

FINANCIAL FEASIBILITY AND RISK SENSITIVITY OF A REGIONALLY OWNED COCOA PROCESSING ENTERPRISE UNDER RECONSTRUCTED FINANCIAL DATA

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Abstract

The financial sustainability of regional agro-processing enterprises depends on investment feasibility and reliable financial information for managerial control. This study evaluates the financial feasibility and risk sensitivity of Cho-Sik, a cocoa-processing enterprise owned by the Regional Government of Sikka, Indonesia. A quantitative evaluative design was applied using Net Present Value (NPV), Payback Period (PP), sensitivity and scenario analysis, and five-year financial projections. Cho-Sik did not maintain a complete accounting information system or comprehensive formal financial statements. The financial dataset was therefore reconstructed from available investment, administrative, operational, production, sales, and asset records. The reconstruction was validated through field observation, semi-structured interviews, source triangulation, documentary reconciliation, and internal-consistency checks. At the 10% analytical hurdle rate, the base-case appraisal indicates that the investment is financially feasible, with a positive NPV and capital recovery within the five-year evaluation horizon. However, feasibility remains conditional on operating performance. Revenue is the dominant sensitivity factor: a 15% decline in revenue makes NPV negative, whereas a 15% increase in cash operating costs alone does not. This asymmetry highlights the importance of revenue stabilization, market development, disciplined cost monitoring, and stronger financial record-keeping. The novelty of this study lies in proposing a managerial diagnostic framework for regional agro-industrial enterprises that links investment appraisal with risk sensitivity and ongoing financial monitoring. The framework contributes to stronger financial governance and evidence-based decision-making, with particular relevance to small- and medium-scale regional government-owned enterprises (BUMDs) operating with incomplete accounting information.

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INTRODUCTION

The cocoa-processing industry plays an important role in strengthening agro-industrial development through value addition, employment creation, and regional economic growth. Indonesia is one of the world's major cocoa-producing countries, yet the domestic cocoa sector still faces challenges in maximizing downstream value creation and industrial competitiveness (Bermúdez et al., 2022; Dianawati et al., 2023; Fahmid et al., 2022; Harya et al., 2025). In eastern Indonesia, cocoa has particular strategic relevance for local economic development. Sikka Regency has substantial

potential for cocoa downstreaming through locally based processing activities, while agriculture and agro-based industries remain important components of the regional economy (Badan Pusat Statistik Kabupaten Sikka, 2026; Dianawati et al., 2023; Zulfiandri, 2023). The development of regional cocoa-processing enterprises therefore requires not only production capacity but also financially sustainable investment management.

Financial sustainability is a critical issue because agro-processing businesses typically require substantial initial expenditure for machinery, production facilities, and supporting infrastructure while operating under uncertainty in revenues, input costs, and market conditions (Safitri et al., 2025; Saleh & Wulandari, 2026; Vilani et al., 2024; Zhai et al., 2023). Capital-budgeting analysis provides a logical basis for addressing these challenges. Net Present Value (NPV) evaluates whether projected cash flows create economic value after considering the time value of money, while Payback Period (PP) indicates the speed of capital recovery. More broadly, capital-budgeting decisions under uncertainty depend on the quality of ex-ante information, project assumptions, and the explicit assessment of downside exposure (Charoenwong et al., 2024; Miller, 2022). Sensitivity and scenario analysis complement these measures by showing how changes in revenue, operating costs, and required returns can alter the feasibility conclusion (Astasari et al., 2024; Dai et al., 2022; Ershad & Rahadian, 2022; Magni & Marchioni, 2020; Sokolov, 2024). Used together, these tools allow financial appraisal to move beyond a simple feasible–infeasible decision toward the identification of conditions under which project value can be preserved or eroded.

A more fundamental methodological problem arises when these capital-budgeting techniques must be applied to enterprises that do not possess complete and systematic accounting records. Conventional financial appraisal requires identifiable investment expenditure, operating cash costs, revenues, and project cash flows. In small regional public-sector enterprises, however, the information required for these calculations may be distributed across administrative, operational, production, sales, investment, and asset records rather than consolidated in comprehensive formal financial statements. This concern is consistent with evidence that the usefulness of financial and managerial analysis in small and medium-sized enterprises depends materially on information-system quality, accounting-information quality, and the reliability of financial reporting (Perdana et al., 2022; Sassi & Damak-Ayadi, 2023). Under such conditions, the analytical problem is not only how to calculate NPV or PP, but also how to construct a sufficiently credible financial dataset before those techniques can be applied. The Cho-Sik cocoa-processing enterprise represents this problem directly because it had not maintained a complete accounting information system or a comprehensive set of formal financial statements during the study period. Consequently, financial appraisal requires empirical reconstruction and validation of the best available management-based evidence.

