International Journal of Economic, Business, Accounting, Agriculture Management and Sharia Administration (IJEBAS)

International Journal of Economic, Business, Accounting, Agriculture Management and Sharia Administration (IJEBAS Journal) | ISSN (e): 2808-4713
Volume 6 No. 5 (2026)

IMPROVING FEEDLOT EFFICIENCY AND PROFITABILITY THROUGH STRATEGIC INVESTMENT EVALUATION OF JAKARTA'S STATE-OWNED FEEDLOT

Afan Wahyu Syafii[1*], Sylviana Maya Damayanti[2]
[12]Master of Business Administration Program, Sekolah Bisnis & Management,
Institut Teknologi Bandung (ITB), Bandung
Email: afanwsyafii@gmail.com

Received	: 15 June 2026	Accepted	: 20 July 2026
Revised	: 19 June 2026	Published	: 30 July 2026

Abstract

Indonesia meets only 55–60% of national beef demand through domestic production, with the remainder sourced from live feeder cattle imports. This paper assesses the financial viability of an integrated investment program to upgrade the physical and management capabilities of the Serang Feedlot of Perumda Dharma Jaya. As part of its role as a Regional State-Owned Enterprise of the DKI Jakarta Provincial Government, this feedlot is responsible for processing the majority of live feeder cattle imported into Indonesia. Due to high costs associated with importing live animals, it has become imperative for Indonesia to develop greater efficiency in utilizing these resources domestically. Despite being the first point of contact for all imported cattle prior to their entry into the human food chain, Indonesian feedlots have historically performed poorly compared to global averages when measured by such performance metrics as average daily weight gain (ADG), percent feed cost per head and space usage per head. The proposed combined investment program includes upgrading pens (pen expansion); total mixed ration (TMR) feeding systems (mechanizing TMR); and a feed inventory system (bulk feed storage). It is based on a 10 year financial projection of cash flows using historical operating data provided by the facility over a 3-year period. In addition to performing a traditional cost benefit analysis and Monte Carlo risk analysis of projected returns on investment (ROI), this research also performs PESTLE analyses and SWOT/TOWS strategic analyses. A total of 13 sensitivity analyses were conducted to test the impact of potential future changes in input prices and/or facility operating conditions. Under the base-case assumptions (including 60% equity and 40% loan financing structure; weighted average cost of capital 12.0%) the total investment outlay will generate a net present value of IDR 349.9 Billion and an internal rate of return (IRR) of approximately 83.97% over the 10 year planning period. Based upon the Monte Carlo simulation results there is 100% confidence level that the expected net present value will be positive. With respect to the sensitivity analyses, all thirteen possible combinations of either increased or decreased costs or reduced or enhanced operation efficiencies resulted in both positive expected values for ROI and rates of return on investment above the respective costs of capital. These results provide evidence that poor performance in this facility is due to a combination of avoidable internal factors rather than non-controllable external factors and that the application of a formalized process-based evaluation model can provide a basis for identifying feasible solutions, justifying those solutions and implementing them.

Keywords: Feedlot Investment; Capital Budgeting; State-Owned Enterprise; Beef Supply Chain; Cost-Benefit Analysis

INTRODUCTION

The beef supply chain of Indonesia has operated under a structural deficit since the mid-1990s. Currently, domestic production accounts for only about 55 to 60 percent of national beef consumption with live feeder cattle imports (primarily Brahman Cross or "BX" cattle from northern Australia) and/or frozen beef filling the remainder. The increasing number of Indonesians consuming beef, from 2.18 kilograms per person in 2013 to 2.56 kilograms per person in 2023 due to the rapid urbanization and rising incomes (BPS, 2024; OECD–FAO, 2024), increases the strain on what is an already limited supply chain. In Jakarta, a city of over 11 million residents and the nation’s largest meat consumer market, reliability of this supply chain is commercially significant and politically important;

price volatility in beef products during Ramadan and Eid ul-Adha directly affect the welfare of households and the confidence that citizens have in their government's ability to manage its supplies.

Feedlots represent the single most critical node in the beef supply chain. All feeder animals imported into Indonesia must spend 90 to 120 days in a feedlot prior to being slaughtered. Feedlot performance can thus greatly impact the quality, quantity, and cost of beef delivered to consumers. However, Indonesian feedlots have historically been less productive than those around the world. Specifically, industry-wide average daily gains ("ADGs") of 0.90 to 1.20 kilograms per head per day, compared to global benchmarks of 1.30 to 1.50 kilograms per head per day, result in significantly higher feed costs as a percentage of overall fattening expenses. Specifically, feed costs range between 75 to 80 percent of total fattening expenditures for Indonesian feedlots compared to a global best practice limit of no greater than 70 percent (Putra, Wiyatna, and Basuki, 2020; MLA, 2023; FAO, 2018). Feedlot inefficiency is especially prevalent among BUMDs (Badan Usaha Milik Daerah), which are regional state-owned entities that serve as dual-purpose entities in that they are expected to generate commercial profits while also fulfilling public interest responsibilities related to food security. These dual mandates create different types of investment decision-making challenges for BUMDs than those experienced by pure private sector firms. That is, capital allocation decisions made by BUMDs must meet fiduciary responsibility standards established by local supervisory boards responsible for overseeing the operation of BUMDs while also meeting public interest-based criteria established by relevant food policies. Further, because there are no formalized frameworks for evaluating investments within BUMDs, historical operational capability gaps continue to exist despite potential improvements to their performance resulting from policy based changes such as increased availability of import quotas (Swastika et al., 2000; Ilham, 2015).

