



Competitiveness of Indonesian Livestock Commodities: A Systematic Review

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Abstract | The livestock sector plays a strategic role in strengthening Indonesia's food security and rural economy through four major commodities: beef, chicken meat, table eggs, and dairy milk. However, previous studies have generally evaluated these commodities separately using different competitiveness indicators, resulting in fragmented evidence and inconsistent conclusions. This study aims to systematically synthesize and compare the competitiveness of Indonesia's major livestock commodities within a unified analytical framework. A Systematic Literature Review (SLR) following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines was conducted. From 431 records identified through database searches, 21 eligible studies published between 2016 and 2025 were selected for qualitative synthesis. The findings demonstrate that livestock competitiveness is multidimensional and should be evaluated from three complementary perspectives: production competitiveness (PCR, DRC, and EPC), domestic market competitiveness (SSR and IDR), and international trade competitiveness (RCA and TSI). Chicken meat exhibited the strongest domestic competitiveness owing to efficient production systems and integrated value chains, although its export competitiveness remained relatively limited. Table eggs showed high production efficiency but weak international trade performance. Beef demonstrated competitive production in several regions but remained weak in international markets because of low productivity, fragmented supply chains, and import dependence. Dairy milk exhibited the weakest overall competitiveness due to structural constraints, including low productivity, small farm size, and heavy reliance on imports. This review proposes a three-dimensional competitiveness framework that reconciles apparent inconsistencies among commonly used competitiveness indicators and provides a comparative basis for designing commodity-specific and value chain-oriented livestock development policies in Indonesia.

Keywords | Systematic literature review; Livestock competitiveness; Beef; Chicken Meat; Table eggs; Dairy milk.

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INTRODUCTION

The livestock sector plays a strategic role in Indonesia's food system by supplying essential animal protein, generating rural employment, and contributing to

agricultural economic growth. Beef, dairy milk, chicken meat, and eggs are the country's four major livestock commodities, each serving different market segments and exhibiting distinct production characteristics. Rising population, urbanization, increasing household incomes,

and changing dietary preferences have continuously increased domestic demand for these commodities, making livestock competitiveness a critical issue for national food security and agricultural development.

Despite its considerable production potential, Indonesia continues to experience contrasting levels of competitiveness across livestock commodities. Beef and dairy milk remain highly dependent on imports because domestic production has been unable to satisfy rapidly growing demand. In contrast, chicken meat and eggs have achieved relatively high levels of domestic self-sufficiency, although both commodities continue to face structural challenges associated with feed costs, market instability, and fluctuating producer prices. These differences suggest that competitiveness cannot be adequately understood through a single commodity perspective but instead requires a comparative evaluation across major livestock subsectors.

Competitiveness in the livestock sector has generally been evaluated using two complementary concepts. Comparative advantage reflects the efficient utilization of domestic resources, whereas competitive advantage emphasizes production efficiency, technological capability, institutional support, market access, and policy environments. Previous studies have measured these dimensions using indicators such as the Policy Analysis Matrix (PAM), Domestic Resource Cost (DRC), Private Cost Ratio (PCR), Effective Protection Coefficient (EPC), Revealed Comparative Advantage (RCA), Trade Specialization Index (TSI), and econometric approaches. However, the findings remain fragmented because most studies focus on individual commodities or specific production regions, making cross-commodity comparisons difficult.

One of the major structural constraints affecting Indonesia's livestock competitiveness is the heavy dependence on imported feed ingredients. Although Indonesia possesses abundant agricultural resources and considerable potential for feed production, feed manufacturing still relies substantially on imported raw materials. According to the Ministry of Agriculture (2025), the national feed industry required approximately 11.75 million tons of corn in 2024, of which 1.74 million tons (14.81%) were imported. Dependence is even greater for soybean meal, where domestic production is negligible and virtually all industrial demand, amounting to approximately 5.43 million tons, is fulfilled through imports (Wijayanti *et al.*, 2024). This reliance increases production costs, exposes producers to international price volatility, and reduces the competitiveness of livestock products, particularly poultry commodities whose production costs are dominated by feed expenditures.

Beyond feed availability, productivity gaps also contribute substantially to differences in competitiveness among livestock commodities. Beef production is constrained by low reproductive performance, limited availability of superior breeding stock, traditional management systems, and relatively slow biological growth. Similarly, dairy farming is characterized by low milk productivity, small herd sizes, and inconsistent product quality. Conversely, the poultry industry has adopted intensive production technologies, improved genetics, commercial feed systems, and integrated supply chains, enabling higher production efficiency and shorter production cycles. Nevertheless, poultry competitiveness remains vulnerable to fluctuations in feed prices and periodic oversupply, demonstrating that high production efficiency alone does not guarantee sustainable competitiveness.

Several previous studies have investigated livestock competitiveness from different perspectives. Rouf *et al.* (2019), Mallu *et al.* (2019), Gerhana *et al.* (2025), and Lasahudu *et al.* (2017) evaluated beef competitiveness using PAM indicators and reported contrasting results across production systems and regions. Ginting (2020) and Yulianti (2024) analyzed dairy farming competitiveness and showed that production scale strongly influences competitive performance. Wibowo *et al.* (2025a) assessed Indonesia's processed chicken exports using RCA and TSI indicators and concluded that domestic production efficiency has not yet translated into strong export competitiveness. Likewise, Hastang *et al.* (2019) and Mulatsih *et al.* (2024) demonstrated that egg production is financially competitive at the farm level, while international trade indicators still indicate relatively weak export performance. Collectively, these studies demonstrate that competitiveness varies not only among commodities but also across analytical frameworks, geographical settings, production scales, and market orientations.

Although the existing literature provides valuable insights, several important limitations remain. First, previous studies have predominantly examined individual commodities in isolation, preventing systematic comparison of the competitiveness patterns among beef, dairy milk, chicken meat, and eggs. Second, different competitiveness indicators have often produced seemingly inconsistent conclusions because each measures different dimensions of competitiveness, yet few studies have synthesized these findings within a common analytical framework. Third, previous reviews have largely summarized empirical results without critically examining how production systems, technological adoption, resource endowments, government policies, and market structures jointly explain variations in competitiveness across commodities. Consequently, policymakers still lack an integrated evidence base for

determining strategic priorities in livestock development.

To address these knowledge gaps, this study employs a Systematic Literature Review (SLR) following the PRISMA framework to synthesize empirical evidence on the competitiveness of Indonesia's four major livestock commodities. Rather than merely summarizing previous findings, this review compares competitiveness indicators, identifies recurring drivers and constraints, explains contradictory findings reported across studies, and develops an integrated understanding of competitiveness at both domestic and international market levels. The findings are expected to contribute to the literature by providing a comparative synthesis of livestock competitiveness and to support evidence-based policy formulation for strengthening Indonesia's livestock sector and enhancing national food security.

RESEARCH METHOD

STUDY DESIGN

This study employed a Systematic Literature Review (SLR) to synthesize empirical evidence regarding the competitiveness of Indonesia's major livestock commodities, namely beef, chicken meat, eggs, and dairy milk. The review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure methodological transparency, reproducibility, and comprehensive reporting (Page *et al.*, 2021).

SEARCH STRATEGY

A systematic literature search was conducted between 10 and 30 August 2025 using five major electronic databases: Scopus, ScienceDirect, Web of Science, Google Scholar, and Crossref. These databases were selected because they collectively provide broad coverage of peer-reviewed international and national publications in agricultural economics, livestock science, agribusiness, and rural development. The search strategy combined Boolean operators with keywords related to livestock competitiveness. The primary search string was: ("livestock" OR "beef" OR "cattle" OR "dairy" OR "milk" OR "chicken" OR "broiler" OR "egg" OR "poultry") AND ("competitiveness" OR "comparative advantage" OR "competitive advantage" OR "Policy Analysis Matrix" OR PAM OR RCA OR DRC OR PCR OR EPC OR "Trade Specialization Index" OR TSI) AND Indonesia. Equivalent search expressions were adapted to the syntax of each database where necessary.

ELIGIBILITY CRITERIA

The eligibility criteria were established before the literature search to minimize selection bias.

INCLUSION CRITERIA

- Empirical studies evaluating the competitiveness of Indonesian livestock commodities.
- Studies focusing on beef cattle, dairy milk, chicken meat, laying hens, or eggs.
- Research employing quantitative competitiveness indicators, including Policy Analysis Matrix (PAM), Domestic Resource Cost (DRC), Private Cost Ratio (PCR), Effective Protection Coefficient (EPC), Revealed Comparative Advantage (RCA), Trade Specialization Index (TSI), or econometric analyses (Table 1).
- Articles published in English or Indonesian.
- Full-text articles published between 2016 and August 2025.

EXCLUSION CRITERIA

- Review articles, opinion papers, editorials, conference abstracts, and book reviews.
- Studies lacking empirical data or quantitative competitiveness analysis.
- Studies addressing livestock production without discussing competitiveness.
- Duplicate publications retrieved from multiple databases.
- Articles whose full text was unavailable.

STUDY SELECTION

The study selection followed the PRISMA 2020 workflow. The initial search identified 431 records across the selected databases. After removing duplicate records, titles and abstracts were screened against the predefined eligibility criteria. Potentially relevant studies then underwent full-text assessment. Articles failing to satisfy the inclusion criteria were excluded with documented reasons, including irrelevant study objectives, absence of competitiveness indicators, duplicate publications, or unavailable full texts. Ultimately, 21 empirical studies fulfilled all eligibility criteria and were included in the qualitative synthesis (Figure 1).

QUALITY ASSESSMENT

To improve the methodological rigor of the review, each included study underwent an independent quality appraisal before data synthesis. The assessment considered five methodological domains: clarity of research objectives; appropriateness of competitiveness indicators; transparency of analytical methods; completeness of reported results; and consistency between results and conclusions.

Each criterion was evaluated using a three-point scale (1 = low quality, 2 = moderate quality, 3 = high quality). Only studies achieving an overall moderate or high methodological quality were retained for synthesis.