Previous studies demonstrate the value of financial feasibility and risk analysis in agro-industrial contexts, including the use of discounted cash-flow, sensitivity, and risk-based approaches to evaluate agricultural investment under uncertain production and market conditions (Caputo et al., 2025; Freitas et al., 2026; Oliveira et al., 2022; Quaicoe et al., 2026; Ribeiro et al., 2024; Saleh & Wulandari, 2026; Scudder et al., 2022; Vilani et al., 2024; Zhai et al., 2023; Zlati et al., 2023). Shwetha et al. (2024) examined the financial structure of agro-processing industries through break-even and financial-ratio analysis, while Manurung et al. (2026) applied sensitivity analysis to assess

investment resilience under changing operational conditions. In the Indonesian cocoa context, Dianawati et al. (2023) focused primarily on competitiveness and downstream positioning from a global value-chain perspective. Pakanyamong et al. (2021) demonstrated the use of conventional financial-feasibility criteria in a chocolate agroindustry, whereas Zulfiandri (2023) examined the relationship between supply-chain integration and the financial performance of small-scale cocoa agroindustry. Qatrunada et al. (2023) further showed that investment criteria combined with switching-value analysis can identify tolerance limits for critical cost and price variables. These studies establish the importance of investment appraisal, risk sensitivity, and switching thresholds, but financial-data reconstruction itself is not foregrounded as an explicit methodological stage of feasibility analysis.

This distinction is important for regionally owned agro-industrial enterprises. When comprehensive historical accounting records are unavailable, directly applying conventional capital-budgeting formulas may create an appearance of analytical precision without first establishing the credibility and traceability of the underlying cash-flow information. The methodological task therefore precedes the investment calculation: available financial and operational evidence must first be identified, reconciled, triangulated, and converted into a coherent cash-flow basis. Only after this reconstruction can NPV, PP, sensitivity analysis, discount-rate robustness, and switching values be interpreted meaningfully. The present study addresses this gap by integrating financial-data reconstruction with subsequent capital-budgeting and risk-sensitivity analysis.

The study therefore differs from conventional cocoa agro-industry feasibility assessments in two related respects. First, it treats incomplete accounting information as part of the research problem rather than assuming that appraisal-ready financial statements are already available. The investment dataset is reconstructed from available investment, administrative, operational, production, sales-related, and asset records and is supported by field observation and semi-structured interviews. Documentary reconciliation, source triangulation, and arithmetic and internal-consistency checks are used to establish an empirically traceable basis for the appraisal. Second, the reconstructed cash-flow model is not used only to produce an accept-or-reject investment decision. It is combined with sensitivity and scenario analysis, discount-rate robustness, and switching-value analysis to identify the conditions under which financial feasibility is maintained or lost. This integration positions financial feasibility analysis as a managerial diagnostic framework for monitoring revenue risk, cash-cost exposure, and investment sustainability in a regional government-owned enterprise. The managerial relevance of this approach is also consistent with the broader state-owned-enterprise literature, which associates governance structures, oversight quality, and managerial competence with organizational and financial performance (Ciolomic et al., 2024; Kaunda & Pelsner, 2023; Sidki et al., 2024).

Based on this methodological and empirical gap, this study aims to evaluate the financial feasibility and risk sensitivity of the Cho-Sik cocoa-processing enterprise owned by the Regional Government of Sikka. The analysis applies NPV, Payback Period, sensitivity and scenario analysis, discount-rate robustness, and switching-value analysis to a five-year financial projection derived from reconstructed financial information. The study contributes methodologically by demonstrating how investment appraisal can be conducted transparently when comprehensive formal financial statements are unavailable. Managerially, it provides a diagnostic framework for linking capital-

budgeting results with financial monitoring, risk control, and evidence-based financial governance in small- and medium-scale regional government-owned enterprises.

RESEARCH METHODS

Research Approach and Design

This study employed a quantitative evaluative approach using a single-enterprise case-based financial evaluation to assess the investment feasibility of the Cho-Sik chocolate processing industry owned by the Regional Government of Sikka Regency. The quantitative approach was selected because the study required systematic measurement and analysis of financial variables related to investment performance, including initial investment expenditure, operating costs, projected revenues, cash-flow generation, and capital recovery. The evaluative design was used to determine whether the projected operating performance of Cho-Sik was capable of generating sufficient economic value over the five-year evaluation horizon.

Financial feasibility was assessed primarily through Net Present Value (NPV) and Payback Period (PP), while sensitivity and scenario analysis was used to evaluate the robustness of the feasibility results under changes in revenue, cash operating costs, and the discount rate. Because Cho-Sik had not yet maintained a complete and systematic accounting information system, the study did not rely exclusively on formal financial statements. Instead, the financial dataset was reconstructed from available investment, administrative, operational, production, sales-related, and asset records, complemented by field observation and semi-structured interviews. The reconstructed data were subjected to documentary reconciliation, source triangulation, and arithmetic and internal-consistency checks before being used in the financial appraisal. Accordingly, the design combines financial reconstruction, investment appraisal, and scenario-based risk evaluation to support both feasibility assessment and managerial improvement.