Perumda Dharma Jaya (PDJ) represents a BUMD under the DKI Jakarta Province of Indonesia and provides an example of this problem. PDJ is responsible for an integrated beef supply chain that includes feedlot operations through to processing and marketing of beef products. Despite achieving high levels of cattle throughput (e.g., 973, 1210, and 2581 head in 2023, 2024, and 2025) at its Serang Feedlot facility, which had annual RKAP targets of 3200, 3800, and 3930 head respectively, the facility achieved only 31.4%, 44.9%, and 74.8% of those targets. Furthermore, the feedlot has a maximum pen capacity of only 1200 head per cycle, making it impossible for it to reach its projected RKAP target of 8670 head in 2026. Importantly however, PDJ was granted an import quota of 7500 BX feeder cattle for use at the Serang Feedlot in 2026 by the Ministry of Trade, representing a policy supported demand signal that could not be satisfied without major new investment.

This study seeks to answer four research questions: (1) What are the current operational performance metrics for the Serang Feedlot facility relative to industry standards? (2) What structural, operational and regulatory constraints contribute to ongoing suboptimal performance? (3) What alternative investments provide the best opportunities to overcome these constraints? (4) Is there a financially viable combination of these investments that generates a positive net present value ("NPV") and internal rate of return ("IRR") above the cost of capital across all reasonable operating conditions? There are two key assumptions that guide this investigation: First, that underperformance is caused by identifiable, internal shortcomings that can be addressed rather than exogenous factors; Second, that implementing a comprehensive investment program designed to remove all barriers to performance simultaneously will produce positive economic results including a favorable NPV and IRR above the cost of capital for all possible operating scenarios.

Three key contributions are made in this study. From a quantitative perspective, it measures feedlot performance deficits using original data and compares them to both national and international standards. It offers a methodology for measuring performance deficits and identifying causal relationships (using PESTLE, SWOT/TOWS analyses) while applying a cost-benefit analysis incorporating Monte Carlo simulations specifically tailored to the unique dual mandate environment facing BUMD agricultural businesses. Finally, it offers a practical solution (including detailed financial modeling and risk management matrices) sufficient for submission to a board of directors for approval to proceed with investing in the identified solutions at the province government level.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Feedlot Performance and Investment Economics

There is a unique combination of characteristics for the economics of investing into feedlots; including an interaction between biological performance characteristics such as average daily gain (ADG) and feed conversion ratio (FCR), commodity price risk and the overall fixed cost structure. Lawrence and Ibarburu (2007) found that every .10kg increase in ADG decreases the feed cost per kilogram of live weight produced by 4-6%. This occurs when feeders eat at the same rate but are producing more kilograms of live animal product. Parsons, Chalupa and Jaster (2011) found that using mechanical systems for total mixed rations resulted in an ADG improvement of 10-20% compared to non-mechanical systems, based upon maintaining stable ruminal fermentation conditions that result from continuous ration delivery. Ladoni et al. (2024) used a feedlot heifer return model to determine that among all factors influencing variation in net returns in a feedlot, feed cost and cattle selling prices were the two most significant factors. Therefore, these two variables will be used as anchors for sensitivity analyses during any feedlot investment evaluation.

A second structural aspect of the economics of feedlots is scale economies. MacDonald & McBride (2009) demonstrated that fixed costs decrease sharply as production volume increases. Fixed cost dilution is the major factor creating this relationship. However, Guo et al. (2025) emphasized that scale economies depend on the achievement of operational efficiency. Technical inefficiency can reduce up to 40% of the cost savings resulting from increased scale. Therefore, investments in mechanization must be made concurrently with expansions in capacity rather than subsequent to them. In terms of Indonesia-based feedlots specifically, Putra et al. (2020) and Swastika et al. (2000) have consistently shown that underutilization of pens due to uncertainty surrounding quotas for importing animals and not due to demand issues was the most consistent cause of high levels of fixed cost per head in feedlots linked to the state.

Strategic Investment Evaluation in State-Owned Agribusinesses

Investment evaluation in state-owned agribusiness enterprises requires a methodological approach that integrates macro-environmental scanning with financial feasibility analysis, because the dual-mandate context means that neither dimension alone produces a complete picture. Gündoğdu, Kahraman, and Gündoğdu (2023) demonstrated in a developing-country agricultural context that combining PESTLE with SWOT produces more actionable strategic priorities than either tool independently, with political and economic factors consistently dominating in regulated industries. Anjum and Hussain (2025) documented a directly comparable case, a state-linked halal meat enterprise in Pakistan showing that PESTLE and SWOT together effectively captured the regulatory and macroeconomic pressures constraining operational investment decisions. Vardopoulos et al. (2021) confirmed that PESTLE-informed SWOT analysis produces more defensible strategic options than intuition-based SWOT, particularly in regulated sectors. The TOWS matrix extension of SWOT, introduced by Weihrich (1982) and validated by Gürel and Tat (2017) and Benzaghta et al. (2021), converts qualitative diagnosis into investment alternatives through systematic cross-referencing of strengths, weaknesses, opportunities, and threats. Benzaghta et al. confirm that SWOT combined with TOWS is particularly effective in operational investment decisions in regulated industries where internal capability gaps and external regulatory constraints must be addressed simultaneously a characterization that describes the Serang Feedlot context precisely.

