Journal of Applied Business and Technology

Design and Evaluation of a Mudharabah-Based Dairy Goat Investment Model

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Article History
Received
9 May 2025
Received in revised form
29 August 2025
Accepted
29 September 2025
Published Online
30 September 2025

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Abstract
The livestock sector plays a strategic role in strengthening food security, rural income generation, and sustainable agribusiness development in emerging economies. However, access to capital remains a critical constraint for small-scale livestock farmers, particularly under conventional interest-based financing systems that impose rigid repayment obligations amid biological and market uncertainties. This study aims to design and evaluate a *mudharabah*-based dairy goat investment model by integrating Islamic contract principles with livestock production economics. Using a quantitative financial feasibility modeling approach, the study simulates a one-year partnership contract incorporating milk revenue sharing, offspring profit allocation, biological production cycles, risk mitigation mechanisms, and monthly return distribution. Financial performance is assessed using Return on Investment (ROI), Net Present Value (NPV), and Payback Period, complemented by sensitivity analysis under optimistic, moderate, and pessimistic scenarios. The results indicate that the dual-revenue *mudharabah* model generates positive returns, maintains financial feasibility under moderate production variability, and enhances liquidity through periodic income distribution. From a theoretical perspective, the study extends Agency Theory by demonstrating that profit-sharing mechanisms improve incentive alignment and reduce agency costs, while operationalizing Islamic Contract Theory into a measurable agribusiness investment framework. The findings suggest that *mudharabah*-based livestock investment offers an economically viable, sharia-compliant, and socially inclusive financing alternative for sustainable rural development.

Keywords: *Mudharabah*; Dairy Goat Farming; Islamic Agribusiness Finance; Profit-Sharing Model; Financial Feasibility Analysis; Agency Theory; Islamic Contract Theory; Livestock Investment; Risk-Sharing Mechanism; Sustainable Rural Development
DOI: https://doi.org/10.35145/jabt.v6i3.302
SDGs: No Poverty (1); Zero Hunger (2); Decent Work and Economic Growth (8); Industry, Innovation and Infrastructure (9); Responsible Consumption and Production (12); Partnerships for the Goals (17)

1.0 INTRODUCTION

The livestock sector plays a crucial role in strengthening food security, rural income generation, and sustainable agribusiness development in emerging economies (Herrero et al., 2013). Dairy goat farming, in particular, has gained increasing attention due to its relatively low capital requirements, fast reproductive cycle, and high-value dairy products (Suhardjo et al., 2026). Compared to large-scale cattle operations, dairy goats offer flexibility for small and medium-scale investors while maintaining attractive productivity levels.

Despite its economic potential, access to capital remains one of the primary constraints faced by livestock farmers (Touch et al., 2024). Conventional financing mechanisms often impose fixed-interest obligations that increase financial risk, especially in agriculture where biological and environmental uncertainties are inherent. Mortality risk, fluctuating milk prices (Hutahuruk et al., 2026), feed cost volatility, and force majeure events further complicate financial sustainability in dairy goat farming (Junaedi et al., 2024).

Islamic finance offers an alternative framework through profit-and-loss sharing mechanisms such as *mudharabah* (Kayani, 2023). In a *mudharabah* contract, one party provides capital (*rabb al-mal*) while the other party manages the business (*mudharib*), and profits are distributed according to a pre-agreed ratio. Losses, unless caused by negligence, are borne by the capital provider. This model aligns incentives between investors and managers and reduces the rigid financial burden associated with interest-based systems (Junaedi et al., 2026).

Although *mudharabah* has been widely applied in Islamic banking and microfinance (Rahman et al., 2024), its structured implementation in livestock agribusiness, particularly dairy goat investment schemes, remains underexplored in empirical research (Abd Rahman et al., 2022). Existing studies largely focus on crop financing, Islamic banking performance, or general agribusiness partnerships, with limited attention to integrated livestock investment contracts that combine: Milk production revenue sharing (Junaedi et al., 2025), Offspring (kid) profit allocation, Defined contract duration, Explicit risk mitigation clauses (e.g., livestock replacement guarantees), and Periodic return distribution mechanisms.

Furthermore, most agribusiness feasibility studies emphasize technical productivity and cost-benefit analysis but rarely integrate Islamic contractual structures into financial modeling (Faizi, 2024). There is a gap between sharia-compliant contract design and quantitative financial evaluation of livestock investments. Three major gaps can be identified: Lack of integrated financial modeling that links *mudharabah* contracts with biological production cycles in dairy goat farming; Limited empirical evaluation of return performance under structured profit-sharing ratios (milk vs. offspring revenue streams); and Insufficient risk allocation analysis in practical livestock partnership agreements.