Research Location and Object

The research was conducted at the Cho-Sik chocolate processing industry located in Sikka Regency, East Nusa Tenggara, Indonesia. The research location was selected purposively due to its relevance to the research objectives and its strategic role as a regionally owned agro-processing business utilizing local cocoa commodities. Cho-Sik represents one of the regional government initiatives aimed at increasing value-added cocoa products and strengthening local economic development through downstream agroindustry activities.

The object of this study was the financial performance and investment feasibility of the Cho-Sik chocolate processing business. The analysis focused on initial investment expenditure, operating costs, production and sales-related information, projected revenues, cash-flow generation, and investment sustainability over a five-year evaluation horizon.

Unit of Analysis and Data Selection

The unit of analysis in this study was the Cho-Sik chocolate processing enterprise owned by the Regional Government of Sikka Regency. The analysis focused on financial and operational information directly relevant to investment feasibility, including initial investment expenditure, operating costs, production and sales-related information, asset utilization, projected revenues, cash-flow generation, and investment recovery. Because Cho-Sik had not yet maintained a complete and systematic accounting

information system, the study did not rely on a predefined population of formal financial statements or respondent-based sampling. Instead, financial, administrative, and operational evidence was selected based on its direct relevance to the investment-appraisal objectives.

The selected data included: (1) documentation of initial investment in machinery, equipment, buildings, land, and initial working capital; (2) available records of operating expenditures; (3) production and sales-related records; (4) asset and administrative documentation; (5) management information used to reconstruct the financial dataset; (6) assumptions used to develop five-year revenue, cost, and cash-flow projections; and (7) supporting information obtained through field observation and interviews with management and operational personnel. Data selection followed a relevance-based purposive approach, in which only information that could be reasonably traced to Cho-Sik's investment, operating performance, and financial projection was incorporated into the analysis. This approach enabled the study to use the best available evidence while explicitly acknowledging gaps in historical accounting records.

Data Types and Sources

This study utilized both primary and secondary data sources. Primary data were collected directly from business managers and operational personnel through interviews and field observations. The interviews aimed to obtain information regarding production activities, operational constraints, investment planning, and business development strategies.

Secondary data were obtained from available administrative and operational records, investment documentation, production records, sales-related documentation, government documents, and other supporting institutional records related to the Cho-Sik chocolate processing industry. Because comprehensive formal financial statements were not available, these sources were combined to reconstruct the financial dataset used in the appraisal. Additional secondary data were gathered from scientific journals, books, and official publications relevant to financial feasibility analysis, investment appraisal, and agro-industrial management.

Data Collection Techniques

Data collection was conducted using several techniques to ensure data completeness and validity, including:

(1) Observation.

Direct observations were conducted to understand production activities, machinery utilization, operational processes, and business facilities within the Cho-Sik chocolate processing industry.

(2) Interviews

Semi-structured interviews were conducted with managers and operational personnel responsible for production, expenditure, sales administration, and business operations. The interview evidence was not treated as a separate quantitative dataset and was not converted into numerical scores or statistical variables. Instead, interviews served primarily as a qualitative cross-check and source-triangulation mechanism. Management explanations were compared with available documentary records and observed operating conditions to clarify the provenance, interpretation, and operational plausibility of financial and operational figures used in the reconstruction process.

Accordingly, the quantitative NPV, PP, sensitivity, and switching-value calculations were performed using the reconstructed financial dataset, while interview evidence supported the validation and interpretation of that dataset.

(3) Documentation

Documentation techniques were used to collect available investment and asset records, operational expenditure records, production documentation, sales-related records, and other administrative documents required to reconstruct the financial dataset and conduct the feasibility calculations.

The combination of observation, interviews, and documentation was used as source triangulation. Because Cho-Sik's accounting records were incomplete, financial figures were reconstructed from multiple available source categories rather than taken from a complete set of formal financial statements. Documentary amounts were compared with management explanations and observed operating conditions, and the resulting figures were reconciled before use in the investment model. This procedure strengthens internal empirical credibility while not constituting an external financial-statement audit.

Data Reconstruction and Empirical Validation

Cho-Sik had not implemented a complete and systematic accounting information system during the study period. Consequently, a comprehensive set of formal financial statements was not available as the sole basis for the financial feasibility analysis. The financial dataset was therefore reconstructed from available operational, administrative, investment, production, sales-related, and asset records maintained by the management unit.

The reconstruction process was documentary and quantitatively oriented. Financial amounts incorporated into the investment model were organized into initial investment expenditure, cash operating costs, projected revenues, and project cash flows. Field observation and semi-structured interviews were used as supporting qualitative validation sources rather than as independently quantified observations. Interview responses were not assigned statistical weights or transformed into numerical variables. Their principal function was to cross-check documentary information, clarify operational conditions, and support source triangulation where historical accounting records were incomplete.

The reconstructed dataset was subjected to three validation procedures. First, documentary reconciliation matched available investment and expenditure records with the corresponding financial components used in the appraisal. Second, source triangulation compared documentary information with management explanations and observed operating activities. Third, arithmetic and internal-consistency checks reconciled investment-component totals, annual operating-cost components, depreciation treatment, projected cash flows, cumulative cash-flow recovery for PP, and discounted cash flows for NPV. The resulting dataset should therefore be interpreted as a reconstructed management-based financial dataset rather than a set of independently audited financial statements. This approach enables the study to use the best available empirical evidence transparently while acknowledging the limitations imposed by the existing accounting system.