Cost-Benefit Analysis and Monte Carlo Simulation for Agricultural Investment

Cost-benefit analysis applying Net Present Value, Internal Rate of Return, and Payback Period constitutes the standard evaluation framework for capital investment decisions in both private and public sector agricultural enterprises (Boardman, Greenberg, Vining, and Weimer, 2018; Brigham and Houston, 2019). The Free Cash Flow to the Firm (FCFF) method discounted at the Weighted Average Cost of Capital derived through the Capital Asset Pricing Model for the cost of equity component is the theoretically consistent approach for project evaluation at the firm level, avoiding the double-counting of debt costs that results from applying WACC to levered cash flows (Brealey, Myers, and Allen, 2020; Damodaran, 2012). Mutoko, Ngigi, and Rao (2022) demonstrated that the combined NPV-IRR-Payback approach in an agricultural investment context produces more robust decisions when supplemented with sensitivity analysis, because investments with positive NPV under adverse scenarios are substantially more likely to realize their projected returns.

Monte Carlo simulation extends deterministic sensitivity analysis by simultaneously varying uncertain variables across their probability distributions, producing a probability distribution of NPV outcomes rather than point estimates (Saltelli, Tarantola, Campolongo, and Ratto, 2008; Vose, 2008). Triangular distributions are standard for bounded variables where minimum, most likely, and maximum values can be estimated from operational data and expert judgment, a condition that ADG and commodity feed prices satisfy in the feedlot context. The simulation's primary contribution is not the mean NPV, which deterministic analysis already provides, but the probability that NPV remains positive across the full joint distribution of uncertain variables, the metric most relevant to governance decision-making under uncertainty.

RESEARCH METHODOLOGY

This study adopts a mixed design organized through five sequential analytical phases. Qualitatively we perform performance gap analysis, trace root causes and do strategic diagnosis to justify investment and derive alternatives; quantitatively we do cost benefit analysis with sensitivity testing and Monte Carlo simulation to determine which alternative is best and how robust that is. Sequential integration follows Yin (2018) case study framework and Creswell and Creswell (2018) principles for mixed methods design. Primary data collection involved semi structured management interviews (feedlot operations manager, finance division and procurement division) and two structured days of field observation at Serang facility in Sukawana, Banten province and vendor consultations for capital expenditure estimation. Privileged access to audited operational records, RKAP planning documents and production data for 2023 to 2025 not available from external sources comes from being an internal Perumda Dharma Jaya employee. Secondary data included benchmark reports for MLA feedlots (2020 and 2023) for reference values of best practice globally, Putra et al. (2020) for averages in the Indonesian industry and Bank Indonesia benchmark rates were used for assumptions about risk free rate. IDX market data was used to derive betas. Triangulation of interview accounts, operational records and field observations was used to validate all primary results and reduce risk of insider bias typical of studies between researchers and practitioners.

Cost benefit analysis uses a horizon of ten years with growth rate of 2 percent on all revenue and cost items reflecting long term inflation. Depreciation which is sunk cost at acquisition is not included in growth assumptions. Scenario A WACC of 12.01% is derived using CAPM: risk free rate of 6.50% (BI Rate 2025), expected market return of 13.70% (long run average for IDX Composite), beta derived from comparable listed agribusiness comparables JPFA, CPIN and MAIN and pre tax cost of debt at 8 percent with a 22 percent shield from corporate income tax PPh. Scenario B allocates equity entirely to PMD and uses cost of equity directly at 15.86%. Monte Carlo simulation using 10,000 samples (seed set to 42 and implemented in RStudio) uses triangular distributions for ADG [minimum of 1.1 kg per person per day, mode at 1.5 kg per person per day and maximum of 1.65 kg per person per day] and feed price deviations [minimum of −10%, mode 0% and maximum of +40%].

RESULTS AND DISCUSSION

Performance Gap Assessment

Three years of audited operational data reveal a feedlot that has persistently underperformed both its corporate plan and industry benchmarks across every key indicator, while demonstrating sound and improving per-head unit economics. Table 1 presents the complete performance record.

Table 1. Serang Feedlot Financial and Operational Performance vs. RKAP Targets

Indicator	RKAP 2023	Act. 2023	RKAP 2024	Act. 2024	RKAP 2025	Act. 2025	RKAP 2026
Revenue (IDR Mio)	57,115	17,918	65,491	29,396	85,392	63,881	192,289
Operating Cost (IDR Mio)	52,789	17,225	58,753	27,501	75,689	59,709	175,842
Net Profit (IDR Mio)	4,325	692	6,737	1,894	9,703	4,172	16,447
Net Profit Margin (%)	7.57%	3.90%	10.29%	6.45%	11.36%	6.53%	8.55%
Cattle Finished (head)	3,200	973	3,800	1,210	3,930	2,581	8,670
ADG - BX (kg/hd/day)	1.50	1.07	1.50	1.12	1.50	1.22	1.50
Pen Utilization (%)	88%	27%	105%	34%	109%	72%	240%

Source: Perumda Dharma Jaya Internal Reports and RKAP Documents (2023–2026)