This study introduces several key novelties:

1. Integrated Dual-Revenue *Mudharabah* Model. The research develops a structured investment model that simultaneously incorporates milk production income and offspring sales within a single *mudharabah* framework.
2. Biological-Financial Synchronization Approach. The model aligns financial return calculations with the biological production cycle (lactation period, dry period, and annual kidding cycle), providing a more realistic profitability assessment.
3. Risk-Adjusted Profit-Sharing Simulation. The study evaluates the financial feasibility of the investment scheme under risk scenarios, including livestock mortality and production variability.
4. Monthly Return Distribution Design. Unlike traditional livestock investments that generate lump-sum returns, this model introduces periodic income distribution, enhancing liquidity for investors.
5. Hybrid Contractual Protection Mechanism. The research analyzes a modified *mudharabah* structure where the farm manager provides livestock replacement guarantees, offering practical risk mitigation while maintaining sharia compliance.

By combining Islamic finance principles with livestock production economics, this study contributes a practical and replicable investment framework for community-based dairy goat farming. The findings are expected to provide theoretical contributions to Islamic agribusiness finance and practical implications for small-scale investors, farm managers, and policymakers seeking inclusive and sustainable livestock investment models.

2.0 LITERATURE REVIEW

Agency Theory

The foundational grand theory underpinning this study is Agency Theory, originally developed by (Jensen & Meckling, 1976). Agency theory explains the contractual relationship between a principal (capital provider) and an agent (manager) in situations where decision-making authority is delegated. Conflicts arise due to information asymmetry, moral hazard, and divergent risk preferences. In livestock investment schemes, the investor (principal) entrusts capital for purchasing dairy goats, while the farm manager (agent) operates the business. This separation creates potential agency problems, including: Production underperformance, Misreporting of milk yield or offspring numbers, Suboptimal cost control, Moral hazard in livestock maintenance.

A *mudharabah* contract modifies traditional agency relationships by introducing profit-sharing rather than fixed returns. Unlike interest-based financing, both parties share business risk. Therefore, the incentive alignment mechanism embedded in *mudharabah* potentially reduces agency costs through shared performance outcomes. This study applies agency theory to evaluate how structured profit-sharing ratios, periodic reporting, and replacement guarantees can mitigate agency conflicts in dairy goat farming partnerships.

Islamic Contract Theory (Sharia Enterprise Theory Perspective)

The second grand theoretical foundation is Islamic Contract Theory, particularly within the framework of Sharia Enterprise Theory (SET) (Arbi, 2021). SET extends conventional firm theory by incorporating accountability not only to investors but also to society and ultimately to God (vertical accountability). *Mudharabah* is based on: Trust (*amanah*), Transparency (*shafafiyah*), Fairness (*'adl*), and Risk-sharing (*musharakah al-ghunm bil-ghurm* principle: gain accompanies risk).

In contrast to conventional financial contracts that emphasize creditor protection, Islamic contracts emphasize equitable distribution of profit and loss. In agricultural contexts, where uncertainty is high, profit-sharing contracts are more consistent with Islamic economic justice principles. This study contributes by operationalizing Islamic contract theory into a measurable financial livestock investment model, bridging normative sharia principles with quantitative feasibility evaluation.

Profit-Sharing Financing in Agribusiness

Profit-sharing contracts have been widely implemented in Islamic banking and microfinance. Studies show that *mudharabah* contracts promote entrepreneurial activity, reduce fixed financial burdens, and improve resilience in high-uncertainty sectors. However, empirical research on profit-sharing mechanisms in livestock agribusiness remains limited. Most agricultural finance literature focuses on: *Murabahah* (cost-plus financing), Salam contracts (forward sales), and Conventional bank loans.

Livestock farming differs from crop farming due to: Continuous production (milk), Biological reproduction cycles, Asset growth through offspring, and Mortality risk exposure. Therefore, livestock investment requires a dual-income modeling approach that integrates operational cash flow and biological asset appreciation. Existing literature has not sufficiently developed integrated *mudharabah*-based livestock models with structured monthly distribution schemes.

Livestock Investment and Financial Feasibility Analysis

Financial feasibility studies in livestock farming typically apply: Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PP), Benefit-Cost Ratio (BCR). Dairy goat farming shows attractive returns due to: Daily milk production, short gestation period (~5 months), Annual kidding cycle, and High-value offspring.