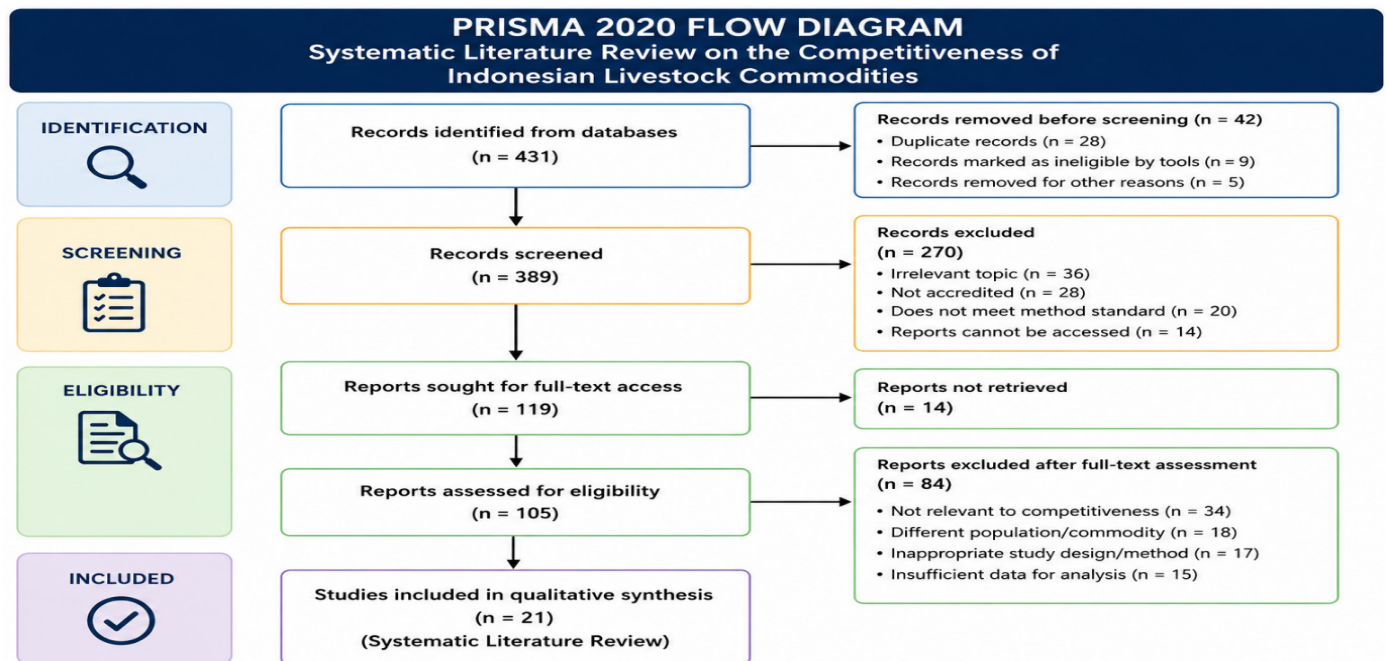


Figure 1: The selection process of a systematic literature review on the competitiveness of Indonesian livestock commodities using the prisma flow diagram.

Table 1: Quantitative indicators used to assess the competitiveness of Indonesian livestock commodities.

Indicator	Definition	Competitive- ness Dimension	Competitiveness Criteria
PAM (Policy Analysis Matrix)	An analytical framework used to evaluate the competitive and comparative advantages of agricultural production systems by comparing private and social profitability. The principal competitiveness indicators derived from PAM are PCR, DRC, and EPC.	Production Competitiveness	Analytical framework for deriving PCR, DRC, and EPC.
DRC (Domestic Resource Cost)	Measures comparative advantage by evaluating the efficiency of domestic resource use in producing tradable commodities.	Production Competitiveness	DRC < 1: Comparative advantage. DRC > 1: Comparative disadvantage. DRC = 1: Break-even condition.
PCR (Private Cost Ratio)	Measures private competitive advantage by comparing domestic factor costs with value added at private prices.	Production Competitiveness	PCR < 1: Competitive advantage. PCR ≥ 1: No competitive advantage.
EPC (Effective Protection Coefficient)	Measures the degree of protection provided by government policies through their effects on value added at domestic prices.	Production Competitiveness	EPC > 1: Effective policy protection. EPC = 1: Neutral policy effect. EPC < 1: Disincentive to domestic production.
SSR (Self-Sufficiency Ratio)	Measures the extent to which domestic production is able to satisfy domestic demand for a commodity.	Domestic Market Competitiveness	Higher SSR: Greater self-sufficiency and stronger domestic market competitiveness. Lower SSR: Greater dependence on external supply.
IDR (Import Dependency Ratio)	Measures the proportion of domestic consumption that depends on imports.	Domestic Market Competitiveness	Lower IDR: Lower import dependence and stronger domestic market competitiveness. Higher IDR: Higher import dependence.
RCA (Revealed Comparative Advantage)	Measures a country's export competitiveness by comparing the share of a product in national exports with its share in world exports.	International Trade Competitiveness	RCA > 1: Strong international trade competitiveness. RCA < 1: Weak international trade competitiveness.
TSI (Trade Specialization Index)	Measures export specialization by comparing net exports with total trade (exports plus imports).	International Trade Competitiveness	TSI > 0: Net exporter with stronger international trade competitiveness. TSI = 0: Balanced trade position. TSI < 0: Net importer with weaker international trade competitiveness.

Studies presenting serious methodological weaknesses or insufficient reporting were excluded.

DATA EXTRACTION

A standardized data extraction form was developed to ensure consistency among reviewers. The following information was extracted from each eligible article: author(s), publication year, research location, livestock commodity, analytical method, competitiveness indicators, principal findings, and policy implications. Data extraction was independently conducted by two reviewers. Discrepancies were resolved through discussion until consensus was achieved.

DATA SYNTHESIS

The selected studies were synthesized using a comparative qualitative synthesis rather than a simple descriptive summary. The synthesis consisted of four sequential stages. First, studies were grouped according to livestock commodity (beef, chicken meat, eggs, and dairy milk). Second, competitiveness indicators (PCR, DRC, EPC, RCA, and TSI) were compared across studies to identify similarities and inconsistencies. Third, recurring determinants of competitiveness—including productivity, feed costs, technology adoption, production scale, government policies, and market structure—were identified and synthesized. Finally, contradictory findings among studies were critically interpreted by considering differences in geographical context, production systems, business scale, and methodological approaches. This comparative synthesis enabled the identification of cross-cutting patterns and commodity-specific drivers of competitiveness, thereby providing an integrated understanding of livestock competitiveness in Indonesia.

RESULTS AND DISCUSSION

BEEF COMPETITIVENESS

COMPARATIVE PERFORMANCE IN DOMESTIC AND INTERNATIONAL MARKETS

The literature consistently indicates that beef is the least competitive among Indonesia's four major livestock commodities. However, the evidence also demonstrates that beef competitiveness is highly heterogeneous across production systems, geographical regions, and analytical perspectives. Studies employing domestic competitiveness indicators such as the Private Cost Ratio (PCR), Domestic Resource Cost (DRC), and Effective Protection Coefficient (EPC) frequently report contrasting conclusions, while international trade indicators, particularly the Revealed Comparative Advantage (RCA) and Trade Specialization Index (TSI), uniformly portray Indonesia as a net importer with limited export competitiveness (Table 2). This divergence suggests that the competitiveness of Indonesian

beef cannot be interpreted through a single indicator; rather, it should be understood as a multidimensional phenomenon influenced by production efficiency, resource endowment, institutional support, and trade policy.

From the perspective of international competitiveness, empirical evidence is remarkably consistent. Indonesia continues to exhibit a weak comparative position in the global beef market. National trade statistics show that the country's beef exports remain negligible, while imports continue to increase to satisfy domestic demand. The Ministry of Agriculture reported that the Import Dependency Ratio (IDR) increased from 27.31% in 2020 to 27.88% in 2024, whereas the Self-Sufficiency Ratio (SSR) declined from 72.70% to 72.12% during the same period, indicating that domestic production capacity has failed to keep pace with growing consumption (Ministry of Agriculture, 2025). Similarly, both the RCA and TSI values remain close to zero or negative, confirming that Indonesia has not yet developed a comparative advantage in international beef trade. These findings are consistent with the regional analysis conducted by Sutawi *et al.* (2019), who demonstrated that Indonesia's beef exports were substantially less competitive than those of several ASEAN member states, reflecting limited export specialization and weak integration into regional markets.

In contrast, studies evaluating competitiveness at the farm level reveal more diverse findings. Rouf *et al.* (2019) reported that smallholder beef cattle farming in Gorontalo was not competitive because the Effective Protection Coefficient (EPC) remained below one, implying that prevailing output prices were insufficient to compensate for the costs of tradable inputs under existing policy conditions. This result suggests that government interventions had not yet created an effective incentive structure for improving farmers' competitiveness. Similar concerns are reflected in national trade performance, where continued dependence on imported beef limits the ability of domestic producers to expand market share despite increasing domestic demand.

Nevertheless, evidence from other regions presents a more optimistic picture. Mallu *et al.* (2019) found that community-based beef cattle enterprises in East Kalimantan achieved both competitive and comparative advantages, as indicated by PCR and DRC values below one. Comparable results were reported by Gerhana *et al.* (2025), who demonstrated that Bali cattle production systems in Southeast Sulawesi achieved PCR values ranging from 0.52 to 0.77 and DRC values between 0.62 and 0.82, reflecting efficient utilization of domestic resources and favorable production costs. These findings indicate that competitiveness is not uniformly low across Indonesia; rather, certain regions possess production

Table 2: Summary of competitiveness studies on Indonesian beef.

Authors	Study Area / Scope	Indicator(s)	Main Findings	Competitiveness Dimension
Rouf <i>et al.</i> (2019)	Smallholder beef cattle farming, Gorontalo Regency	EPC < 1	Government policies provided insufficient effective protection, resulting in weak production competitiveness.	Production Competitiveness (Policy Protection)
Mallu <i>et al.</i> (2019)	Community-based beef cattle breeding, North Penajam Paser, East Kalimantan	PCR = 0.77; DRC = 0.96	Beef cattle farming demonstrated both competitive and comparative advantages under existing production conditions.	Production Competitiveness (PCR, DRC)
Sutawi <i>et al.</i> (2019)	Indonesian beef trade within ASEAN	RCA = 0.00; TSI = -1.00	Indonesian beef exhibited the weakest export competitiveness among ASEAN member countries.	International Trade Competitiveness (RCA, TSI)
Gerhana <i>et al.</i> (2025)	Bali cattle farming, South-east Sulawesi	PCR = 0.52–0.77; DRC = 0.60–0.82	Bali cattle production demonstrated strong competitive and comparative advantages.	Production Competitiveness (PCR, DRC)
Ministry of Agriculture (2025)	National beef trade performance	RCA = 0.00; TSI = -1.00	Indonesian beef remained weakly competitive in international markets.	International Trade Competitiveness (RCA, TSI)

systems capable of competing efficiently under existing market conditions.

The apparent inconsistency among previous studies should not be interpreted as contradictory evidence but rather as an indication that competitiveness is highly context dependent. Differences in agroecological conditions, feed availability, production scale, cattle breeds, and institutional arrangements contribute substantially to variations in competitiveness across regions. Sterzer and Azizah (2021) emphasized that abundant agricultural by-products, locally adapted cattle breeds, and relatively affordable labor constitute important sources of Indonesia's comparative advantage. Consequently, regions possessing these favorable production factors are more likely to achieve efficient resource utilization than regions constrained by limited feed resources or higher production costs.

Another important distinction emerging from the reviewed studies concerns the difference between domestic production competitiveness and international trade competitiveness. Several farm-level studies demonstrate that beef production can be economically viable within particular local production systems, yet these localized advantages have not translated into national export competitiveness. This discrepancy reflects structural challenges extending beyond farm efficiency, including fragmented supply chains, inconsistent product quality, limited processing capacity, and insufficient market integration. Thus, competitive production at the farm level alone is insufficient to establish comparative advantage in international markets unless accompanied by improvements

throughout the value chain.

Collectively, the reviewed evidence demonstrates that Indonesian beef competitiveness exhibits a dualistic pattern. At the microeconomic level, several production regions possess competitive production systems supported by favorable resource endowments and efficient management practices. At the macroeconomic level, however, Indonesia continues to experience low international competitiveness characterized by increasing import dependence and limited export performance. This duality highlights the importance of distinguishing between farm-level efficiency and national trade competitiveness when evaluating livestock development strategies. Future policy interventions should therefore not only enhance production efficiency but also strengthen value chain integration, market institutions, and trade competitiveness to enable localized competitive advantages to contribute more effectively to national food security and international market participation.

PRODUCTIVITY, TECHNOLOGY, FEED, AND SUPPLY CHAINS

The reviewed literature demonstrates that the competitiveness of Indonesia's beef sector is determined by multiple interrelated structural factors rather than by production efficiency alone. Across the selected studies, four determinants consistently emerge as the principal drivers of competitiveness: productivity, technological adoption, feed availability, and supply chain performance. These factors interact to influence production costs, resource-use efficiency, and market performance, thereby explaining the considerable variation in competitiveness observed among production regions.