The data in Table 1 establish that underperformance is a throughput problem, not a unit economics problem. Revenue per head improved consistently from IDR 18.4 million in 2023 to IDR 24.8 million in 2025, confirming sound per-animal profitability. The financial gap is entirely driven by volume: actual throughput reached only 30.4%, 31.8%, and 65.7% of RKAP targets across the three years, with pen utilization collapsing to 27% and 34% in 2023 and 2024 before recovering to 72% in 2025. Critically, the 2025 operational improvement pen utilization rising from 34% to 72% and revenue growing by 117% occurred without any infrastructure change, driven entirely by the government's resumption of direct BX feeder cattle importation after a 28-year policy vacuum. This natural experiment provides the clearest possible evidence of causation: BX cattle availability is the primary throughput determinant, not operational management quality. Against MLA (2023) global benchmarks, the feedlot's BX ADG of 1.22 kg per head per day in 2025 falls 0.28 kg per day below the benchmark midpoint of 1.50, and 0.08 kg per day below even the lower Indonesian industry average of 1.30 (Putra et al., 2020). Labour productivity of one worker per 99 head compares unfavorably to the benchmark of 200 to 300 head per worker. Feed storage coverage of less than seven days against a 30-day benchmark prevents bulk procurement economies and creates supply disruption vulnerability. Each of these gaps has a documented quantitative consequence: the ADG gap alone costs IDR 10.98 billion per year in foregone EBITDA at full capacity of 15,000 head.

Root cause analysis using the 5 Whys framework traces the performance gap to three internal, addressable deficiencies. The first is the 28-year absence of direct BX cattle importation, now resolved through government policy. The second is the manual feeding system a single 500 kg vertical mixer without a weighing mechanism and a pickup truck delivery circuit that takes most of the working day which produces inconsistent ration composition between batches and disrupts the rumen fermentation cycle that converts feed energy into tissue. The third is the 350 m² unsegregated feed storage facility providing less than seven days of inventory coverage, which prevents bulk procurement, eliminates volume discounts, and creates vulnerability to supply disruption. These three causes are operationally interdependent: none can be fully resolved without addressing the other two, which is the analytical foundation for the combined investment recommendation.

Strategic Analysis: PESTLE, SWOT, and TOWS

The PESTLE analysis identifies the external environment as exceptionally favorable for investment at this specific moment. Politically, the approved 7,500-head BX import quota for 2026 represents both a policy-backed demand signal and a time-constrained opportunity: failure to demonstrate utilization capacity risks future quota reductions. Economically, Indonesia's sustained GDP growth of 5.05% (BPS, 2024) and rising per capita beef consumption from 2.18 to 2.56 kg (OECD-FAO, 2024) create structural long-run demand growth. Technologically, commercially mature TMR mechanization solutions at accessible price points are available in the Indonesian market, eliminating technology risk from the investment. Legally, the Perumda governance framework under Regional Regulation No. 2/2021 provides the PMD equity injection mechanism and supervisory board approval pathway for capital commitment.

The SWOT analysis identifies the feedlot's most important internal strength as the institutional support of the Jakarta Provincial Government which provides import quota facilitation, PMD equity access, and public service mandate income that commercial operators cannot access alongside the consistent per-head margin improvement that demonstrates sound commercial fundamentals when cattle volume is available. The critical weaknesses are the manual feeding system, inadequate storage, and the pen capacity ceiling that makes the 2026 RKAP target mathematically impossible without expansion. The primary external opportunity is the approved import quota; the primary threats are feed price volatility and USD/IDR exchange rate exposure.

The TOWS matrix derives four investment alternatives through systematic cross-referencing. The SO quadrant deploying government institutional support to capitalize on the import quota opportunity generates the pen expansion alternative. The WO quadrant addressing the manual feeding weakness by exploiting commercially available mechanization technology generates the TMR mechanization alternative. The WT quadrant minimizing the feed storage weakness against the feed price volatility threat generates the bulk storage alternative. The combined WT alternative, the only one that resolves all three root causes simultaneously, is the recommended investment. The TOWS derivation is the analytical move that distinguishes this recommendation from an arbitrary equipment comparison: every component of the investment package has a documented strategic rationale traceable to the diagnosis.

Financial Feasibility: Two Funding Scenarios

The combined investment package comprises pen expansion from 1,200 to 5,000 head per cycle at IDR 40.0 billion (20-year useful life, straight-line depreciation), three TMR Roto-Mix mixer trucks at IDR 12.0 billion total (8-year useful life), and a 1.000-ton segregated bulk feed storage facility at IDR 8.5 billion (20-year useful life). Total CAPEX: IDR 60.5 billion. Total annual depreciation post-investment: IDR 3.925 billion (non-cash; does not grow with inflation). The base-case unit economics are: revenue per head IDR 28,670,000 (470 kg finishing weight × IDR 61,000/kg), cattle purchase cost per head IDR 17,762,500 (290 kg × USD 3.50 × IDR 17,500), total feed cost per head IDR 5,208,728 (two-phase TMR program), and other variable costs per head IDR 176,333. Gross margin per head at base: IDR 5,522,439 (19.26% of revenue). Annual fixed cash operating costs at Year 1 base: IDR 3,610,500,000. All revenue and cost items grow at 2% annually; depreciation is constant. The production ramp-up schedule applies conservative utilization rates: 40% (6,000 head) in Year 1, 70% (10,500 head) in Year 2, 90% (13,500 head) in Year 3, and 100% (15,000 head) in Years 4 through 10. Even at 40% utilization in Year 1, throughput of 6,000 head exceeds the 2025 actual of 2,581 head by 133%, confirming that the investment generates substantial operational improvement from the first year. Table 2 presents the comparative investment appraisal for both funding scenarios.

