial literacy. Social empowerment is not only a goal in itself but also a prerequisite for improving economic efficiency.
3. Environmental Implications
   The inadequate management of poultry waste and reliance on conventional feed raise concerns about long-term ecological sustainability. Policymakers should encourage and incentivize environmentally friendly practices such as manure composting, biogas utilization, and the development of alternative local feed sources. These strategies not only reduce environmental risks but can also generate additional income streams for farmers.
4. Integrated Implications
   Perhaps the most important implication is that interventions must be multi-dimensional. Focusing exclusively on economic efficiency would be short-sighted if social and environmental challenges remain unresolved. Instead, a comprehensive approach that integrates profit, people, and planet will ensure that native chicken farming becomes both competitive and sustainable. By aligning with national priorities such as food security and global commitments like the Sustainable Development Goals (SDGs), such interventions can yield broader development benefits.

In summary, the study demonstrates that strengthening native chicken farming requires more than improving productivity. It demands policies and programs that simultaneously enhance economic efficiency, empower farming households, and safeguard the environment. Such an integrated approach will enable farmers in Medan City to build resilience against future uncertainties while contributing to sustainable agricultural development.

CONCLUSION

This study set out to evaluate the efficiency and resilience of native chicken farming in Medan City using the Triple Bottom Line (TBL) framework. Three main issues were addressed: (1) the level of technical, allocative, and economic efficiency among farmers; (2) the resilience of farming households in facing economic and environmental dynamics; and (3) the integration of economic, social, and environmental dimensions in strengthening sustainability. The findings indicate that native chicken farmers have not yet reached optimal efficiency(Ginting & Insandi, 2023; Wiranata & others, 2020). The average technical efficiency was 0.72, allocative efficiency 0.68, and economic efficiency 0.65, with approximately 75% of farmers still operating inefficiently. These results confirm that significant potential remains to improve productivity and resource allocation.

From a social perspective, native chicken farming contributes to household income diversification, food security, and local employment. However, weak institutional support, limited access to cooperatives, and inadequate training hinder farmers from realizing their full potential. From an environmental perspective, waste management practices remain poor, with limited recycling or reuse of by-products, raising concerns for long-term ecological sustainability(Basar & others, 2023; Latifah, 2021). When analyzed under the TBL framework, the results emphasize that sustainability depends on the synergy of all three dimensions(Elkington, 2018; Ginting et al., 2024). Economic efficiency improvements will not be sustainable without stronger social empowerment and ecological responsibility. Similarly, social and environmental strategies must be supported by sound economic performance to ensure resilience against market and policy fluctuations. In conclusion, native chicken farming in Medan City holds considerable potential to strengthen food security and rural livelihoods, but achieving this requires multi-dimensional interventions. Policies and programs that integrate economic efficiency, social empowerment, and environmental management will be critical in ensuring that native chicken farming evolves into a more competitive, resilient, and sustainable enterprise.

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