Productivity represents the most fundamental determinant of beef competitiveness. Unlike the poultry industry, which has achieved substantial improvements through intensive production systems, Indonesia's beef sector remains largely dominated by smallholder farms characterized by low herd size, slow growth rates, and limited production efficiency. Previous studies consistently report that traditional husbandry practices continue to constrain animal performance, resulting in higher production costs and lower profitability (Adikusuma and Utami, 2018; Mappigau *et al.*, 2017). These limitations reduce farmers' capacity to respond to increasing domestic demand while simultaneously weakening their ability to compete with imported beef products.

The reviewed studies further indicate that productivity differences largely explain why competitiveness varies substantially among regions. Regions reporting PCR and DRC values below one generally combine superior production management with better utilization of local resources. In contrast, production systems characterized by low reproductive performance, inefficient feeding practices, and limited managerial capacity tend to exhibit weaker competitiveness despite operating under similar market conditions. This finding suggests that competitiveness should be interpreted as an outcome of production efficiency rather than merely the availability of natural resources.

Technological adoption constitutes the second major determinant identified across the literature. Several studies emphasize that productivity improvements cannot be separated from technological innovation in breeding, feeding, animal health, and farm management. Rouf *et al.* (2019) demonstrated that increasing average daily weight gain through improved feeding practices and crossbreeding programs significantly enhances production efficiency and economic competitiveness. Similarly, Sterzer and Azizah (2021) argued that locally adapted cattle breeds combined with appropriate production technologies create important sources of comparative advantage because they enable producers to utilize domestic resources more efficiently.

Nevertheless, the literature also reveals that technological diffusion remains uneven across Indonesia. Most competitive production systems are concentrated in regions where extension services, breeding programs, and institutional support are relatively stronger. Conversely, many smallholder farmers continue to rely on traditional production methods with limited adoption of improved genetics, reproductive technologies, or digital farm management. Consequently, technological disparities contribute directly to differences in productivity and production costs across regions, reinforcing unequal

competitiveness within the national beef industry.

Feed availability and feed efficiency emerge as another critical determinant throughout the reviewed studies. Feed represents the largest production cost component in beef production, making its availability and price decisive factors affecting competitiveness. Sterzer and Azizah (2021) emphasized that abundant agricultural residues, forage resources, and locally available feed ingredients provide significant comparative advantages in several production areas. These locally available resources reduce dependence on commercial feed and improve production efficiency.

However, the reviewed literature also indicates that feed resources remain underutilized in many parts of Indonesia. Adikusuma and Utami (2018) reported that agricultural by-products have not yet been optimally incorporated into beef production systems, while seasonal shortages of forage continue to constrain productivity, particularly during prolonged dry periods. Such conditions increase feeding costs, reduce animal growth rates, and ultimately lower business competitiveness. Therefore, regional differences in feed resource management partially explain why certain production areas consistently outperform others in competitiveness analyses.

Beyond farm-level production factors, the literature increasingly recognizes supply chain performance as a structural determinant of competitiveness. Beef competitiveness depends not only on efficient production but also on the effectiveness of coordination among producers, traders, processors, distributors, and consumers. Mappigau *et al.* (2017) identified fragmented supply chain structures, weak market coordination, and inefficient information flows as major constraints limiting the competitiveness of Indonesian smallholder beef production. In many regions, producers remain disconnected from modern value chains, reducing their bargaining position and limiting incentives to improve production quality.

Supply chain inefficiencies also contribute to Indonesia's continuing dependence on imported beef. Although domestic demand continues to increase, fragmented marketing systems, inconsistent product quality, and limited processing capacity prevent domestic producers from fully capturing expanding market opportunities. Consequently, imports remain necessary to stabilize domestic supply, despite the existence of competitive production systems in several regions. This discrepancy illustrates that improvements in farm productivity alone are insufficient to strengthen national competitiveness unless accompanied by stronger market integration and more efficient value chain governance.

An important insight emerging from this review is that these four determinants are highly interconnected rather than operating independently. Technological innovation contributes directly to productivity improvements, while productivity gains depend heavily on feed availability and efficient resource utilization. Likewise, improvements in production efficiency generate limited economic benefits if supply chains remain fragmented and market access continues to be constrained. Therefore, competitiveness should be understood as the outcome of interactions among production technology, natural resource management, institutional support, and market organization rather than as the consequence of a single production factor.

Overall, the reviewed evidence suggests that strengthening Indonesia's beef competitiveness requires systemic improvements across the entire production and marketing ecosystem. Policies focusing exclusively on increasing cattle populations are unlikely to produce substantial competitiveness gains unless accompanied by investments in productivity enhancement, technology dissemination, feed resource development, and value chain integration. A systems perspective therefore provides a more comprehensive explanation of competitiveness differences than approaches emphasizing isolated production variables alone.

POLICY IMPLICATIONS AND COMPARATIVE SYNTHESIS

The comparative evidence synthesized in this review indicates that Indonesia's beef competitiveness should not be interpreted as a binary condition of either being competitive or uncompetitive. Instead, competitiveness exists along a continuum shaped by regional resource endowments, production efficiency, institutional capacity, and policy effectiveness. While several empirical studies demonstrate that particular regions have achieved competitive and comparative advantages through efficient resource utilization and favorable production environments (Gerhana *et al.*, 2025; Mallu *et al.*, 2019), these localized successes have not yet translated into sustained national competitiveness. This discrepancy highlights the importance of distinguishing between localized production competitiveness and national market competitiveness, two dimensions that require different policy approaches.

The reviewed literature consistently shows that farm-level competitiveness does not automatically improve national trade performance. Beef production systems with favorable PCR and DRC values demonstrate efficient use of domestic resources, yet Indonesia continues to record extremely low RCA and persistently negative TSI values (Ministry of Agriculture, 2025; Sutawi *et al.*, 2019). This finding suggests that improvements achieved within individual production systems remain disconnected

from broader market structures. Weak coordination among producers, processors, distributors, and marketing institutions limits the ability of domestic producers to capture value throughout the supply chain. Consequently, competitive production systems coexist with increasing dependence on imported beef, creating a structural paradox within the Indonesian beef industry.

Another important finding emerging from the comparative synthesis is that competitiveness is cumulative rather than additive. Productivity improvement, technological innovation, feed efficiency, and supply chain integration reinforce one another and therefore cannot be addressed through isolated interventions. Studies reviewed in this analysis consistently indicate that technological improvements generate the greatest benefits when accompanied by adequate feed resources, effective extension services, and well-functioning market institutions (Rouf *et al.*, 2019; Sterzer and Azizah, 2021). Conversely, investment in a single production component without complementary institutional reforms is unlikely to produce substantial competitiveness gains. This systems perspective explains why similar government programs often produce different outcomes across regions despite comparable financial investments.

The evidence further suggests that Indonesia's comparative advantage lies primarily in its abundant domestic resources rather than in its current market performance. Agricultural by-products, locally adapted cattle breeds, and relatively competitive labor costs constitute strategic assets that can support more efficient beef production (Sterzer and Azizah, 2021). However, these natural advantages remain underexploited because technological diffusion, breeding improvement, and feed resource management have not progressed uniformly across production regions. As a result, significant differences in productivity persist between regions, reducing the overall competitiveness of the national beef sector.

From a policy perspective, the findings imply that future livestock development strategies should move beyond production-oriented targets, such as increasing cattle populations alone. Instead, competitiveness policies should adopt an integrated value chain approach encompassing genetic improvement, feed resource development, technology dissemination, producer organizations, logistics modernization, market information systems, and trade facilitation. Strengthening institutional coordination among government agencies, research institutions, cooperatives, and private agribusinesses is equally important to ensure that localized production advantages are transformed into sustainable national competitiveness.

Overall, this systematic review demonstrates that Indonesia possesses significant opportunities to improve beef competitiveness; however, these opportunities will only be realized through coordinated structural transformation rather than isolated production interventions. Future competitiveness should therefore be evaluated not only by improvements in farm-level efficiency but also by the ability of the national beef industry to reduce import dependence, strengthen domestic value chains, and progressively improve its position within regional and international markets. Such an integrated perspective provides a more comprehensive framework for livestock development than conventional approaches focusing exclusively on production indicators.

CHICKEN MEAT COMPETITIVENESS

COMPARATIVE PERFORMANCE IN DOMESTIC AND INTERNATIONAL MARKETS

Among Indonesia's major livestock commodities, chicken meat demonstrates the strongest overall production performance and domestic market competitiveness. Nevertheless, the evidence synthesized in this review reveals that domestic competitiveness should not be equated with international trade competitiveness. While Indonesia has achieved remarkable success in satisfying domestic demand through efficient commercial production systems, its export competitiveness remains relatively weak. This distinction is essential because several previous studies have evaluated competitiveness using different analytical perspectives, leading to conclusions that appear contradictory when interpreted without considering the scale of analysis.

At the domestic level, the reviewed literature consistently indicates that chicken meat is Indonesia's most competitive livestock commodity. National production has expanded rapidly over the last decade, supported by intensive production systems, rapid technological adoption, and increasing consumer demand. According to the [Ministry of Agriculture \(2024\)](#), Indonesia's Import Dependency Ratio (IDR) for chicken meat was almost zero, ranging only from approximately 0.0000001% to 0.0019%, while the Self-Sufficiency Ratio (SSR) remained close to 100% throughout the observation period. These indicators demonstrate that domestic production is fully capable of meeting national consumption requirements without significant reliance on imported products. Compared with beef and dairy milk, which continue to depend substantially on imports, chicken meat represents Indonesia's strongest achievement in livestock self-sufficiency.

The strength of the domestic market is further supported by consumption patterns. Per capita chicken meat consumption reached approximately 8.4 kg annually in

2024, more than three times higher than beef consumption. [Wibowo *et al.* \(2025b\)](#) reported that demand for chicken meat is relatively price inelastic, indicating that household consumption remains stable even when prices fluctuate moderately. Such market characteristics provide producers with relatively predictable domestic demand, thereby reducing market uncertainty and encouraging investment in commercial production. Combined with short production cycles and rapid capital turnover, these conditions create a favorable business environment that strengthens domestic competitiveness.

Despite these favorable domestic indicators, the reviewed evidence paints a markedly different picture when international competitiveness is assessed. Studies using the Revealed Comparative Advantage (RCA) index consistently report values below one, indicating that Indonesian chicken meat exports do not possess a comparative advantage in global markets. [Wibowo *et al.* \(2025a\)](#) found that processed chicken products achieved limited competitiveness only in relatively small export destinations such as Timor-Leste and Palau, whereas they remained uncompetitive in larger international markets. Likewise, [Ministry of Agriculture \(2024\)](#) trade statistics reported RCA values ranging from 0.00 to 0.02 between 2019 and 2023, confirming Indonesia's weak export specialization despite strong domestic production performance ([Table 3](#)).

The apparent contradiction between domestic self-sufficiency and weak export competitiveness reflects the multidimensional nature of competitiveness. High domestic production does not automatically translate into international comparative advantage because export performance depends on additional factors, including production costs, product quality, sanitary and phytosanitary standards, logistics efficiency, and international market access. Therefore, indicators such as SSR and IDR measure the capacity to satisfy domestic demand, whereas RCA evaluates a country's relative export performance in comparison with global competitors. These indicators represent different dimensions of competitiveness and should not be interpreted interchangeably.