Table 2. Comparative Investment Appraisal: Scenario A (WACC 12.01%) vs. B (Ke 15.86%)

Metric	Scenario A (WACC 12.01%)	Scenario B (Ke 15.86%)	Notes
Total CAPEX (IDR B)	60.5	60.5	Equal physical investment
Equity Outlay (IDR B)	36.3 (60% Equity)	60.5 (100% Equity)	Scenario A: IDR 24.2B less government capital
Debt (IDR B)	24.2 (8% p.a., 10 yr)	0	Tax shield benefit: Kd(AT) = 6.24%
Discount Rate	WACC = 12.01%	Ke = 15.86%	Lower WACC reflects tax shield on debt
NPV - FCFF (IDR B)	349.86	283.92	Difference of IDR 65.94B = present value of tax shield
IRR - FCFF	83.97%	83.97%	Identical, IRR is a project property, not a financing property
Profitability Index	6.783×	5.693×	Higher in Scenario A because equity outlay (denominator) is smaller
Discounted Payback (years)	1.77	1.85	Scenario A recovers faster due to lower discount rate
Decision	**ACCEPT**	**ACCEPT**	**Both scenarios unanimously justified**

Source: Author's financial model; CAPEX IDR 60.5B; 10-year horizon; 2% annual growth;

Three findings from Table 2 merit analytical emphasis. First, the IRR of 83.97% is identical across both scenarios confirming the theoretical principle that IRR is a property of the investment's operating cash flows, not its financing structure. Both scenarios clear their respective hurdle rates (WACC 12.01% and Ke 15.86%) by factors of approximately seven and five respectively, providing exceptional safety margins. Second, the NPV difference of IDR 65.94 billion between scenarios is entirely attributable to the discount rate difference and represents the present value of the tax shield benefit of debt: interest payments on the IDR 24.2 billion bank loan at 8% are deductible at the 22% PPh Badan rate, reducing the effective cost of debt from 8.00% to 6.24%. Third, the equity IRR divergence 117.44% in Scenario A versus 83.97% in Scenario B reflects financial leverage: the government's IDR 36.3 billion PMD equity contribution in Scenario A generates a 33.47 percentage point higher return than committing the full IDR 60.5 billion under Scenario B, because the same project NPV is earned on a smaller equity base.

The economies of scale mechanism explains the investment's exceptional returns. The investment increases total annual fixed costs from approximately IDR 2.2 billion (pre-investment) to IDR 3.6 billion fixed cash costs (post-investment) a 64% increase. But throughput capacity grows from a maximum of 3,600 head per year to 15,000 head per year, a 317% increase. Because throughput grows 5.0 times faster than fixed costs, the fixed cost per head falls from IDR 1,398,488 at the 2025 actual throughput of 2,581 head to IDR 240,700 at full post-investment capacity an 82.8% reduction. The break-even throughput the minimum head count to cover all post-investment fixed cash costs is 654 head per year, exceeded by a factor of 9.2 times in Year 1 at 40% utilization. This scale mechanism is why the investment is not marginally positive but exceptionally positive.

Sensitivity Analysis and Monte Carlo Simulation

Table 3 presents the deterministic sensitivity analysis, testing 13 scenarios across five key variables.

Table 3. Sensitivity Analysis: 13 Scenarios Across 5 Key Variables

Scenario	Variable	NPV (IDR B)	IRR	Decision
ADG conservative: 1.35 kg/day (−10%)	ADG	263.91	69.42%	**Accept**
ADG base case: 1.50 kg/day (RKAP target)	ADG	349.86	83.97%	**Accept**
ADG optimistic: 1.60 kg/day (+7%)	ADG	407.45	93.32%	**Accept**
Feed price +15% above base	Feed price	288.70	73.70%	**Accept**
Feed price +30% above base	Feed price	227.54	62.98%	**Accept**
Pen utilization 60% of capacity	Utilization	176.95	53.63%	**Accept**
Pen utilization 75% of capacity	Utilization	242.43	65.75%	**Accept**
Selling price −10% (IDR 54,900/kg)	Sell price	125.44	43.46%	**Accept**
Selling price +10% (IDR 67,100/kg)	Sell price	574.28	119.26%	**Accept**
Cattle buy price +10% (USD 3.85/kg)	Buy price	210.82	59.95%	**Accept**
WORST CASE: Feed +30% AND Util. 60%	Combined	103.56	38.85%	**Accept**
BEST CASE: Sell +10% AND ADG +7%	Combined	637.63	128.78%	**Accept**

Source: Author's financial model; all scenarios hold non-tested variables at base case

The sensitivity analysis produces a finding of unambiguous clarity: the investment recommendation holds NPV positive and IRR substantially above WACC across every scenario tested, without exception. The combined worst case of feed price 30% above base and pen utilization limited to 60% of capacity still produces NPV of IDR 103.56 billion and IRR of 38.85%, 3.2 times the WACC hurdle rate. The break-even selling price, at which NPV falls to zero, is IDR 52,683 per kilogram, a 13.6% decline from the current market price of IDR 61,000. Selling price has the largest individual impact (IDR 224B range per 10% movement), followed by ADG (IDR 144B range across the full distribution), and feed price (IDR 122B range between base and +30%). Table 4 presents the Monte Carlo simulation results.