Analytical Framework and Methodological Boundaries

The analytical framework proceeded from the reconstructed financial dataset to

project-level cash-flow appraisal and risk testing. Net Present Value (NPV) was used as the primary criterion for assessing economic value creation, while Payback Period (PP) was used as a complementary indicator of investment recovery. Sensitivity and scenario analysis, discount-rate robustness, and switching-value analysis were subsequently applied to evaluate the conditions under which the base-case feasibility conclusion would remain valid or become invalid.

A 10% discount rate was used solely as the base-case analytical hurdle rate for the financial appraisal. This rate was not derived from Cho-Sik's observed financing structure and should not be interpreted as an empirically estimated weighted average cost of capital (WACC). A project-specific WACC could not be calculated defensibly because the available reconstructed records did not provide sufficiently documented information on capital structure, borrowing costs, project-specific tax parameters, or an explicit required return. Accordingly, the use of the 10% rate represents a methodological boundary of the study rather than a firm-specific estimate of the cost of capital. To reduce dependence on a single discount-rate assumption, NPV robustness was examined at 8%, 10%, 12%, 15%, 18%, and 20%, while the Internal Rate of Return (IRR) was calculated as a supplementary break-even discount-rate indicator.

Analytical Measures and Mathematical Definitions

The analytical measures, mathematical formulations, and decision criteria used in the financial appraisal are summarized in Table 1.

Table 1. Analytical Measures, Mathematical Formulations, and Decision Criteria

Analytical Measure	Operational Definition	Mathematical Formulation	Decision Criteria / Indicator
Five-Year Financial Projection	Estimation of annual revenue, cash operating costs, and pre-tax project cash flows over the five-year evaluation horizon.	$CF_t = R_t - C_t$	Positive CF_t indicates that projected annual revenue exceeds cash operating costs. The resulting cash flows are subsequently evaluated using NPV and PP.
Net Present Value (NPV)	The difference between the present value of projected pre-tax cash flows and the initial investment over the evaluation horizon.	NPV $= -I_0 + \sum_{t=1}^n \frac{CF_t}{(1+r)^t}$	NPV > 0 = financially feasible; NPV = 0 = break-even; NPV < 0 = not financially feasible.
Payback Period (PP)	The time required for cumulative project cash flows to recover the initial investment.	PP $= k + \frac{I_0 - \sum_{t=1}^k CF_t}{CF_{k+1}}$	PP < five-year evaluation horizon indicates that the initial investment is recovered within the projection period.
Sensitivity and Scenario Analysis	Assessment of changes in financial feasibility resulting from changes in projected revenue, cash operating costs, and discount rates.	NPV_s $= -I_0 + \sum_{t=1}^n \left[\frac{CF_{t,s}}{(1+r_s)^t} \right]$	$NPV_s > 0$ indicates feasibility under scenario s ; $NPV_s < 0$ indicates that the tested scenario makes the investment financially infeasible.

Analytical Measure	Operational Definition	Mathematical Formulation	Decision Criteria / Indicator
Switching Value – Revenue	The maximum proportional decline in projected revenue that reduces NPV to approximately zero while other base-case assumptions remain constant.	$0 = -I_0 + \sum_{t=1}^n \frac{(1 - s^R)R_t - C_t}{(1 + r)^t}$	s^R represents the maximum tolerable proportional decline in revenue. A lower switching value indicates greater sensitivity to revenue deterioration.
Switching Value – Cash Operating Cost	The maximum proportional increase in cash operating costs that reduces NPV to approximately zero while other base-case assumptions remain constant.	$0 = -I_0 + \sum_{t=1}^n \frac{R_t - (1 + s^C)C_t}{(1 + r)^t}$	s^C represents the maximum tolerable proportional increase in cash operating costs. A lower switching value indicates greater sensitivity to cost escalation.

Source: Authors' analytical framework based on reconstructed research data, 2026.

Where: I_0 = initial investment; CF_t = pre-tax project cash flow in year t ; R_t = projected revenue in year t ; C_t = projected cash operating cost in year t ; r = discount rate; n = five-year evaluation horizon; k = last completed year before full investment recovery; s = sensitivity or scenario condition; s^R = proportional revenue switching value; and s^C = proportional cash-operating-cost switching value.

Data Analysis Techniques

Data analysis was conducted quantitatively using reconstructed project cash flows, capital-budgeting techniques, and deterministic sensitivity analysis. The analytical sequence consisted of: (1) reconstruction and classification of initial investment and operating financial information; (2) development of five-year revenue, cash operating-cost, and pre-tax cash-flow projections; (3) NPV analysis using the stated base-case analytical hurdle rate; (4) cumulative-cash-flow PP analysis; (5) sensitivity and scenario analysis of revenue, cash operating costs, and discount rates; and (6) switching-value analysis to determine the approximate proportional changes in revenue and cash operating costs required to reduce NPV to zero. The mathematical formulations and decision rules are summarized in Table 1.