Comparative evidence further suggests that Indonesia's poultry industry has successfully developed production systems capable of supporting large domestic markets but has not yet achieved sufficient cost competitiveness to compete with major poultry exporters. [Soedjana and Priyanti \(2017\)](#) observed that broiler production costs in Indonesia remain higher than those in Thailand, one of the region's leading poultry exporters. Similarly, [Ferlito and Respatiadi \(2018\)](#) estimated that Indonesian broiler prices were approximately 24–33% higher than those in

Table 3: Summary of competitiveness studies on Indonesian chicken meat.

Authors	Study Area / Scope	Indicator(s)	Main Findings	Competitiveness Dimension
Ministry of Agriculture (2024)	National chicken meat trade performance	RCA = 0.01–0.03; TSI = 0.10–1.00	Chicken meat showed moderate export competitiveness despite a strong domestic production system.	International Trade Competitiveness (RCA, TSI)
Wibowo <i>et al.</i> (2025)	Indonesian processed chicken exports	RCA = 0.00	Processed chicken products exhibited low export competitiveness compared with major poultry-exporting countries.	International Trade Competitiveness (RCA)

Europe and North America. Although part of this price difference reflects stronger domestic demand and distinct patterns, higher production costs inevitably reduce export competitiveness in international markets where price competition is particularly intense.

Another important pattern emerging from the reviewed studies concerns the role of industrial structure. Unlike beef production, which is dominated by fragmented smallholder systems, chicken meat production has increasingly adopted vertically integrated commercial models involving hatcheries, feed manufacturers, contract farming, processing industries, and modern distribution networks. Wahyono and Utami (2017) argued that these integrated production systems significantly improve production efficiency, reduce transaction costs, and facilitate technology adoption. Consequently, Indonesia has achieved relatively stronger domestic competitiveness in poultry than in other livestock commodities characterized by fragmented production structures.

Nevertheless, domestic competitiveness remains vulnerable to several structural constraints. The poultry industry continues to depend heavily on imported feed ingredients, particularly soybean meal and, in some years, feed corn. Rising international feed prices therefore directly increase domestic production costs and reduce profitability. Furthermore, periodic oversupply resulting from rapid production expansion frequently depresses farm-gate prices, threatening the financial sustainability of producers despite continuing growth in consumer demand (Nugroho, 2020). These challenges indicate that production efficiency alone cannot guarantee sustainable competitiveness without effective market coordination and policy support.

Overall, the comparative evidence demonstrates that chicken meat occupies a unique competitive position within Indonesia's livestock sector. It exhibits outstanding domestic competitiveness characterized by near-complete self-sufficiency, strong consumer demand, and efficient commercial production systems. However, these advantages have not yet been transformed into strong international competitiveness, as reflected by persistently low RCA values and limited export specialization. This duality suggests that

future competitiveness strategies should focus not only on maintaining domestic production efficiency but also on enhancing export readiness through cost reduction, quality improvement, downstream processing, compliance with international standards, and expanded market diversification. Recognizing the distinction between domestic and international competitiveness provides a more accurate framework for interpreting the performance of Indonesia's poultry industry and addresses one of the major inconsistencies identified in previous studies.

PRODUCTION EFFICIENCY, TECHNOLOGY, FEED DEPENDENCY, AND MARKET INTEGRATION

The reviewed literature demonstrates that the competitiveness of Indonesia's chicken meat industry is shaped by a combination of interconnected production, technological, economic, and institutional factors. Unlike the beef sector, where competitiveness is constrained primarily by low productivity and fragmented production systems, the poultry industry has developed a more integrated production structure capable of achieving high levels of domestic efficiency. Nevertheless, this competitiveness remains vulnerable because several structural constraints continue to limit the industry's ability to compete internationally. Four determinants consistently emerge across the reviewed studies: production efficiency, technological innovation, feed dependency, and market integration.

Production efficiency constitutes the principal source of Indonesia's domestic poultry competitiveness. The biological characteristics of broiler chickens, including rapid growth, high feed conversion efficiency, and short production cycles, enable producers to achieve faster capital turnover than other livestock commodities. These production advantages are reinforced by economies of scale within Indonesia's commercial poultry industry, allowing producers to reduce unit production costs while maintaining continuous market supply. Wibowo *et al.* (2025b) further showed that relatively inelastic domestic demand provides producers with a stable market, reducing commercial risk and encouraging continuous investment in production expansion. Consequently, domestic production has consistently maintained national self-sufficiency

despite increasing household consumption.

The literature also highlights technological innovation as a major determinant differentiating the poultry sector from other livestock industries. [Wahyono and Utami \(2017\)](#) emphasized that intensive production systems have enabled the widespread adoption of improved genetics, commercial feed formulations, automated housing, vaccination programs, and biosecurity management. Similarly, [Febrianto et al., \(2023\)](#) demonstrated that vertically coordinated partnership systems facilitate technology transfer between integrated companies and contract farmers, improving production performance and reducing mortality rates. These technological improvements not only increase biological productivity but also enhance production consistency, enabling poultry enterprises to satisfy growing domestic demand throughout the year.

However, technological progress has not been uniformly distributed across all production systems. Large integrated companies generally possess greater access to advanced technologies, technical expertise, and financial resources than independent smallholders. Consequently, differences in technological adoption contribute to unequal productivity and profitability among producers. This finding indicates that technological innovation alone does not guarantee competitiveness unless supported by institutional arrangements capable of facilitating knowledge transfer and equitable access to modern production technologies.

Feed dependency represents the most critical structural constraint identified throughout the reviewed studies. Although Indonesia has developed an efficient poultry production system, feed continues to account for the largest proportion of total production costs. [Junaidi et al. \(2023\)](#) estimated that feed expenditures contribute more than 60% of broiler production costs, making profitability highly sensitive to fluctuations in feed prices. While domestic corn production has expanded considerably, soybean meal remains almost entirely imported, exposing the poultry industry to exchange rate volatility and disruptions in global commodity markets. Consequently, increases in international feed prices are rapidly transmitted into domestic production costs, reducing producers' price competitiveness.

This dependence on imported feed explains why Indonesia can simultaneously achieve strong domestic production performance while remaining less competitive internationally. Efficient farm management cannot fully offset structural disadvantages arising from higher feed costs relative to major exporting countries. Therefore, comparative disadvantage in export markets is influenced not only by farm-level productivity but also by the structure

of upstream input industries. Strengthening domestic feed production and improving feed efficiency are therefore essential components of long-term competitiveness strategies.

Beyond production factors, the reviewed literature identifies market integration and supply chain coordination as equally important determinants of competitiveness. Indonesia's poultry industry has evolved toward increasingly integrated value chains linking breeding companies, feed manufacturers, contract farmers, slaughterhouses, processors, distributors, and modern retail markets. Such vertical coordination reduces transaction costs, facilitates quality control, and improves production planning throughout the supply chain. [Wahyono and Utami \(2017\)](#) argued that these integrated business models have significantly enhanced operational efficiency compared with more fragmented livestock sectors.

Nevertheless, effective market integration also creates new challenges. [Nugroho \(2020\)](#) reported that rapid expansion of commercial broiler production frequently generates temporary oversupply, causing substantial declines in farm-gate prices. Although consumers benefit from lower retail prices, prolonged oversupply reduces producer profitability and threatens business sustainability. These findings demonstrate that competitiveness depends not only on production efficiency but also on effective market governance capable of balancing production growth with market demand.

The reviewed evidence further suggests that competitiveness is increasingly influenced by downstream development rather than primary production alone. [Wibowo et al. \(2025a\)](#) emphasized that Indonesia possesses considerable opportunities to strengthen export competitiveness through processed poultry products rather than relying exclusively on fresh chicken meat. Downstream processing increases product value, extends shelf life, improves compliance with international quality standards, and enables producers to enter niche export markets with higher value-added products. This finding implies that future competitiveness should be evaluated across the entire poultry value chain instead of focusing solely on farm-level production indicators.

Overall, the reviewed studies indicate that Indonesia's poultry competitiveness results from the interaction of efficient production systems, rapid technological adoption, integrated value chains, and strong domestic demand. However, persistent dependence on imported feed ingredients, unequal technological diffusion, periodic market oversupply, and limited downstream export development continue to constrain international

competitiveness. These findings suggest that future policy interventions should strengthen competitiveness through integrated improvements in input industries, technology dissemination, supply chain governance, and value-added processing rather than concentrating exclusively on increasing production volumes.

POLICY IMPLICATIONS AND COMPARATIVE SYNTHESIS

The comparative evidence reviewed in this study indicates that Indonesia's chicken meat industry occupies a distinctive position within the national livestock sector. Unlike beef and dairy milk, whose competitiveness is constrained primarily by low productivity and import dependence, the poultry industry has achieved strong domestic competitiveness through intensive production systems, technological advancement, and high levels of market self-sufficiency. Nevertheless, the synthesis also demonstrates that domestic production success has not yet translated into comparable international competitiveness. This distinction provides an important policy lesson: strengthening production capacity alone is insufficient to establish sustainable competitive advantage in global markets.

A major finding emerging from the reviewed literature is that domestic competitiveness and export competitiveness are driven by different determinants. Indicators such as the Import Dependency Ratio (IDR) and Self-Sufficiency Ratio (SSR) confirm that Indonesia has successfully met domestic chicken meat demand through local production (Ministry of Agriculture, 2024). However, persistently low Revealed Comparative Advantage (RCA) values indicate that Indonesian poultry products remain relatively weak in international trade (Wibowo *et al.*, 2025a). These findings suggest that future competitiveness policies should move beyond production-oriented objectives and increasingly emphasize export capability, product differentiation, and international market integration.

The review also reveals that competitiveness is generated through interactions among production efficiency, technological innovation, feed security, and institutional coordination rather than through improvements in a single production factor. Intensive farming systems, vertically integrated partnerships, and widespread technology adoption have substantially improved production efficiency, but these gains continue to be offset by dependence on imported feed ingredients, especially soybean meal. Consequently, reducing vulnerability within upstream feed supply chains should become a strategic priority for long-term competitiveness. Increasing domestic production of feed raw materials, expanding alternative feed resources, and improving feed conversion efficiency would reduce production costs while simultaneously strengthening

resilience against international price volatility.

Another important implication concerns the governance of poultry value chains. The reviewed studies consistently demonstrate that vertically coordinated production systems have contributed significantly to Indonesia's domestic poultry success by facilitating technology transfer, improving quality control, and reducing transaction costs. However, the same production structure also creates risks of market imbalance when production expansion exceeds demand growth, leading to periodic oversupply and declining farm-gate prices (Nugroho, 2020). Therefore, future policy should strengthen market intelligence systems, production forecasting, and coordination among producers, processors, distributors, and government agencies to improve market stability without reducing production efficiency.

The comparative synthesis further indicates that future competitiveness will increasingly depend on downstream industrial development rather than on primary production alone. Wibowo *et al.* (2025a) emphasized that processed poultry products offer greater opportunities for expanding Indonesia's presence in international markets than exports of fresh chicken meat. Investments in processing technology, food safety certification, halal assurance, cold-chain logistics, and international quality standards would therefore create higher value-added products capable of competing more effectively in export markets. Such downstream development would also diversify market opportunities and reduce dependence on domestic consumption as the principal driver of industry growth.