Table 4. Monte Carlo Simulation: NPV Probability Distribution

Statistic	Value	Interpretation
Simulations	N = 10,000	Reproducible seed 42; simultaneous ADG and feed price uncertainty
ADG distribution	Triangular [1.10, 1.50, 1.65] kg/hd/day	Min = 2023 actual; mode = RKAP target; max = MLA upper benchmark

Statistic	Value	Interpretation
Feed price distribution	Triangular [−10%, 0%, +40%]	Mode = 2025 base prices; max reflects severe commodity spike
Mean NPV	IDR 261.3 billion	Central expected value under simultaneous uncertainty
Standard deviation	IDR 80.4 billion	Measure of combined variability from both uncertain variables
5th Percentile (P5)	IDR 119.6 billion	95% of simulations exceed this - strong downside floor at 1.98× equity outlay
Median (P50)	IDR 267.1 billion	Half of all 10,000 outcomes exceed this value
95th Percentile (P95)	IDR 382.7 billion	Upper confidence bound - substantial upside potential
P(NPV > 0)	100.0%	Zero probability of value destruction across all 10,000 iterations
ADG NPV impact range	IDR 308.2 billion	Primary risk driver: each 0.10 kg/day improvement = IDR 10.98B annual EBITDA
Feed price NPV impact range	IDR 196.7 billion	Secondary driver: 40% price spike reduces annual EBITDA by IDR 30.8B

Source: Author's simulation (RStudio, seed 42); ADG and feed price parameter

The Monte Carlo simulation produces three analytically significant results. First, the probability of positive NPV is 100% across all 10,000 iterations. In every simulated combination of ADG and feed price uncertainty, the investment creates value. The minimum observed NPV across the entire distribution is approximately −IDR 1.1 billion, occurring in fewer than 0.1% of simulations at the extreme adverse intersection of the lowest ADG and highest feed prices; the 5th percentile NPV of IDR 119.6 billion represents a far more conservative floor exceeded in 95% of outcomes. Second, the mean simulated NPV of IDR 261.3 billion is below the deterministic base case of IDR 349.86 billion, reflecting the asymmetric feed price distribution: the maximum possible increase of 40% is more severe than the 10% possible decrease, pulling the simulation mean left. Third, ADG emerges as the dominant source of NPV variability, with an individual impact range of IDR 308.2 billion compared to IDR 196.7 billion for feed price. This ranking has a direct managerial implication: post-investment ADG monitoring ensuring that the TMR mechanization delivers the target 1.50 kg per head per day is the single most financially consequential management activity available after capital commitment.

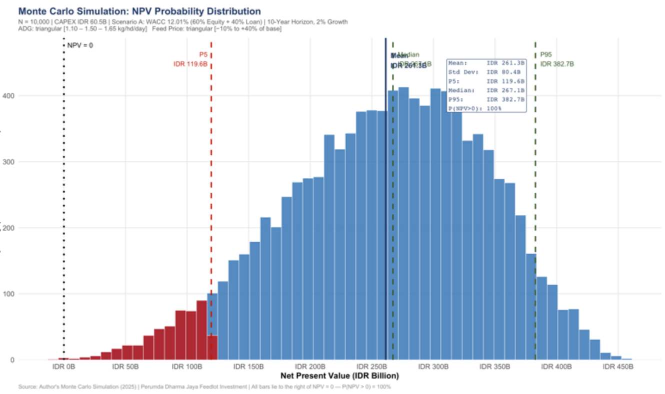

Figure 1. Monte Carlo Simulation: NPV Probability Distribution (N = 10,000)
Source: Author's Monte Carlo Simulation (2025)

The three Monte Carlo charts generated by the RStudio simulation provide complementary visual perspectives. The NPV probability distribution histogram confirms that every bar lies to the right of zero, no simulated outcome destroys value and reveals a slight left skew from the asymmetric feed price distribution. The cumulative probability

S-curve shows that the curve never crosses the NPV = 0 threshold, enabling governance stakeholders to read off directly the probability of exceeding any given NPV level.

Figure 2. Monte Carlo Simulation: NPV Joint Sensitivity - ADG and Feed Price
Source: Author's Monte Carlo Simulation (2025)

The ADG-vs.-NPV scatter plot, where color intensity encodes feed price deviation, shows a clear positive correlation between ADG and NPV with the entire point cloud above the break-even line confirming ADG primacy and complete investment robustness across the joint uncertainty space.