The analysis process involved several stages:

1. Investment Cost Analysis

Initial investment expenditure was identified separately from recurring operating expenditures. Initial investment included production machinery and processing equipment, buildings and production facilities, land acquisition, and initial working capital. Recurring operating expenditures were analyzed separately when constructing annual cash operating costs and projected cash flows.

2. Financial Projection Analysis

Five-year financial projections were developed from the reconstructed base-year financial and operational dataset and the annual revenue and cost assumptions documented during the research process rather than by imposing a single constant growth rate. Projected revenue increases from IDR 850,000,000 in Year 1 to IDR 1,420,000,000 in Year 5, equivalent to year-on-year growth of approximately 14.12%, 13.40%, 13.64%, and 13.60% (CAGR approximately 13.69%). Cash operating costs increase from IDR 501,000,000 to IDR 640,000,000, with year-on-year growth of approximately 4.79%, 6.67%, 7.14%, and 6.67% (CAGR approximately 6.31%). These growth rates represent projection assumptions derived from the reconstructed

research dataset and documented management expectations; they should not be interpreted as historical realized growth rates. Because machinery depreciation of IDR 95,000,000 per year is a non-cash expense, it was excluded from cash operating costs when deriving the cash flows used in NPV and Payback Period calculations. Tax payments, terminal or salvage values, and working-capital recovery were not included because the available reconstructed records did not provide a sufficiently documented basis for estimating these items. The five-year period is therefore treated as an evaluation horizon rather than the full economic life of the assets.

3. Net Present Value (NPV) Analysis

The financial feasibility of the investment was evaluated using the Net Present Value method. NPV was calculated as the sum of discounted annual pre-tax cash flows less the initial investment using the equation provided in Table 1. Where CF_t represents pre-tax cash flow in period t (calculated as revenue minus cash operating costs, excluding non-cash depreciation), r is the discount rate, I_0 is the initial investment, and n is the five-year evaluation horizon. The investment was considered financially feasible if the NPV value was greater than zero.

Discount Rate Robustness Analysis

Because the 10% base-case hurdle rate was defined as an analytical assumption rather than an empirically estimated project WACC, discount-rate robustness was tested at 8%, 10%, 12%, 15%, 18%, and 20%. For each rate, the same projected pre-tax cash flows were discounted to determine whether NPV remained positive. The Internal Rate of Return (IRR) was additionally calculated as a supplementary break-even discount-rate indicator.

4. Payback Period Analysis

Payback Period was calculated from cumulative annual cash flows because the projected cash flows were not constant across years. The recovery fraction in the year of payback was determined using Equation (1):

$$PP = k + \frac{I_0 - \sum_{t=1}^k CF_t}{CF_{k+1}}$$

A Payback Period shorter than the five-year evaluation horizon indicates that the initial investment is recovered within the projection period. PP is interpreted as a liquidity indicator and is therefore evaluated together with NPV, which incorporates the time value of money.

5. Sensitivity and Scenario Analysis

Sensitivity and scenario analysis was conducted to evaluate the robustness of the base-case NPV to changes in key financial assumptions. The tested scenarios included a 15% decrease in revenue, a 15% increase in cash operating costs, a combined 15% revenue decrease and 15% cash-cost increase, an increase in the discount rate from 10% to 12%, and an upside scenario combining a 20% revenue increase with a 15% cash-cost reduction. Revenue-based scenarios were applied to projected revenue rather than physical sales volume because the reconstructed records did not contain sufficiently reliable unit-level quantity and variable-cost data. This design avoids unsupported assumptions regarding the cost response to changes in production volume.

6. Switching-Value Analysis

Switching-value analysis was used to estimate the proportional deterioration in a key operating assumption required to reduce the base-case NPV to approximately zero. Two switching values were calculated while holding all other base-case assumptions constant. The revenue switching value (s^R) represents the proportional decline in projected revenue that satisfies NPV=0, whereas the cash-operating-cost switching value (s^C) represents the proportional increase in projected cash operating costs that satisfies NPV=0. The analysis therefore identifies the approximate tolerance threshold of the investment to adverse changes in revenue and cash operating costs. A lower proportional switching value indicates greater financial sensitivity to the corresponding variable.

Data Credibility and Validation

Data credibility was established through the reconstruction and validation procedures described above. Because the underlying records were incomplete, the study does not claim external audit assurance; rather, credibility refers to the traceability, triangulation, documentary reconciliation, and internal consistency of the best available financial and operational evidence.

Ethical Considerations

The study maintained confidentiality and used financial and operational data solely for academic purposes. All data collection activities were conducted with permission from Cho-Sik management and the relevant regional government institutions.

RESULTS AND DISCUSSION

Result

Initial Investment Structure of the Cho-Sik Chocolate Processing Industry

The financial feasibility analysis began with identifying the initial investment structure required for establishing and operating the Cho-Sik chocolate processing industry. The investment components consisted of production machinery, production facilities, land acquisition, and initial working capital. The investment structure is presented in Table 2.