Overall, the reviewed evidence suggests that Indonesia has established a strong domestic foundation for poultry competitiveness but has not yet fully converted this strength into international comparative advantage. Future policy should therefore adopt a value chain perspective integrating upstream input development, technological innovation, institutional coordination, downstream processing, and export market expansion. Such an integrated strategy would enable Indonesia to transform its current production efficiency into sustainable global competitiveness while maintaining domestic food security. This comparative synthesis demonstrates that the poultry sector offers the greatest opportunity among Indonesia's major livestock commodities to evolve from domestic self-sufficiency toward internationally competitive agribusiness, provided that structural constraints beyond farm-level production are systematically addressed.

TABLE EGGS COMPETITIVENESS

COMPARATIVE PERFORMANCE IN DOMESTIC AND INTERNATIONAL MARKETS

Table eggs represent one of Indonesia's most strategically

important livestock commodities because they provide an affordable source of high-quality animal protein for a broad segment of the population. Compared with beef and dairy products, eggs are consumed more frequently due to their relatively low price, high nutritional value, ease of storage, and versatility in household and food-processing industries. The evidence synthesized in this review indicates that Indonesia has achieved a relatively high level of domestic competitiveness in egg production. However, similar to the chicken meat sector, this domestic strength has not yet translated into strong international competitiveness. The apparent inconsistency among competitiveness indicators reported in previous studies can be explained by distinguishing farm-level production efficiency from export performance.

At the domestic level, Indonesia's egg industry demonstrates a high degree of production self-sufficiency. [Ministry of Agriculture \(2023\)](#) statistics indicate that the Import Dependency Ratio (IDR) remained extremely low, approximately 0.02%, while the Self-Sufficiency Ratio (SSR) reached about 99.98% during the 2018–2022 period. These indicators confirm that domestic egg production is capable of supplying almost the entire national demand without substantial dependence on imports. Compared with beef and dairy milk, which continue to rely on imported products to satisfy domestic consumption, the egg industry has achieved a much stronger degree of food self-reliance.

Production capacity is supported by a geographically concentrated but highly productive production system. [Relawati et al. \(2023\)](#) identified nine provinces as the principal production bases of Indonesia's egg industry, with East Java accounting for nearly one-third of total national production. The concentration of production in regions possessing abundant feed resources, experienced producers, and well-developed agribusiness infrastructure has generated significant economies of scale. This regional specialization enables efficient production and contributes substantially to national food security.

Evidence from farm-level studies further confirms the strong production competitiveness of Indonesian egg enterprises ([Table 4](#)). [Hastang et al. \(2019\)](#), using the Policy Analysis Matrix (PAM), reported Private Cost Ratio (PCR), Domestic Resource Cost (DRC), and Effective Protection Coefficient (EPC) values below one, indicating that commercial egg production possesses both competitive and comparative advantages under domestic production conditions. These findings demonstrate that layer farming efficiently utilizes domestic resources while remaining financially profitable for producers. Therefore, from a production perspective, Indonesian egg farming

performs considerably better than several other livestock commodities.

Nevertheless, the reviewed literature reveals a contrasting picture when competitiveness is evaluated using international trade indicators. [Ministry of Agriculture \(2023\)](#) reported negative Trade Specialization Index (TSI) values ranging from approximately −0.41 to −0.84, together with Revealed Comparative Advantage (RCA) values below one. These indicators consistently classify Indonesia as a net importer with weak export specialization in egg products. Consequently, although domestic production systems are efficient, Indonesia has not yet established a significant comparative advantage in international egg markets.

At first glance, the coexistence of efficient production systems and weak export performance appears contradictory. However, these findings actually measure different dimensions of competitiveness. Farm-level indicators such as PCR and DRC evaluate the efficiency with which domestic resources are transformed into production outputs, whereas RCA and TSI assess a country's relative position within international trade. Efficient production therefore does not automatically generate export competitiveness because access to international markets depends on broader factors including production scale, product standardization, logistics, sanitary regulations, trade policies, and international demand. Recognizing these conceptual differences helps reconcile the contrasting findings reported across previous studies.

Another important characteristic of Indonesia's egg industry is its strong dependence on the domestic market. [Wibowo et al. \(2025b\)](#) reported that egg demand exhibits higher price elasticity than chicken meat, indicating that household consumption responds more sensitively to changes in market prices. Consequently, producers must maintain an appropriate balance between production costs and selling prices to preserve market competitiveness. Although the domestic market is large, fluctuations in feed prices and temporary oversupply frequently influence farm profitability. These market dynamics highlight that competitiveness depends not only on production efficiency but also on effective price stabilization and supply management.

The comparative evidence further indicates that Indonesia possesses considerable opportunities to strengthen future competitiveness through product diversification rather than relying exclusively on conventional table eggs. [Mulatsih et al. \(2024\)](#) demonstrated that omega-3 enriched eggs are financially feasible and exhibit promising market prospects due to increasing consumer

Table 4. Summary of competitiveness studies on Indonesian table eggs.

Authors	Study Area / Scope	Indicator(s)	Main Findings	Competitiveness Dimension
Hastang <i>et al.</i> (2019)	Layer farming, Pinrang Regency, South Sulawesi	PCR = 0.16; DRC = 0.14; EPC = 0.84	Layer farming demonstrated strong production competitiveness despite relatively weak policy protection.	Production Competitiveness (PCR, DRC, EPC)
Ministry of Agriculture (2023)	National egg trade performance	RCA = 0.042–0.130; TSI = –0.84 to –0.41	Indonesian table eggs exhibited relatively weak international trade competitiveness despite efficient domestic production.	International Trade Competitiveness (RCA, TSI)

awareness of functional foods. Value-added products such as nutritionally enriched eggs, processed egg products, and industrial food ingredients may therefore provide new avenues for expanding competitiveness while reducing dependence on conventional fresh egg markets.

Overall, the reviewed literature demonstrates that Indonesia's egg industry performs strongly in terms of domestic production efficiency and national food security but remains relatively weak in international trade. Farm-level competitiveness has been achieved through efficient resource utilization and geographically concentrated production systems, whereas export competitiveness continues to be constrained by structural factors beyond primary production. These findings indicate that future development strategies should preserve domestic production efficiency while simultaneously strengthening downstream processing, product differentiation, quality assurance, and export market integration. Such a balanced perspective provides a more comprehensive understanding of egg competitiveness than evaluating production or trade indicators separately.

PRODUCTION EFFICIENCY, FEED AVAILABILITY, REGIONAL CLUSTERING, AND MARKET DYNAMICS

The reviewed literature indicates that the competitiveness of Indonesia's egg industry is determined by a combination of biological efficiency, feed availability, regional production specialization, market conditions, and value-added product development. Compared with beef and dairy farming, commercial layer production has achieved relatively higher production efficiency because of shorter production cycles, established management practices, and continuous technological improvements. Nevertheless, the sustainability of this competitiveness remains highly dependent on feed costs, price stability, and the industry's ability to respond to changing consumer preferences. These findings suggest that egg competitiveness is generated through interactions among multiple components rather than by improvements in a single production factor.

Production efficiency represents the primary source of competitiveness within the Indonesian egg industry.

Evidence synthesized from the reviewed studies consistently demonstrates that commercial layer farming utilizes domestic resources efficiently while maintaining financial profitability. Hastang *et al.* (2019) reported PCR, DRC, and EPC values below one, indicating both competitive and comparative advantages under domestic production conditions. These results suggest that layer farms are capable of producing eggs at costs that remain economically efficient relative to available domestic resources. Consequently, the Indonesian egg industry has been able to maintain an exceptionally high level of national self-sufficiency despite continuously increasing consumer demand.

However, production efficiency alone cannot explain regional differences in competitiveness. The reviewed literature consistently identifies regional production clustering as another important determinant. Relawati *et al.* (2023) demonstrated that egg production is geographically concentrated in several provinces, particularly East Java, which contributes nearly one-third of national production. Similar production clusters also exist in Central Java, Yogyakarta, West Sumatra, North Sumatra, Bali, North Sulawesi, West Kalimantan, and Banten. These regional concentrations generate economies of scale through the availability of supporting infrastructure, experienced producers, efficient marketing networks, and specialized agribusiness services. Such industrial clustering reduces production and transaction costs while facilitating knowledge exchange among producers, thereby strengthening regional competitiveness.

Feed availability constitutes another fundamental determinant influencing both production efficiency and long-term competitiveness. Feed remains the largest component of production costs in commercial layer farming, making profitability highly sensitive to fluctuations in feed prices. The reviewed literature highlights three major comparative advantages enjoyed by leading egg-producing regions. First, abundant domestic corn production provides an important source of energy ingredients for poultry feed. Second, farmers increasingly formulate their own feed by combining corn, concentrates, and rice bran, thereby reducing dependence on commercial feed

manufacturers. Third, long-established poultry production systems have created integrated local supply chains that improve input availability and reduce logistics costs. These advantages collectively enhance production efficiency while strengthening the competitiveness of domestic egg production.

Despite these advantages, dependence on imported feed ingredients, particularly soybean meal, continues to expose the industry to international market volatility. Rising global commodity prices and exchange rate fluctuations rapidly increase production costs because imported protein sources remain indispensable for commercial feed formulation. Consequently, the competitiveness of Indonesian egg production is strongly influenced not only by farm management but also by the resilience of upstream feed supply systems. These findings emphasize that feed security should be viewed as a strategic component of national competitiveness rather than simply a production input.

The reviewed studies further demonstrate that market dynamics exert a substantial influence on egg competitiveness. Unlike chicken meat, whose demand is relatively price inelastic, egg consumption exhibits greater price responsiveness (Wibowo *et al.*, 2025b). This characteristic requires producers to maintain a careful balance between production costs and selling prices in order to preserve consumer demand. Temporary increases in feed prices or oversupply may therefore have more immediate effects on producer profitability than in other livestock sectors. Consequently, maintaining competitiveness requires not only efficient production but also effective market coordination capable of stabilizing prices while ensuring continuous product availability.

Another important determinant emerging from the reviewed evidence is product innovation and value addition. Mulatsih *et al.* (2024) demonstrated that omega-3 enriched eggs represent a financially feasible and commercially promising segment within Indonesia's poultry industry. Growing consumer awareness of nutrition and functional foods has created opportunities for producers to diversify beyond conventional table eggs. Product differentiation through nutritional enhancement, food safety assurance, branding, and processing can increase market value while reducing dependence on price competition alone. This transition from commodity-based production toward value-added agribusiness is increasingly recognized as an important pathway for strengthening long-term competitiveness.

Institutional support also plays a significant role in sustaining competitiveness. The Ministry of Agriculture has proposed

several strategic initiatives, including integrated production clusters, investment in poultry infrastructure, improved feed security, expansion of production outside Java, and stronger support for national nutrition programs. These initiatives indicate that competitiveness is increasingly viewed as the outcome of coordinated policies linking farmers, feed industries, processors, financial institutions, and government agencies rather than the responsibility of producers alone. Such institutional coordination is particularly important because competitiveness depends simultaneously on production efficiency, input availability, marketing systems, and consumer demand.

Overall, the reviewed literature indicates that Indonesia's egg competitiveness is shaped by a mutually reinforcing interaction among efficient production systems, strategic feed resources, regional production clusters, market stability, and continuous product innovation. However, structural dependence on imported feed ingredients and relatively weak export orientation continue to constrain the industry's international competitiveness. These findings suggest that future development should strengthen the entire egg value chain—from feed production and farm management to downstream processing and market diversification—rather than focusing exclusively on increasing production volumes. Such an integrated approach would enhance both domestic resilience and future international competitiveness.