Implementation Plan and Risk Management

The six-phase implementation plan specifies the critical path items that determine whether the investment generates its projected Year 1 EBITDA of IDR 29.5 billion. The most time-sensitive is the procurement of the three TMR mixer trucks, which carry an import lead time of 8 to 12 weeks and must be ordered no later than the fourth quarter of 2025 to enable commissioning before the 2026 BX stocking season. A one-month delay in commissioning costs approximately IDR 2.46 billion in foregone Year 1 EBITDA. A trial batch of approximately 200 BX head for one full 120-day cycle, with ADG ≥ 1.35 kg per head per day as the acceptance criterion, is specified before full commercial ramp-up, providing an empirical validation point for the mechanization's biological effect before throughput commitments are made. The risk management framework, developed using the ISO 31000:2018 methodology, identifies three High-classified risks (probability × impact score ≥ 12): feed price spike (score 16), ADG underperformance post-mechanization (score 12), and BX import quota reduction (score 12). These three risks correspond exactly to the three root causes identified in the 5 Whys analysis a convergence that reflects the internal consistency of the analytical framework. Feed price risk is mitigated through five complementary strategies: long-term supply contracts with CBOT index-linked price clauses, strategic bulk procurement using the 500-ton storage facility as a financial risk management instrument (enabling procurement below the 90-day commodity price rolling average), GPMT industry network membership for collective purchasing, preferred supplier relationships, and a monthly price monitoring protocol with explicit procurement triggers. ADG risk is mitigated through batch-level monitoring with a 1.35 kg per day alert threshold, a TMR vendor service level agreement with 48-hour technical support, and animal nutritionist engagement for ration formulation oversight. Quota risk is mitigated through proactive Ministry of Trade and Ministry of Agriculture engagement and conservative RKAP planning at 80% of approved quota rather than 100%.

CONCLUSIONS AND IMPLICATIONS

This study demonstrated that the Serang Feedlot's persistent under-performance in terms of revenue achievement of 31.4% to 74.8% compared to RKAP targets over the past three years were caused by the existence of three identifiable and addressable internal/infrastructure related factors. These factors were, a 28 year gap in BX imports since the time it was banned by policy, an existing manual feeding system that is limiting average daily gain (ADG) to 0.28 kg/day and lower than the established benchmarks and the lack of adequate feed storage facilities resulting in the inability to procure feeds in bulk quantities. Investment of IDR 60.5 billion in pen expansions, TMR mechanizations and bulk feed storages will resolve these three deficiencies at the same time. In terms of financial returns under the primary funding scenario (60% PMD equity, 40% bank loan at a Weighted Average Cost of Capital of 12.01%) the proposed investments yield a Net Present Value (NPV) of IDR 349.86 billion, Internal Rate of Return (IRR) of 83.97%, Profitability Index of 6.783 times, and discounted payback periods of 1.77 years. With respect to the full equity scenario, the NPV remains the same of IDR 283.92 billion at the same IRR of 83.97%. Monte Carlo simulations confirm a 100 % probability of achieving positive NPV for 10,000 iterations of both ADG and feed prices uncertainties at the same time. Furthermore, even if the worst-case sensitivity scenarios are realized, there will remain a difference of IDR 103.56 billion which is three times greater than the WACC hurdle rates.

From a theoretical point of view, the main contribution of this study lies in demonstrating that an integrated sequence of analytical steps (PESTLE scanning informing SWOT diagnosis; TOWS cross-referencing generating possible investment alternatives; cost-benefit analysis with probabilistic simulation evaluating and validating those alternatives), can be implemented as an operationalizable investment evaluation template for state-owned agribusinesses operating within developing countries. As such, while each step in this framework represents an analytically distinct tool that has been extensively employed within the literature, what provides the added-value to the overall framework is their systemic integration and the unambiguous linkage from diagnostic phase through the identification of relevant investment alternatives to the structural elements of the financial model. Such an integration ensures that the financial model assesses potential investments based upon criteria that are relevant to that investment rather than some arbitrary selection process as is commonly experienced when undertaking stand-alone Cost Benefit Analysis (CBA) within organizational investment decision-making processes.

In addition to providing practical insights into how best to optimize feedlot operations in Indonesia, this study highlights two significant issues concerning the role of public policy in supporting private sector investment decisions regarding agricultural commodities production. Firstly, this study confirmed that the Government of Indonesia’s resumption of BX cattle imports in 2025 represented the single most effective feedlot performance intervention during the three year observation period – more so in its first year than any internal operational changes that the Company could undertake. Secondly, this study highlights that for future quota allocations to achieve desired levels of planning certainty necessary for large scale BUMD capital investment decisions, Ministries responsible for trade and agriculture should ensure that future Import Quota Frameworks include multi-year predictable quota allocation trajectories rather than annual quota determinants. This approach will avoid perpetuating the historical ‘disincentive circle’ where BUMD investment does not occur due to the absence of planning certainty that precludes the creation of capacity to utilize available import quotas.

Finally, there are three areas where future studies may build upon the findings of this study. Firstly, conducting Monte Carlo Simulation including all five financially influential parameters (e.g., ADG, feed price, selling price, cattle purchase price and pen utilization rate) using Sobol sensitivity index will enable to conduct a complete variance decomposition and identify priority areas for risk management. Secondly, conducting comparative risk analysis using ISO 31000:2018 risk matrix framework applied to BUMD operated feedlots located in different Indonesian Provinces will determine whether the three High-classified risks identified in this study are general across state linked Indonesian feedlots or are they specific to the Serang operation. Finally, conducting longitudinal post-investment evaluation after two (Year 3) and four (Year 5) years of operation will enable to verify assumptions regarding increases in ADG (IDR 308.2 Billion) and test whether feed price risk mitigating strategies produced the expected decreases in cost volatility, thus representing first empirical evidence regarding TMR mechanization effects on Indonesian commercial feedlots.

REFERENCES

Aguilar, F. J. (1967). Scanning the business environment. Macmillan.