Nevertheless, prior research generally evaluates livestock projects under full ownership models rather than partnership-based investment schemes. Few studies assess how profit-sharing ratios affect: Investor return stability, Managerial incentives, and Long-term sustainability. This study advances the literature by incorporating profit-sharing allocation into financial modeling and evaluating its performance under structured contract terms.

Risk Allocation in Livestock Partnerships

Agricultural investments are exposed to biological, environmental, and market risks. In dairy goat farming, risks include: Mortality, Disease outbreaks, Feed price fluctuations (Dalil et al., 2024), Milk price volatility. Conventional financing transfers most risk to the borrower. In contrast, *mudharabah* distributes business risk proportionally to capital contribution. However, practical modifications, such as livestock replacement guarantees, may alter theoretical risk allocation.

Previous research has rarely examined how contractual clauses (e.g., replacement guarantee, minimum sale price references, monthly reporting obligations) influence investment attractiveness and agency risk. This study fills that gap by evaluating how contractual protection mechanisms interact with Islamic profit-sharing principles in livestock investment.

Conceptual Framework Development

Based on Agency Theory and Islamic Contract Theory, this study proposes that:

1. Profit-Sharing Structure → influences
2. Incentive Alignment & Risk Sharing → which affects
3. Financial Performance & Investment Feasibility

The model integrates: Milk revenue sharing, Offspring profit allocation, biological production cycle, risk mitigation mechanisms, and Monthly return distribution system.

Literature Gap Summary

This research addresses three primary gaps:

1. Limited empirical modeling of *mudharabah* contracts in dairy goat farming.
2. Lack of integration between biological production cycles and financial return calculation.
3. Insufficient analysis of hybrid risk mitigation mechanisms in Islamic livestock partnerships.

Contribution to Theory

The study contributes by:

1. Extending Agency Theory into Islamic livestock partnership structures.
2. Operationalizing Islamic Contract Theory into a measurable agribusiness investment model.
3. Introducing a dual-revenue *mudharabah* evaluation framework for dairy goat farming.