POLICY IMPLICATIONS AND COMPARATIVE SYNTHESIS

The comparative evidence synthesized in this review indicates that Indonesia's egg industry has established one of the strongest domestic competitive positions among the country's major livestock commodities. High levels of self-sufficiency, efficient utilization of domestic resources, and geographically concentrated production systems have enabled the industry to satisfy national demand with minimal dependence on imports. However, the reviewed literature also demonstrates that these strengths have not yet translated into strong international competitiveness. This divergence highlights an important policy implication: future competitiveness strategies should focus not only on sustaining domestic production efficiency but also on addressing structural constraints that limit participation in international markets.

A major conclusion emerging from the reviewed studies is that different competitiveness indicators evaluate different dimensions of industry performance. Farm-level indicators such as the Private Cost Ratio (PCR) and Domestic Resource Cost (DRC) confirm that Indonesian layer farming efficiently transforms domestic resources into profitable production systems (Hastang *et al.*, 2019). Conversely, trade-based indicators, including the Revealed Comparative Advantage (RCA) and Trade Specialization

Index (TSI), indicate that Indonesia remains a relatively weak exporter of egg products (Ministry of Agriculture, 2023). These findings demonstrate that achieving production efficiency alone is insufficient to establish international comparative advantage. Accordingly, future policy evaluation should incorporate both production and trade indicators to provide a more comprehensive assessment of competitiveness.

The synthesis further suggests that feed security should become a central pillar of long-term competitiveness policy. Although domestic corn production has strengthened the availability of energy sources for poultry feed, dependence on imported soybean meal continues to expose producers to exchange rate volatility and fluctuations in global commodity markets. Because feed accounts for the largest share of production costs, reducing vulnerability within the feed supply chain would substantially improve industry resilience. Policy interventions should therefore encourage domestic production of protein-rich feed ingredients, promote research on alternative feed resources, improve feed conversion efficiency, and strengthen coordination between crop and livestock sectors. Such measures would reduce production costs while enhancing the competitiveness of domestic egg production.

Another important implication concerns regional production development. The reviewed evidence shows that the concentration of production in several highly productive provinces has generated economies of scale and strengthened domestic competitiveness (Relawati *et al.*, 2023). However, excessive geographical concentration may also increase vulnerability to disease outbreaks, climate-related disruptions, and regional market imbalances. Future policy should therefore encourage the development of new production clusters outside existing centers while maintaining comparable standards of infrastructure, technical services, and market access. Expanding regional production capacity would improve national supply resilience while promoting more balanced rural economic development.

The reviewed studies also indicate that future competitiveness will increasingly depend on downstream development rather than primary production alone. Mulatsih *et al.* (2024) demonstrated that functional products such as omega-3 enriched eggs provide opportunities to increase value added and respond to changing consumer preferences. Investments in product innovation, food safety systems, traceability, packaging, branding, and processing technologies would allow producers to compete on quality and differentiation rather than price alone. Such downstream development would simultaneously strengthen domestic consumer confidence

and expand opportunities for participation in premium international markets.

Finally, the comparative synthesis demonstrates that competitiveness should be understood as a value chain outcome rather than solely as a farm-level achievement. Efficient production, secure feed supplies, regional production clusters, market stability, technological innovation, downstream processing, and institutional coordination operate as mutually reinforcing components of a competitive egg industry. Policies focusing exclusively on increasing production volume are therefore unlikely to generate sustainable competitiveness unless accompanied by improvements throughout the entire value chain. Adopting this integrated perspective would enable Indonesia to maintain its strong domestic competitive position while gradually strengthening its international market presence. More broadly, the egg industry illustrates that sustainable livestock competitiveness depends not only on productive efficiency but also on the capacity to transform production advantages into higher value-added products and internationally competitive agribusiness systems.

MILK COMPETITIVENESS

COMPARATIVE PERFORMANCE IN DOMESTIC AND INTERNATIONAL MARKETS

Among Indonesia's major livestock commodities, dairy milk exhibits the weakest overall competitiveness when evaluated from both domestic production and international trade perspectives. Unlike chicken meat and eggs, which have achieved high levels of national self-sufficiency, Indonesia's dairy industry remains heavily dependent on imported milk and dairy products to satisfy domestic demand. Nevertheless, the reviewed literature indicates that this weak competitive position is not solely the result of low farm productivity. Rather, it reflects structural constraints operating across the entire dairy value chain, including production scale, feed availability, herd genetics, processing capacity, and market organization. Consequently, dairy competitiveness should be interpreted as a multidimensional issue involving both farm-level efficiency and national industrial capability.

The reviewed evidence consistently demonstrates that domestic milk production remains insufficient to meet rapidly growing consumer demand. Ministry of Agriculture (2020) statistics show that the Self-Sufficiency Ratio (SSR) for dairy milk remained below 25% during recent years, while the Import Dependency Ratio (IDR) exceeded 75%, indicating that approximately three-quarters of domestic consumption continues to be supplied through imports. Compared with beef, where import dependence is moderate, and poultry commodities, where imports

are negligible, dairy milk represents Indonesia's highest level of dependence on international markets. These indicators confirm that domestic production capacity has not expanded sufficiently to keep pace with increasing demand generated by population growth, rising incomes, and changing dietary patterns.

Farm-level studies provide a more nuanced assessment of competitiveness. Research employing the Policy Analysis Matrix (PAM) suggests that many dairy farms retain comparative advantages under domestic production conditions despite relatively low productivity (Table 5). Yulianti *et al.* (2024) reported favorable Domestic Resource Cost (DRC) values, indicating that domestic resources can be used efficiently for milk production when evaluated within local production systems. However, private profitability remains constrained by small herd sizes, high production costs, and relatively low milk yields per cow. These findings suggest that efficient resource utilization at the farm level is insufficient to overcome broader structural disadvantages affecting the national dairy industry.

International trade indicators reinforce this conclusion. The reviewed studies consistently report low Revealed Comparative Advantage (RCA) values together with persistent trade deficits in dairy commodities. Indonesia imports substantial quantities of milk powder, whey products, cheese, butter, and other processed dairy products from major exporting countries such as New Zealand, Australia, the European Union, and the United States. Consequently, domestic milk production contributes only a limited share of national dairy consumption, while imported products dominate industrial processing and consumer markets. These trade patterns demonstrate that Indonesia has not yet established a comparative advantage within international dairy markets despite maintaining a sizeable domestic dairy sector.

The apparent discrepancy between farm-level efficiency and weak national competitiveness reflects differences in the analytical dimensions captured by various competitiveness indicators. Measures such as DRC evaluate whether domestic resources are used efficiently in milk production, whereas indicators such as SSR, IDR, and RCA evaluate broader market performance and international trade specialization. Thus, a dairy farm may operate efficiently within its local production environment while the national industry simultaneously remains internationally uncompetitive because aggregate production is insufficient, production costs remain relatively high, and imported dairy products are available at lower prices. Distinguishing these analytical perspectives helps reconcile the differing conclusions reported in previous studies.

Another important finding concerns the industrial structure of Indonesia's dairy sector. Unlike poultry production, which has evolved toward vertically integrated commercial systems, dairy production continues to be dominated by smallholder farmers owning only a few lactating cows. Milk collection, quality control, cooling facilities, and processing are largely coordinated through dairy cooperatives. Although these cooperative institutions have played an important role in supporting rural livelihoods and facilitating milk marketing, their limited investment capacity often constrains technological upgrading and productivity improvement. Consequently, institutional arrangements remain an important determinant of competitiveness beyond individual farm performance.

Demand dynamics also contribute to the industry's competitive challenges. Rising household incomes, urbanization, expanding food industries, and increasing awareness of nutritional benefits have stimulated rapid growth in dairy consumption. However, domestic production has expanded much more slowly than demand, widening the gap between national supply and consumption. Rather than reflecting declining producer performance, increasing imports primarily indicate that domestic production growth has been unable to match the pace of market expansion. This distinction is important because policies aimed solely at restricting imports would not eliminate the underlying structural imbalance between supply and demand.

Overall, the comparative evidence demonstrates that Indonesia's dairy industry occupies a fundamentally different competitive position from other major livestock commodities. While chicken meat and eggs have largely achieved domestic self-sufficiency and beef exhibits moderate import dependence, dairy milk remains characterized by persistent structural deficits in both production capacity and international competitiveness. These findings suggest that improving dairy competitiveness requires comprehensive interventions extending beyond farm productivity to include genetic improvement, feed resource development, cooperative strengthening, processing capacity, cold-chain infrastructure, and value chain integration. Understanding competitiveness from this broader perspective provides a more coherent explanation of Indonesia's dairy sector than evaluating production or trade indicators independently.

PRODUCTIVITY, FARM STRUCTURE, MARKET ORGANIZATION, AND INSTITUTIONAL SUPPORT

The reviewed literature demonstrates that the competitiveness of Indonesia's dairy industry is determined by a combination of technological, structural, institutional, and market-related factors. Unlike the poultry sector, where competitiveness has largely been driven by rapid

Table 5: Summary of competitiveness studies on Indonesian dairy milk.

Authors	Study Area / Scope	Indicator(s)	Main Findings	Competitiveness Dimension
Ginting (2020)	Domestic dairy farming	PCR = 0.80–0.99; DRC = 0.73–0.86	Competitive and comparative advantages were mainly observed in medium- and large-scale dairy farms.	Production Competitiveness (PCR, DRC)
Ministry of Agriculture (2020)	National dairy trade performance	RCA = 0.073–0.141; TSI = –0.88 to –0.80	Indonesian dairy products demonstrated very weak international trade competitiveness because of heavy dependence on imports.	International Trade Competitiveness (RCA, TSI)
Yulianti <i>et al.</i> (2024)	Dairy farming, Pasuruan Regency	PCR = 0.54; DRC = 0.02	Dairy farming demonstrated comparative zness under prevailing market conditions.	Production Competitiveness (PCR, DRC)

technological adoption and vertically integrated production systems, the dairy industry continues to face multiple structural constraints that reinforce one another throughout the value chain. The evidence synthesized from the reviewed studies indicates that low productivity, uneconomical farm size, weak market bargaining power, inconsistent milk quality, and insufficient institutional support collectively explain why domestic dairy production remains unable to compete effectively with imported dairy products despite possessing comparative advantages under certain production conditions.

Productivity constitutes the most fundamental determinant of dairy competitiveness. Across the reviewed studies, low milk yield consistently emerges as the principal factor limiting production efficiency. [Sutawi \(2024\)](#) reported that average milk productivity among Indonesian dairy cows remains approximately 10 liters per cow per day, whereas productivity levels of at least 15 liters are considered necessary to achieve economically competitive production systems. Similarly, the comparison between traditional smallholder farms and modern commercial dairy enterprises illustrates the magnitude of this productivity gap. [Daryanto *et al.* \(2021\)](#) observed that while smallholders, who own an average of only three dairy cows, still contribute approximately 77% of Indonesia's fresh milk production, modern dairy farms can achieve daily yields exceeding 20 liters per cow through improved genetics, nutrition, and management practices. These findings indicate that technological improvement rather than resource availability represents the primary driver of future competitiveness.