Table 2. Initial Investment Components of The Cho-Sik Chocolate Processing Industry

No	Investment Component	Amount (IDR)
1	Production machinery and processing equipment	1,187,865,000
2	Building and production facilities	155,000,000
3	Land acquisition	200,000,000
4	Initial working capital	44,000,000
Total Initial Investment		1,586,865,000

Source: Reconstructed research data, 2026

Table 2 shows that production machinery constituted the largest investment component, accounting for approximately 74.86% of total investment expenditure. This condition indicates that the Cho-Sik chocolate processing industry is highly dependent on production technology and mechanized processing systems. The substantial allocation toward machinery investment also reflects the capital-intensive characteristics of cocoa-processing industries, particularly in downstream agro-

industrial operations requiring integrated production systems.

The machinery investment included cocoa bean processing machines, fermentation equipment, drying systems, roasting machines, grinding equipment, packaging systems, and chocolate refining machines. These facilities are essential for ensuring product quality, production efficiency, and operational continuity throughout the processing stages.

Operational Cost Structure

The operational cost structure consisted of cash operating expenditures and non-cash depreciation. Cash operating expenditures included raw materials and supporting materials, labor, electricity and utilities, packaging, maintenance and repairs, and transportation and distribution. Machinery depreciation represented a non-cash accounting expense. The annual accounting and operating cost structure is presented in Table 3.

Table 3. Annual Accounting and Operating Cost Structure

No	Operational Cost Component	Amount (IDR per Year)
1	Raw materials and supporting materials	245,000,000
2	Labor costs	120,000,000
3	Electricity and utilities	48,000,000
4	Packaging costs	36,000,000
5	Maintenance and repairs	28,000,000
6	Transportation and distribution	24,000,000
7	Machinery depreciation	95,000,000
Total Operational Cost		596,000,000

Source: Reconstructed research data, 2026

Table 3 shows that raw materials and supporting materials constituted the largest operational cost component. Machinery depreciation amounted to IDR 95,000,000 per year. For discounted cash-flow analysis, depreciation was treated as a non-cash expense and therefore excluded from cash operating costs, while it remained relevant for accounting-cost reporting.

Five-Year Financial Projection

Financial projections were developed to estimate the operational performance of the Cho-Sik chocolate processing industry over a five-year period. The original projections reported revenue and accounting operating costs. For investment appraisal, annual depreciation of IDR 95,000,000 was removed from operating costs to obtain cash operating costs and pre-tax cash flows. The resulting projection is presented in Table 4.

Table 4. Five-Year Financial Projection of the Cho-Sik Chocolate Processing Industry

Year	Revenue (IDR)	Cash Operating Cost (IDR)	Pre-tax Cash Flow (IDR)
1	850,000,000	501,000,000	349,000,000
2	970,000,000	525,000,000	445,000,000
3	1,100,000,000	560,000,000	540,000,000

Year	Revenue (IDR)	Cash Operating Cost (IDR)	Pre-tax Cash Flow (IDR)
4	1,250,000,000	600,000,000	650,000,000
5	1,420,000,000	640,000,000	780,000,000

Source: Reconstructed research data; authors' calculations, 2026

Table 4 shows increasing projected revenue throughout the five-year period, accompanied by gradual growth in cash operating costs. After excluding non-cash depreciation, annual pre-tax cash flows are projected at IDR 349,000,000; IDR 445,000,000; IDR 540,000,000; IDR 650,000,000; and IDR 780,000,000 from Years 1 to 5, respectively.

All projected annual cash flows are positive. Nevertheless, investment feasibility depends on whether the discounted value of those cash flows is sufficient to compensate for the initial investment of IDR 1,586,865,000; this is evaluated using NPV and Payback Period analysis.

Net Present Value (NPV) Analysis

The NPV analysis used a 10% discount rate as the study's base-case analytical hurdle rate. Each annual pre-tax cash flow was discounted separately, and the sum of the present values was compared with the initial investment. The calculation is presented transparently in Table 5.

Table 5. Net Present Value (NPV) Analysis

Year	Pre-tax Cash Flow (IDR)	Discount Factor (10%)	Present Value (IDR)
1	349,000,000	0.909091	317,272,727
2	445,000,000	0.826446	367,768,595
3	540,000,000	0.751315	405,709,992
4	650,000,000	0.683013	443,958,746
5	780,000,000	0.620921	484,318,632
Total present value of cash inflows			2,019,028,693
Initial investment			1,586,865,000
Net Present Value (NPV)			432,163,693

Source: Reconstructed research data; authors' calculations, 2026

Table 5 shows that the total present value of the five projected cash flows is IDR 2,019,028,693, exceeding the initial investment of IDR 1,586,865,000. The resulting NPV is therefore positive at IDR 432,163,693. Under the NPV decision rule, the investment is financially feasible because $NPV > 0$, indicating that the projected cash flows create economic value above the 10% base-case analytical hurdle rate.