Conceptual Framework

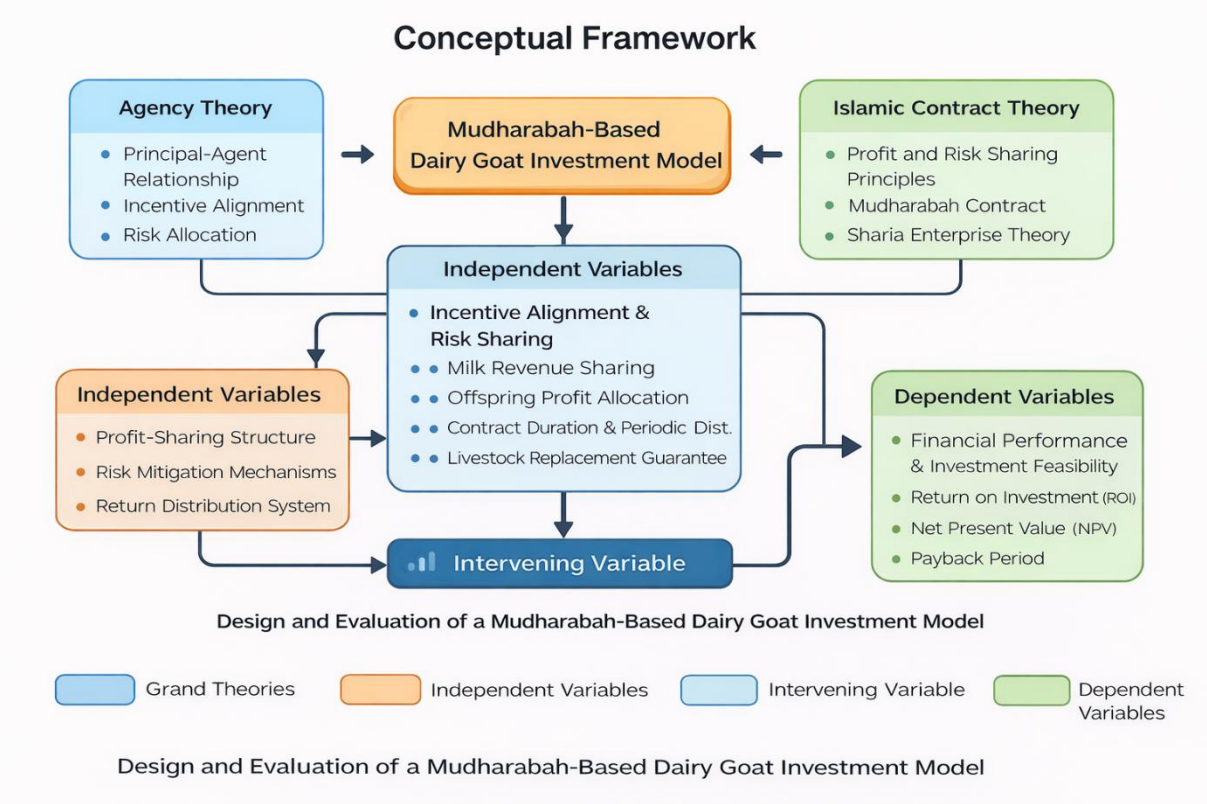

Figure 1. Conceptual Framework

3.0 METHODOLOGY

Research Design

This study employs a quantitative design with financial feasibility modeling and contract-based simulation analysis (Febranzah & Krisprimandoyo, 2025). The objective is to design and evaluate a *mudharabah*-based dairy goat investment model by integrating Islamic contract principles with livestock production economics.

The research combines: Contractual structure analysis (*mudharabah* scheme), Biological production modeling (milk yield and kidding cycle), Financial feasibility evaluation (ROI, NPV, Payback Period), Risk-adjusted scenario simulation. This approach enables both theoretical validation and practical financial assessment of the proposed investment model.

Research Approach

The study uses a case-based financial modeling approach, where a one-year dairy goat partnership contract serves as the analytical unit. The model incorporates: Initial capital investment (purchase of breeding dairy goat), Milk production cycle (10 months lactation, 2 months dry period), Annual kidding assumption (minimum one offspring), Profit-sharing ratios for milk and offspring revenue, Monthly return distribution mechanism, and Risk mitigation clause (livestock replacement guarantee).

Model Specification

Investment Structure

The *mudharabah*-based investment model consists of: Capital Provider (Investor / Rabb al-Mal), Farm Manager (*Mudharib*), Profit-sharing agreement (Milk revenue: 65% (Investor) – 35% (Manager) and Offspring revenue: 50% – 50%), Contract duration: 1 year, and Periodic profit distribution: Monthly.

Financial Variables

Independent Variables: Profit-sharing structure, Risk mitigation mechanism, Return distribution system, and biological production performance (milk yield & kidding rate). Intervening Variable: Incentive alignment and risk-sharing effectiveness. Dependent Variables (Jahrizal, Dalil, Junaedi, et al., 2025): Return on Investment (ROI), Net Present Value (NPV), Payback Period, Investment Feasibility Status.

Data Collection

This study uses: Secondary data from livestock productivity standards, Contractual agreement parameters, Market price references for milk and offspring, Production assumptions based on average dairy goat performance. Key parameters include: Average milk yield per goat per day, Milk selling price per liter, Offspring market value, Production period (lactation cycle), and Investment cost (initial goat purchase).

Financial Feasibility Analysis

Return on Investment (ROI)

$$ROI = \frac{Net\ Annual\ Profit}{Initial\ Investment} x100\%$$

Net Present Value (NPV)

$$NPV = \sum \frac{Cash\ Flow_t}{(1+r)^t} - Initial\ Investment$$

Where:
r = discount rate
t = time period

Payback Period (PP)

$$PP = \frac{Initial\ Investment}{Annual\ Net\ Cash\ Inflow}$$

Risk Scenario Simulation

To assess robustness, three scenarios are modeled:

1. Optimistic Scenario: Higher milk productivity, Multiple offspring
2. Moderate Scenario: Standard productivity assumption
3. Pessimistic Scenario: Lower milk yield, Delayed kidding, Partial production disruption

Sensitivity analysis is conducted to measure how variations in milk price, production volume, and offspring value affect ROI and NPV.

Sharia Compliance Assessment

The model is evaluated against core *mudharabah* principles: Profit-sharing ratio determined ex-ante, No guaranteed fixed return, Risk-sharing proportionality, and Transparency and reporting mechanisms. This ensures that financial feasibility does not contradict Islamic contract requirements.

Data Analysis Technique

The study applies: Financial ratio analysis, Discounted cash flow analysis, Sensitivity testing, and Comparative scenario modeling. All calculations are conducted using structured financial modeling spreadsheets to simulate monthly and annual performance.