Closely associated with productivity is the structural characteristic of dairy farming itself. The reviewed evidence consistently identifies farm size as a critical determinant of competitiveness. Approximately 90% of Indonesian dairy farms remain small-scale family enterprises with only three to four lactating cows per household ([Sutawi, 2024](#)). Such production scales limit opportunities to exploit economies of scale, mechanize production, improve herd management, and spread fixed investment costs across

larger output volumes. This conclusion is supported by [Ginting \(2020\)](#), who demonstrated that medium-scale farms (5–10 cows) and large-scale farms (>10 cows) possess both competitive and comparative advantages, whereas small-scale farms generally fail to achieve competitive performance. Likewise, [Yulianti \(2024\)](#) found that dairy farming in Pasuruan Regency maintained comparative efficiency but failed to achieve competitive profitability because prevailing market conditions and policy incentives remained insufficient to support producers. Collectively, these findings suggest that farm expansion is not merely a matter of increasing production capacity but an essential prerequisite for improving long-term competitiveness.

Feed availability and herd genetics further reinforce productivity differences among dairy production systems. Modern dairy enterprises achieve substantially higher milk yields because they combine superior genetic resources with balanced feeding systems, improved herd health, and better livestock management. Conversely, many smallholder farms continue to experience nutritional deficiencies and limited access to high-quality breeding stock, reducing production efficiency over time. Since feed represents one of the largest production cost components, improvements in forage development, feed quality, and genetic improvement programs are likely to produce simultaneous gains in productivity, production costs, and milk quality. The reviewed studies therefore suggest that technological upgrading should be viewed as an integrated package involving genetics, nutrition, animal health, and farm management rather than isolated technical interventions.

Another determinant repeatedly emphasized in the literature concerns market organization and bargaining power. [Sutawi \(2024\)](#) described Indonesia's fresh milk market as functioning largely under monopsonistic conditions, where farmers generally sell their milk to Village Unit Cooperatives (Koperasi Unit Desa, KUD) or milk collectors, which subsequently supply Dairy Processing Industries (DPI). This marketing structure substantially limits farmers' negotiating power regarding milk prices

and quality premiums. Because processors can alternatively import cheaper dairy ingredients with more consistent quality, domestic producers frequently face unfavorable price competition despite increasing production costs. Consequently, competitiveness is influenced not only by production efficiency but also by governance arrangements throughout the marketing chain.

Milk quality constitutes another decisive determinant linking production systems with market competitiveness. The reviewed studies consistently indicate that locally produced milk often fails to satisfy industrial quality standards because of inadequate animal husbandry practices, poor milking hygiene, and insufficient post-harvest handling. As a result, Dairy Processing Industries continue to rely heavily on imported milk powder and other dairy ingredients that provide more standardized quality at lower prices. The inability to consistently meet Codex and industrial processing standards therefore reduces both domestic market competitiveness and export potential. These findings indicate that investments in milk collection systems, cooling facilities, quality assurance, and traceability are as important as increasing production volume.

Institutional and policy environments also emerge as important determinants of competitiveness. Daryanto *et al.* (2021) argued that regulatory support and investment policies for the dairy sector remain relatively weak compared with other agricultural industries. Limited investment incentives have constrained modernization, technological adoption, and expansion of dairy enterprises, particularly among cooperatives and smallholder farmers. Complementing this finding, Putri and Karmini (2023) demonstrated that fluctuations in dairy imports are influenced more strongly by macroeconomic variables, particularly foreign exchange reserves, than by changes in domestic milk production alone. Their findings suggest that improving competitiveness requires not only farm-level interventions but also broader industrial and macroeconomic policies capable of strengthening the domestic dairy sector within an increasingly open international market.

The strategic priorities proposed in the Dairy Industry Road Map and subsequent studies reinforce this integrated perspective. Taufik (2019) recommended increasing herd ownership to more than ten cows per farmer, raising productivity beyond 20 liters per cow per day, increasing the domestic share of fresh milk supply, improving processing technology, and expanding value-added dairy products. Similarly, Kollo (2025) identified three strategic priorities through Quantitative Strategic Planning Matrix analysis: expanding operational scale, improving milk

quality and productivity, and optimizing internal resources while minimizing exposure to external risks. Rather than representing separate recommendations, these strategies collectively emphasize that sustainable competitiveness requires simultaneous improvements in production capacity, product quality, institutional support, processing capability, and value chain coordination.

Overall, the reviewed evidence demonstrates that the competitiveness of Indonesia's dairy industry is shaped by a complex interaction among productivity, farm structure, technological capability, market organization, milk quality, and policy support. The relatively weak international competitiveness of Indonesian dairy products cannot therefore be attributed solely to low production levels. Instead, it reflects cumulative structural constraints operating throughout the dairy value chain. Strengthening competitiveness consequently requires integrated interventions that combine technological innovation, economically viable farm expansion, institutional reform, improved milk quality management, and stronger investment support. Such a systemic approach offers greater potential for narrowing the competitiveness gap between domestic dairy production and imported dairy products than isolated improvements in production alone.

POLICY IMPLICATIONS AND COMPARATIVE SYNTHESIS

The comparative evidence synthesized in this review demonstrates that improving the competitiveness of Indonesia's dairy industry requires a fundamentally different policy approach from that applied to beef, chicken meat, and eggs. Whereas the poultry sector has largely achieved domestic self-sufficiency through technological innovation and efficient commercial production systems, the dairy industry continues to experience structural deficits in production capacity, milk quality, and industrial competitiveness. Consequently, policies aimed merely at increasing milk production are unlikely to produce sustainable competitiveness unless they simultaneously address the structural weaknesses operating throughout the dairy value chain.

A major finding emerging from the reviewed studies is that different competitiveness indicators capture different dimensions of industry performance. Farm-level analyses using the Policy Analysis Matrix indicate that medium- and large-scale dairy farms are capable of producing milk efficiently under domestic production conditions, as reflected by favorable PCR and DRC values (Ginting, 2020; Yulianti, 2024). In contrast, trade-based indicators, including the Revealed Comparative Advantage (RCA), Trade Specialization Index (TSI), Self-Sufficiency Ratio (SSR), and Import Dependency Ratio (IDR), consistently demonstrate that Indonesia remains highly dependent on

imported dairy products (Ministry of Agriculture, 2020). Rather than representing contradictory findings, these indicators describe different analytical dimensions of competitiveness. Domestic production efficiency therefore should not be interpreted automatically as evidence of international competitiveness. Future policy evaluation should integrate both production-based and trade-based indicators to provide a more comprehensive assessment of dairy sector performance.

The reviewed literature further indicates that productivity improvement should remain the primary strategic priority. However, productivity cannot be improved through genetic enhancement alone. The studies consistently emphasize that milk yield depends on the interaction among herd genetics, feed quality, animal health, housing management, and economically viable herd size (Daryanto *et al.*, 2021; Sutawi, 2024; Taufik, 2019). Policies that address only one component are therefore unlikely to generate substantial improvements in competitiveness. Instead, integrated dairy development programs should combine breeding improvement, forage and feed development, veterinary services, extension support, and farm management training within a coordinated production system.

Another important implication concerns structural transformation of smallholder dairy farming. Most Indonesian dairy producers continue to operate family farms with only three to four lactating cows, substantially below the scale required for efficient commercial production (Sutawi, 2024). The reviewed evidence suggests that expanding herd size, strengthening producer cooperatives, and improving farmers' access to investment financing would generate economies of scale while facilitating technological adoption and quality improvement. These interventions would also strengthen farmers' bargaining position within the dairy supply chain, where monopsonistic marketing arrangements continue to limit farm profitability.

The synthesis also highlights the importance of strengthening downstream processing and milk quality management. Domestic milk frequently fails to satisfy industrial processing standards because of inconsistent quality and inadequate post-harvest handling, encouraging processors to rely on imported dairy ingredients (Sutawi, 2024). Investments in milk collection centers, cooling facilities, traceability systems, hygienic milk handling, and quality-based pricing mechanisms would therefore improve both industrial competitiveness and producer incentives. At the same time, expanding domestic processing capacity and promoting value-added dairy products would reduce dependence on imported processed milk while creating new market opportunities for local producers.

Finally, the reviewed studies consistently demonstrate that sustainable dairy competitiveness depends on coordinated institutional support rather than isolated production interventions. Investment policies, cooperative development, research and innovation, extension services, financial incentives, and market governance operate as complementary components of a competitive dairy value chain (Daryanto *et al.*, 2021; Kollo, 2025; Putri and Karmini, 2023). Consequently, policies focusing exclusively on increasing milk production are unlikely to reduce import dependence unless accompanied by broader reforms in processing capacity, market organization, and industrial development. Compared with the other livestock commodities reviewed in this study, dairy milk requires the most comprehensive structural transformation because competitiveness is constrained simultaneously at the production, processing, and marketing levels. This comparative synthesis therefore demonstrates that strengthening dairy competitiveness should be viewed as a long-term value chain development strategy rather than a short-term production expansion program.

CROSS-COMMODITY COMPARATIVE DISCUSSION

The principal contribution of this systematic review lies not in describing the competitiveness of individual livestock commodities, but in comparing the structural patterns underlying competitiveness across beef, chicken meat, eggs, and dairy milk. Previous studies have generally evaluated these commodities independently using different analytical approaches, making cross-commodity comparison difficult. By synthesizing evidence from 21 empirical studies, this review demonstrates that competitiveness is multidimensional and cannot be adequately explained by a single indicator such as PCR, DRC, RCA, or TSI alone. Instead, each indicator captures a different dimension of competitiveness operating at different stages of the livestock value chain (Table 6).

A major finding emerging from this review is the clear distinction between domestic production competitiveness and international trade competitiveness. Studies employing the Policy Analysis Matrix (PAM), including PCR and DRC, primarily evaluate production efficiency at the farm level. In contrast, RCA and TSI measure comparative performance in international markets, while SSR and IDR describe national production capacity relative to domestic demand (Monke and Pearson, 1989; Balassa, 1965). Consequently, commodities may perform well under one indicator but poorly under another without producing contradictory conclusions.

This distinction explains many of the apparent inconsistencies identified across the reviewed literature. Beef, eggs, and dairy milk frequently exhibit favourable

Table 6: Cross-commodity comparative synthesis of the competitiveness of Indonesian livestock commodities.

Dimension	Beef	Chicken Meat	Table Eggs	Dairy Milk
Domestic Production Competitiveness (PCR/DRC/EPC)	Moderate; competitive in several regions but heterogeneous	High; efficient intensive production systems	High; efficient commercial layer farming	Low–Moderate; competitive only in medium and large farms
Domestic Market Performance (SSR/IDR)	SSR ≈72%; IDR ≈28%; moderate import dependence	SSR ≈100%; negligible imports	SSR ≈99.98%; very low imports	Low SSR; high dependence on imported dairy products
International Trade Competitiveness (RCA/TSI)	Very weak (RCA≈0; TSI -1)	Weak despite strong domestic production	Weak despite domestic self-sufficiency	Weakest among all commodities
Main Sources of Competitive Advantage	Local breeds, forage resources, regional production potential	Technology adoption, vertically integrated industry, short production cycle	Production efficiency, regional production clusters, stable domestic demand	Comparative efficiency at medium–large farm scale
Major Structural Constraints	Low productivity, fragmented farms, breeding limitations, import dependence	Imported feed ingredients, oversupply risk, limited exports	Feed price volatility, limited exports, product perishability	Low productivity, small herd size, milk quality, processing capacity, market structure
Dominant Determinants	Productivity, breeding, feed resources, supply chain	Production efficiency, technology, feed, market integration	Feed availability, production clusters, market stability, innovation	Productivity, genetics, feed, cooperatives, processing industry
Primary Policy Priority	Productivity improvement and breeding development	Export-oriented downstream industry and feed security	Value-added products and downstream processing	Structural transformation of the dairy value chain
Overall Competitive Position	Moderate domestically; weak internationally	Strongest overall competitiveness	Strong domestically; limited internationally	Weakest overall competitiveness

Sources: Synthesized from the 21 studies included in this Systematic Literature Review, including Rouf *et al.* (2019), Mallu *et al.* (2019), Lasahudu *et al.* (2017), Ginting (2020), Hastang *et al.* (2019), Daryanto *et al.* (2021), Ministry of Agriculture (2020, 2023, 2025), Sutawi (2024), Wibowo *et al.* (2025a, 2025b), Mulatsih *et al.* (2024), Relawati *et al.* (2023), Yulianti (2024), and other studies included in the review.