The positive NPV is supported by progressively stronger cash generation over the projection horizon. However, the margin of value creation is still sensitive to revenue and cost assumptions, particularly because the project is capital intensive and production machinery represents the largest share of the initial investment.

Accordingly, the base-case NPV should be interpreted as conditional financial feasibility rather than as evidence of risk-free performance. The robustness of this conclusion is examined further through sensitivity analysis.

Payback Period (PP) Analysis

The Payback Period was calculated using cumulative pre-tax cash flows rather than average annual cash flow, because annual cash flows vary substantially over the projection period. The cumulative calculation is presented in Table 6.

Table 6. Payback Period Analysis

Year	Cash Flow (IDR)	Cumulative Cash Flow (IDR)	Unrecovered Investment (IDR)
1	349,000,000	349,000,000	1,237,865,000
2	445,000,000	794,000,000	792,865,000
3	540,000,000	1,334,000,000	252,865,000
4	650,000,000	1,984,000,000	0
5	780,000,000	2,764,000,000	0
Payback Period			3.39 years

Source: Reconstructed research data; authors' calculations, 2026

Table 6 indicates that cumulative cash flow reaches IDR 1,334,000,000 at the end of Year 3, leaving IDR 252,865,000 unrecovered. Dividing this balance by the Year-4 cash flow of IDR 650,000,000 gives a recovery fraction of 0.389 year. The resulting Payback Period is approximately 3.39 years, which is within the five-year evaluation horizon.

The PP result is consistent with the positive NPV in indicating that the project can recover its initial investment within the projection period. Nevertheless, PP is used only as a complementary liquidity measure because it does not discount cash flows or capture value generated after the payback point.

Sensitivity and Scenario Analysis

Sensitivity and scenario analysis tested both adverse and favorable changes around the base case. The scenarios were designed to identify whether the positive NPV remains robust when revenue, cash operating costs, or the discount rate change. The results are presented in Table 7.

Table 7. Sensitivity Analysis of Investment Feasibility

Scenario	Assumption	NPV (IDR)	Feasibility
Base case	Current projected revenue and cash operating costs; $r = 10\%$	432,163,693	Feasible
Scenario 1	Revenue decreases by 15%	-188,281,539	Not feasible
Scenario 2	Cash operating costs increase by 15%	114,572,765	Feasible
Scenario 3	Revenue -15% and cash operating costs +15%	-505,872,467	Not feasible
Scenario 4	Discount rate increases to 12%	319,534,451	Feasible
Scenario 5	Revenue +20% and cash operating costs -15%	1,577,014,929	Feasible

Source: Reconstructed research data; authors' calculations, 2026

Table 7 shows that the base-case NPV of IDR 432,163,693 is sensitive primarily to revenue deterioration. A 15% decline in revenue changes NPV to IDR -188,281,539, making the project financially infeasible. By contrast, a 15% increase in cash operating costs alone still produces a positive NPV of IDR 114,572,765, although the value margin is substantially reduced.

The combined downside scenario, consisting of a 15% revenue decrease and a 15% increase in cash operating costs, produces the weakest outcome, with NPV declining to IDR -505,872,467. This indicates that simultaneous market and cost pressure represents a material financial risk to the project.

The project remains feasible when the discount rate increases from 10% to 12%, generating an NPV of IDR 319,534,451. Under the upside scenario of a 20% revenue increase and a 15% reduction in cash operating costs, NPV rises to IDR 1,577,014,929.

Discount-Rate Robustness and Switching Values

A supplementary robustness check was performed because the 10% base-case rate is an analytical hurdle rate rather than an observed project WACC. The project remains NPV-positive at 8%, 10%, 12%, 15%, and 18%, but becomes NPV-negative at 20%. This pattern is consistent with an IRR of approximately 18.81%, which represents the approximate break-even discount rate for the projected cash-flow stream.

Table 8. Discount-Rate Robustness of NPV

Discount Rate	NPV (IDR)	Feasibility
8%	555,092,631	Feasible
10%	432,163,693	Feasible
12%	319,534,451	Feasible
15%	167,593,421	Feasible
18%	33,358,412	Feasible
20%	-47,574,877	Not feasible

Source: Reconstructed research data; authors' calculations, 2026

Switching-value analysis further indicates that, holding all other base-case assumptions constant, NPV falls to approximately zero when projected revenue decreases by about 10.45% or when cash operating costs increase by about 20.41%. The lower revenue switching threshold confirms that market-side deterioration is the more critical risk exposure in the current model.

Figure 1 summarizes the NPV outcomes under the base case and alternative operational and financial scenarios, visually illustrating the substantially greater downside effect of revenue deterioration relative to an equivalent increase in cash operating costs.