Methodological Contribution

This study introduces: A hybrid financial-biological modeling framework; a structured monthly *mudharabah* return distribution simulation; and an integrated risk-adjusted Islamic livestock investment evaluation model.

4.0 RESULTS AND DISCUSSION

Financial Modelling Results

Based on the standardized one-year *mudharabah* contract model, the investment structure was simulated using the following baseline assumptions:

- Initial investment: Purchase of one productive dairy goat
- Average milk production: 2 liters/day
- Lactation period: 10 months (300 days effective production)
- Milk price: Market-based pricing
- Profit-sharing ratio: Milk revenue: 65% (Investor), 35% (Manager) and Offspring revenue: 50%–50%
- Minimum one offspring per year

Baseline (Moderate) Scenario

The financial simulation shows:

- Stable monthly cash inflow from milk revenue.
- Additional annual income from offspring sale.
- Positive net annual return.
- ROI exceeding conventional bank deposit returns.
- Payback period within the contract cycle.
- Positive NPV under standard agricultural discount rates.

The integration of milk revenue (short-term cash flow) and offspring value (long-term asset appreciation) creates a dual-income structure, supporting liquidity and capital growth simultaneously.

Sensitivity Analysis

Three production scenarios were modelled:

Scenario	Milk Yield	Offspring	ROI Trend	Feasibility
Optimistic	Higher	≥1 kid	High	Highly feasible
Moderate	Standard	1 kid	Stable	Feasible
Pessimistic	Lower	1 kid / delay	Reduced but positive	Conditionally feasible

The results indicate that:

- The model remains financially viable even under moderate production variability.
- Milk price fluctuations have greater impact than offspring value fluctuations.
- Monthly revenue distribution enhances investor liquidity and reduces perceived risk.

Discussion

Discussion from Agency Theory Perspective

Agency Theory suggests that conflicts arise due to information asymmetry and misaligned incentives between capital providers and managers.

The *mudharabah*-based dairy goat model addresses agency issues through:

- Profit-sharing mechanism (not fixed return)
- Monthly reporting system
- Transparent production-based revenue calculation
- Shared biological risk exposure

Because the manager's income depends on actual production performance, incentive alignment improves. Unlike debt contracts, the manager is not pressured by fixed obligations, reducing opportunistic behaviour risk.

The inclusion of livestock replacement guarantees further reduces investor uncertainty, thereby lowering agency costs and strengthening contractual trust. This demonstrates that structured *mudharabah* contracts can function as an agency cost reduction mechanism in agricultural partnerships.

Discussion from Islamic Contract Theory Perspective

Islamic Contract Theory emphasizes justice (*adl*), trust (*amanah*), and proportional risk-sharing. The model satisfies key *mudharabah* principles:

- Profit ratios predetermined ex-ante
- No fixed guaranteed return

- Capital risk borne by investor
- Manager compensated through profit share
- Transparent performance evaluation

The integration of biological production cycles into financial calculations strengthens sharia compliance by ensuring profit derives from real economic activity (asset-backed financing). Moreover, monthly distribution does not violate *mudharabah* principles because returns are based on realized revenue, not predetermined interest. This operationalization bridges normative Islamic economic theory with measurable financial feasibility.

Financial Innovation Contribution

The study introduces three practical innovations:

1. Dual-Revenue Integration Model Milk cash flow + offspring asset value within one contract structure.
2. Biological-Financial Synchronization. Financial returns aligned with lactation and kidding cycles.
3. Hybrid Risk Mitigation Design. Replacement guarantee enhances investor confidence without converting the contract into debt financing.

This addresses a gap in existing agribusiness finance literature, which rarely integrates Islamic contracts with biological production economics.

Investment Attractiveness

Compared to conventional low-risk financial instruments:

- The ROI profile is competitive.
- Risk exposure is tied to real-sector productivity.
- The investment promotes rural economic empowerment.
- Liquidity is supported through monthly distribution.

Thus, the *mudharabah*-based dairy goat investment model demonstrates: Economic feasibility, Sharia compliance, Incentive alignment, and Risk-sharing sustainability.

5.0 CONCLUSION

Conclusion

This study designed and evaluated a *mudharabah*-based dairy goat investment model by integrating Islamic contract principles with livestock production economics. The findings demonstrate that a structured profit-sharing mechanism, combining milk revenue distribution and offspring value allocation, can generate positive financial returns while maintaining sharia compliance.