PCR and DRC values in specific production systems, indicating efficient utilization of domestic resources (Ginting, 2020; Hastang *et al.*, 2019; Mallu *et al.*, 2019). Nevertheless, these same commodities consistently record very low RCA values and negative TSI values, reflecting weak export competitiveness and persistent dependence on imports (Ministry of Agriculture, 2020, 2023, 2025). Rather than representing conflicting evidence, these findings demonstrate that production efficiency alone is insufficient to achieve international competitiveness. Export performance also depends on production scale, quality consistency, processing capacity, logistics, market access, product standardization, and international trade policies.

Among the four commodities reviewed, chicken meat demonstrates the strongest overall competitiveness, although its competitive advantage differs substantially between domestic and international markets. Domestically, chicken production benefits from vertically integrated production systems, rapid technology adoption, efficient commercial management, short production cycles, and a

stable domestic demand supported by relatively inelastic consumer behavior (Wahyono and Utami, 2017; Wibowo *et al.*, 2025a; Wibowo *et al.*, 2025b). These characteristics enable Indonesia to achieve an SSR approaching 100% with an almost negligible Import Dependency Ratio. However, despite these domestic strengths, Indonesian chicken products continue to record RCA values below one, indicating that competitiveness remains concentrated in the domestic rather than international market. This finding illustrates that domestic market dominance should not automatically be interpreted as export competitiveness.

Eggs represent an intermediate competitive position. Similar to chicken meat, domestic production almost completely satisfies national demand, with SSR values close to 100% and minimal import dependence (Ministry of Agriculture, 2023). Farm-level studies consistently report excellent production efficiency through favourable PCR, DRC, and EPC values (Hastang *et al.*, 2019). However, international competitiveness remains weak because egg exports are limited and TSI and RCA values remain low. This pattern reflects structural characteristics

of egg markets. Eggs are highly perishable commodities with relatively high transportation costs, limiting export opportunities despite efficient domestic production. Consequently, future competitiveness is likely to depend more on value-added processing, functional eggs, quality differentiation, and downstream product diversification than on increasing production volume alone (Mulatsih *et al.*, 2024).

Beef exhibits the largest disparity between regional production competitiveness and national competitiveness. Several regional studies demonstrate efficient beef production systems with favourable PCR and DRC values (Lasahudu *et al.*, 2017; Mallu *et al.*, 2019; Gerhana *et al.*, 2025). Nevertheless, these local advantages have not translated into national competitiveness because Indonesia continues to experience low productivity, fragmented smallholder production, limited breeding capacity, and persistent dependence on imported cattle and beef products (Rouf *et al.*, 2019; Sutawi *et al.*, 2019; Ministry of Agriculture, 2025). The review therefore indicates that beef competitiveness is constrained primarily by structural and institutional factors rather than biological production potential alone.

The dairy sector demonstrates the weakest overall competitiveness among the four commodities. Although medium- and large-scale dairy farms may achieve competitive PCR and DRC values under favourable production conditions (Ginting, 2020; Yulianti, 2024), national milk production remains insufficient to satisfy industrial demand. Indonesia continues to rely heavily on imported dairy ingredients because domestic milk production is characterized by small herd sizes, relatively low productivity, inconsistent quality, monopsonistic marketing arrangements, and limited downstream processing capacity (Daryanto *et al.*, 2021; Sutawi, 2024). Consequently, the dairy industry faces simultaneous constraints at the production, processing, and marketing stages of the value chain, making structural transformation substantially more complex than in the poultry sector.

Another important pattern emerging from this review concerns the determinants of competitiveness. Across all four commodities, productivity remains a necessary

condition for competitiveness but is not sufficient by itself. Production efficiency consistently interacts with feed availability, technology adoption, institutional support, supply chain integration, market organization, and government policy. Feed security represents one of the strongest cross-cutting determinants because feed constitutes the largest production cost in both poultry and dairy production while also affecting beef productivity through forage availability (Pambudy *et al.*, 2021; Wijayanti *et al.*, 2024; Ministry of Agriculture, 2025). Indonesia's continued dependence on imported soybean meal and partial dependence on imported corn therefore represent strategic constraints affecting competitiveness across multiple livestock commodities rather than isolated sectoral problems.

The review further reveals that value chain integration is a stronger determinant of competitiveness than farm-level efficiency alone. Chicken meat demonstrates this principle most clearly because competitiveness is supported by integrated breeding, feed production, commercial farming, processing, distribution, and marketing systems. In contrast, beef and dairy sectors remain dominated by fragmented smallholder production with weaker vertical coordination. Eggs occupy an intermediate position, benefiting from relatively well-developed production clusters while still requiring stronger downstream processing and market diversification. These findings suggest that strengthening competitiveness requires simultaneous improvement across the entire value chain instead of isolated interventions at the farm level.

From a policy perspective, the comparative synthesis indicates that commodity-specific strategies are more appropriate than uniform livestock development policies (Table 7). Beef policies should prioritize productivity improvement, breeding programs, feed resource development, and supply chain modernization to reduce structural dependence on imports. Dairy development requires large-scale institutional reforms involving cooperative strengthening, quality improvement, investment in processing industries, and expansion of commercially viable herd sizes. For chicken meat, future priorities should focus on export competitiveness through processing technology, quality certification, and international market diversification while

Table 7: Conceptual comparison of competitiveness dimensions across livestock commodities.

Commodity	Production Competitiveness	Domestic Market Competitiveness	International Competitiveness	Value Chain Maturity	Strategic Priority
Beef	Medium	Medium	Low	Low	Productivity and breeding
Chicken meat	High	High	Medium-Low	High	Export expansion
Table Eggs	High	High	Low	Medium-High	Downstream diversification
Dairy milk	Low	Low	Low	Low	Structural transformation

maintaining domestic production efficiency. Egg development should emphasize value-added products, processing innovation, quality assurance, and market diversification beyond conventional shell eggs.

Overall, this systematic review demonstrates that concept operating simultaneously at production, value chain, and international market levels. The comparison competitiveness should be understood as a multidimensional across four livestock commodities contributes a new conceptual framework by distinguishing production competitiveness, domestic market competitiveness, and international trade competitiveness as complementary rather than interchangeable dimensions. This framework explains why different competitiveness indicators frequently generate apparently contradictory conclusions and provides a more coherent interpretation of empirical findings reported across Indonesian livestock studies. By integrating these dimensions within a single comparative analysis, this review extends previous commodity-specific research and offers a more comprehensive basis for designing differentiated livestock development policies in Indonesia.

CONCLUSION

This systematic review synthesized evidence from 21 empirical studies to compare the competitiveness of Indonesia's four major livestock commodities—beef, chicken meat, table eggs, and dairy milk—using a unified analytical framework. The findings demonstrate that livestock competitiveness is inherently multidimensional and should be evaluated through three complementary dimensions: production competitiveness (PCR, DRC, and EPC), domestic market competitiveness (SSR and IDR), and international trade competitiveness (RCA and TSI). Chicken meat exhibited the strongest overall competitiveness because of efficient production systems, integrated value chains, and high domestic self-sufficiency. Table eggs also showed strong production and domestic market competitiveness but limited export performance. Beef possessed competitive production systems in several regions; however, national competitiveness remained constrained by low productivity, fragmented supply chains, and continued dependence on imports. Dairy milk demonstrated the weakest competitiveness owing to structural constraints related to productivity, farm scale, milk quality, and heavy reliance on imported dairy products. These findings confirm that production efficiency alone is insufficient to achieve sustainable competitiveness without improvements throughout the value chain.

This review contributes to the literature by proposing a three-dimensional competitiveness framework that integrates production, domestic market, and

international trade perspectives into a single analytical approach. The framework helps reconcile the seemingly contradictory findings reported by previous studies and provides a more comprehensive basis for evaluating livestock competitiveness across commodities. From a policy perspective, strengthening Indonesia's livestock sector requires commodity-specific and value chain-oriented strategies, including productivity enhancement, feed resource development, technological innovation, institutional strengthening, downstream processing, and improved market integration. Although this review was limited to studies published between 2016 and 2025 and employed qualitative synthesis, it provides a robust foundation for future research integrating comparative quantitative analyses, meta-analysis, and broader international comparisons to support evidence-based livestock development policies.

PRACTICAL AND POLICY IMPLICATIONS

Based on the comparative synthesis, several strategic implications emerge for livestock development in Indonesia.

- Competitiveness should be evaluated using multiple complementary indicators rather than relying solely on production efficiency or trade performance.
- Commodity-specific policies are more appropriate than uniform livestock development strategies, because each commodity faces distinct structural constraints.
- Value chain integration should become the primary policy focus, encompassing breeding, feed systems, production, processing, logistics, quality assurance, and market development.
- Feed security should be recognized as a cross-cutting national priority, given its influence on beef, poultry, eggs, and dairy competitiveness.
- Future livestock policies should emphasize competitiveness upgrading rather than merely increasing production, enabling Indonesian livestock commodities to compete more effectively in both domestic and international markets.

NOVELTY STATEMENT

Previous studies have primarily examined the competitiveness of Indonesian livestock commodities separately, focusing on individual commodities, specific regions, or single analytical indicators such as the Policy Analysis Matrix (PAM), Revealed Comparative Advantage (RCA), Domestic Resource Cost (DRC), Private Cost Ratio (PCR), Effective Protection Coefficient (EPC), Trade Specialization Index (TSI), Self-Sufficiency Ratio (SSR), or Import Dependency Ratio (IDR). This study advances the literature by providing the first systematic

cross-commodity synthesis that comparatively evaluates the competitiveness of Indonesia's four principal livestock commodities—beef, chicken meat, eggs, and dairy milk—within a unified analytical framework. Rather than treating different competitiveness indicators as interchangeable, this review distinguishes production competitiveness, domestic market competitiveness, and international trade competitiveness as complementary dimensions that explain the apparent inconsistencies reported in previous studies. By integrating evidence across commodities and value chains, this review proposes a comparative conceptual framework that offers a more comprehensive interpretation of livestock competitiveness and provides a stronger scientific basis for designing commodity-specific and value chain-oriented livestock development policies in Indonesia.

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AUTHOR'S CONTRIBUTION

Stw and **Ekr** conceived the idea, prepared the initial draft of the study and supervised the overall research work. **IP** prepared the research instrument and collected data. **AS** and **JTI** analysed the data and interpreted the results. **AN** and **AM** review the manuscript and validation. **Syn** revise grammatically, creating illustration, and validation. **LH** and **AH** prepared the final manuscript and incorporated the changes suggested by the reviewers. All authors read and approved the final version of the manuscript.

GENERATIVE AI AND AI ASSISTED TECHNOLOGY STATEMENT

The authors declare that no generative AI and AI assisted technology was used in the creation of this manuscript.

CONFLICT OF INTEREST

The authors confirm that there was no conflict of interest with any financial, personal, or other relationships with other people or organizations related to this paper.

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