Anjum, M., and Hussain, M. (2025). Strategic evaluation using PESTLE and SWOT frameworks: Public sector perspective. ISRG Journal of Economics, Business and Management, 3(1), 108–114. https://doi.org/10.5281/zenodo.14854362

Benzaghta, M. A., Elwalda, A., Mousa, M., Nassar, I., and Shah, M. (2021). SWOT analysis applications: An integrative literature review. Journal of Global Business and Technology, 17(1), 55–73.

Boardman, A. E., Greenberg, D. H., Vining, A. R., and Weimer, D. L. (2018). Cost-benefit analysis: Concepts and practice (5th ed.). Cambridge University Press.

BPS (Badan Pusat Statistik). (2024). Indonesian economic statistics 2024. Jakarta: BPS.

Brealey, R. A., Myers, S. C., and Allen, F. (2020). Principles of corporate finance (13th ed.). McGraw-Hill Education.

Brigham, E. F., and Houston, J. F. (2019). Fundamentals of financial management (15th ed.). Cengage Learning.
Bryman, A. (2016). Social research methods (5th ed.). Oxford University Press.
Creswell, J. W., and Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications.
Damodaran, A. (2012). Investment valuation: Tools and techniques for determining the value of any asset (3rd ed.). John Wiley and Sons.
FAO (Food and Agriculture Organization of the United Nations). (2018). Livestock production guidelines. FAO.
FAO. (2023). World food and agriculture – Statistical yearbook 2023. FAO.
Gürel, E., and Tat, M. (2017). SWOT analysis: A theoretical review. International Journal of Academic Research in Business and Social Sciences, 7(11), 994–1006.
Gündoğdu, S., Kahraman, A., and Gündoğdu, H. (2023). Strategic analysis for advancing smart agriculture using SWOT/PESTLE framework. Agriculture, 13(12), 2275. https://doi.org/10.3390/agriculture13122275
Guo, T., et al. (2025). Revisiting economies of scale: The moderating role of efficiency. Frontiers in Sustainable Food Systems. https://doi.org/10.3389/fsufs.2025.1621038
Hartman, J., and Schafrick, I. (2004). The relevant internal rate of return. Economic Papers, 36(2). https://doi.org/10.1111/1759-3441.12179
Helms, M. M., and Nixon, J. (2010). Exploring SWOT analysis — where are we now? Journal of Strategy and Management, 3(3), 215–251.
Ilham, N. (2015). Structural constraints in Indonesian state-linked feedlot enterprises. Jurnal Agro Ekonomi, 33(1), 1–20.
Ladoni, M., et al. (2024). Impacts of economic factors on net returns of beef feedlot heifers. Translational Animal Science, 8, txae021. https://doi.org/10.1093/tas/txae021
Lawrence, J., and Ibarburu, M. (2007). Economic analysis of feed and feeding management decisions in beef feedlots. Iowa State University Extension.
MacDonald, J., and McBride, W. (2009). The transformation of U.S. livestock agriculture: Scale, efficiency, and risks. USDA Economic Research Report No. EIB-43. https://doi.org/10.22004/ag.econ.55181
Marchioni, A., and Magni, C. A. (2018). Investment decisions and sensitivity analysis: NPV-consistency of rates of return. European Journal of Operational Research, 268(1), 361–372. https://doi.org/10.1016/j.ejor.2018.01.007
MLA (Meat and Livestock Australia). (2020). Feedlot benchmarking report 2020. MLA.
MLA. (2023). Feedlot benchmarking report 2023. MLA.
Mutoko, M. C., Ngigi, M., and Rao, E. (2022). Cost-benefit analysis of climate-smart agricultural practices among smallholder farmers. PLOS ONE, 17(4), e0266883. https://doi.org/10.1371/journal.pone.0266883
OECD-FAO. (2024). OECD-FAO agricultural outlook 2024–2033. OECD.
Ohno, T. (1988). Toyota production system: Beyond large-scale production. Productivity Press.
Parsons, C. M., Chalupa, W., and Jaster, R. (2011). Effects of TMR mechanization on feedlot ADG and feed conversion efficiency. Journal of Animal Science, 89(Suppl.), 285.
Perumda Dharma Jaya. (2024). Annual report 2024. Jakarta: Perumda Dharma Jaya.
Putra, T. D., Wiyatna, M. F., and Basuki, P. (2020). Feed cost structure and performance efficiency of beef cattle feedlots in Indonesia. Jurnal Peternakan Indonesia, 22(1), 45–55.
Saltelli, A., Tarantola, S., Campolongo, F., and Ratto, M. (2008). Global sensitivity analysis: The primer. John Wiley and Sons.
Sammut-Bonnici, T., and Galea, D. (2015). PESTLE analysis. In C. Cooper (Ed.), Wiley encyclopedia of management (Vol. 12). John Wiley and Sons.
Swastika, D. L. S., Yusmichad, Y., Sayuti, S., and Sudana, W. (2000). Pen utilization constraints in Indonesian beef cattle feedlots. Forum Penelitian Agro Ekonomi, 18(1), 1–15.
Vardopoulos, I., et al. (2021). PESTLE and SWOT-AHP integrated model assessing sustainability. Applied Sciences, 11(15), 6773. https://doi.org/10.3390/app11156773
Vose, D. (2008). Risk analysis: A quantitative guide (3rd ed.). John Wiley and Sons.
Weihrich, H. (1982). The TOWS matrix - a tool for situational analysis. Long Range Planning, 15(2), 54–66.
Yin, R. K. (2018). Case study research and applications: Design and methods (6th ed.). SAGE Publications.