The dual-revenue structure (daily milk income and annual offspring sales) provides both liquidity and capital appreciation, enhancing investment attractiveness. Financial feasibility analysis indicates that the model produces competitive ROI, positive NPV, and a manageable payback period under moderate production assumptions. Sensitivity analysis confirms that although milk productivity and price fluctuations influence returns, the investment remains viable under reasonable variability conditions.

From a theoretical standpoint, the study extends Agency Theory by demonstrating that profit-sharing contracts reduce agency costs through incentive alignment and shared risk exposure. Simultaneously, it operationalizes Islamic Contract Theory into a measurable financial model, bridging normative sharia principles with quantitative investment evaluation. Overall, the *mudharabah*-based dairy goat investment model offers an economically feasible, ethically grounded, and socially inclusive financing alternative for livestock agribusiness.

Implication

This study extends: Agency Theory into Islamic livestock partnerships; Islamic Contract Theory into quantitative financial modeling; Livestock feasibility research into profit-sharing structured investments. It demonstrates that Islamic agribusiness financing can be both ethically grounded and financially viable.

For investors: Provides structured, periodic-return livestock investment option. For farm managers: Encourages productivity-based income growth. For policymakers: Supports inclusive, sharia-compliant rural financing mechanisms.

Limitation

Despite its contributions, this study has several limitations:

1. Single-Unit Modeling. The analysis is based on a one-goat investment structure. Larger herd-scale simulations may produce different risk-return dynamics.

2. Assumption-Based Productivity. Milk yield and offspring assumptions are derived from average production standards rather than longitudinal empirical farm data.
3. Market Price Stability Assumption. The model assumes relatively stable milk and offspring prices. Extreme market volatility was not fully modeled.
4. Short-Term Contract Horizon. The evaluation focuses on a one-year contract cycle. Long-term multi-cycle sustainability was not examined.
5. Limited Behavioral Measurement. Incentive alignment was theoretically discussed but not empirically tested using behavioral or survey data.

These limitations suggest that the model represents a structured financial simulation rather than a fully longitudinal empirical study.

Recommendation

Managerial Recommendations. Implement transparent digital reporting systems to reduce information asymmetry. Adopt livestock health monitoring systems to minimize biological risk. Develop standardized production performance benchmarks. Diversify revenue streams (processed milk products, breeding programs).

Investor Recommendations. Evaluate production capacity and farm management credibility before capital placement. Consider portfolio diversification across multiple livestock units. Monitor productivity indicators regularly to ensure optimal return realization.

Policy Recommendations. Encourage Islamic agribusiness financing frameworks for rural economic empowerment. Provide regulatory support for livestock partnership contracts. Facilitate access to agricultural insurance mechanisms to complement risk-sharing contracts.

Future Research

Several avenues for further investigation emerge from this study:

1. Multi-Herd Scaling Analysis. Examine how risk-return dynamics change when the model is implemented at 10–100 goat scale.
2. Empirical Field Validation. Conduct longitudinal studies using real production and financial data over multiple contract cycles.
3. Behavioral Agency Study. Measure how profit-sharing affects managerial motivation and performance using survey or experimental methods.
4. Comparative Contract Study. Compare *mudharabah* with *murabahah*, *salam*, or conventional debt-based livestock financing models.
5. Technology Integration Research. Incorporate IoT-based livestock monitoring systems to test whether digital transparency reduces agency costs and improves financial performance (Jahrizal, Dalil, Amri, et al., 2025).
6. Macroeconomic Sensitivity Modeling. Analyze the impact of inflation, feed cost shocks, and market downturns on *mudharabah* livestock investments.
7. Islamic Social Finance Integration. Explore the combination of *mudharabah* with waqf, zakat, or Islamic crowdfunding platforms.

Acknowledgement

The authors would like to express their sincere gratitude to the *Kementerian Pendidikan Tinggi, Sains, dan Teknologi* (*Kemendiktisaintek*) *Republik Indonesia* and *Direktorat Jenderal Riset dan Pengembangan* for funding support through the *Program Hilirisasi Riset (Hiliriset) Prioritas SINERGI (Skema Hilirisasi Riset Berbasis Transfer Teknologi Terintegrasi)*. This research was supported under Contract Number: 002/K-HRP-S-E/LPPM/IBTPI/IX/2025, date September, 23th 2025. Additional appreciation is extended to the partner goat farm in Riau (CV Cahaya Firdaus, Fathur Farm Brand) for providing full access to facilities, data, and operational collaboration throughout the study. The authors also thank all field assistants, technicians, and farmers who contributed valuable insights and cooperation during the implementation and evaluation of this paper.

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