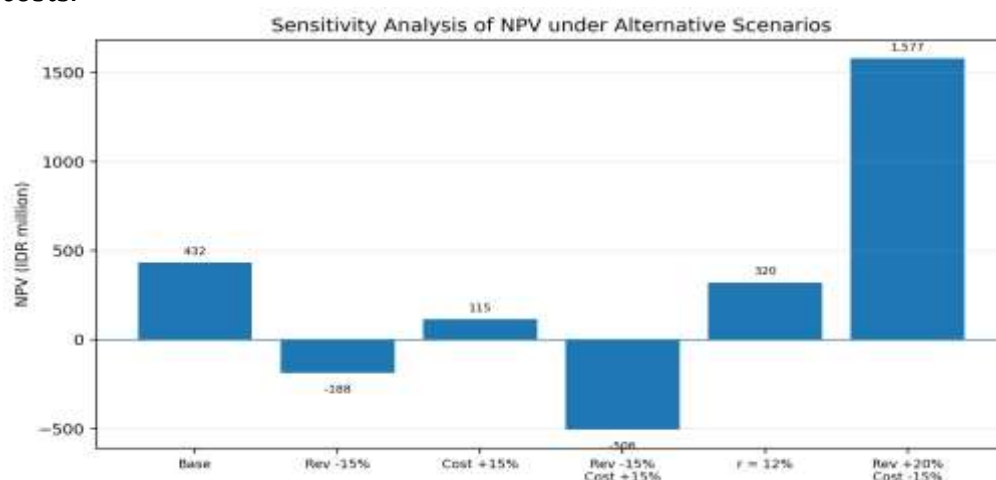


Figure 1. Sensitivity Analysis of NPV under Alternative Operational and Financial Scenarios

Figure 1 highlights the asymmetric risk structure of the project. The base case remains financially feasible, but the revenue-downside scenario moves NPV below zero, whereas an equivalent 15% increase in cash operating costs leaves project value positive. The combined adverse scenario produces the largest deterioration in NPV. This visual pattern is consistent with the switching-value results, which show a narrower tolerance margin for revenue deterioration than for cash-cost escalation.

DISCUSSION

The corrected discounted cash-flow analysis indicates that the Cho-Sik chocolate processing industry is financially feasible under the stated five-year base-case assumptions. At the 10% analytical hurdle rate, the project generates an NPV of IDR 432,163,693, meaning that the present value of projected operating cash flows exceeds the initial investment. This result is consistent with value-based investment principles, under which a positive NPV indicates expected economic value creation at the applied discount rate (Magni & Marchioni, 2020; Sokolov, 2024). Importantly, the 10% rate is not presented as an estimated project WACC. The incomplete accounting and financing records available to Cho-Sik did not provide sufficiently documented capital-structure, borrowing-cost, or tax parameters for such an estimate, so the rate is treated transparently as a base-case analytical hurdle and tested over a broader range.

A critical methodological point in interpreting the base-case result concerns the construction of project cash flows. Machinery depreciation of IDR 95,000,000 per year was excluded from cash operating costs because it does not represent a direct cash outflow. This treatment is consistent with discounted cash-flow principles and prevents accounting expense from being incorrectly treated as cash expenditure.

However, the resulting cash flows should be interpreted as pre-tax cash flows within a finite five-year evaluation horizon. Tax cash flows were not modeled because the reconstructed historical records did not provide a sufficiently documented basis for determining project-specific taxable income, applicable tax treatment, or actual tax-payment patterns. If material tax payments would otherwise arise, their exclusion may cause the estimated cash flows and NPV to be higher than those produced by a complete after-tax appraisal.

Conversely, terminal or residual values for machinery, buildings, land, and other long-lived assets were not included because reliable supporting information on realizable end-of-horizon values was unavailable. Because these assets may retain economic value beyond Year 5, excluding terminal value may understate project value. The tax and terminal-value omissions may therefore affect NPV in opposite directions, and their net effect cannot be determined reliably from the available evidence. Accordingly, the reported NPV should be interpreted as a conditional pre-tax, no-terminal-value feasibility estimate rather than a complete life-cycle valuation of the investment.

The Payback Period of approximately 3.39 years provides complementary evidence regarding liquidity. Unlike an average-cash-flow shortcut, the calculation in this study uses cumulative annual cash flows because projected cash inflows differ across years. The initial investment is not fully recovered by the end of Year 3, but the remaining balance is recovered during Year 4. This interpretation is consistent with Sokolov (2024), who emphasizes the usefulness of PP as a measure of investment recovery while recognizing its limitations relative to discounted cash-flow methods.

The consistency between positive NPV and a Payback Period shorter than the five-year horizon strengthens the base-case feasibility conclusion. NPV remains the primary value-creation criterion because it incorporates the time value of money, whereas PP provides information on the speed of capital recovery. Using both indicators therefore provides a more balanced assessment of value and liquidity.

Sensitivity analysis, however, demonstrates that the project is not equally resilient to all shocks. A 15% decline in revenue produces an NPV of IDR -188,281,539, while a 15% increase in cash operating costs alone leaves NPV positive at IDR 114,572,765. The combined adverse scenario results in an NPV of IDR -505,872,467, indicating that revenue weakness becomes especially damaging when accompanied by cost escalation.

The project remains feasible when the discount rate increases to 12%, with an NPV of IDR 319,534,451. The extended discount-rate test shows positive NPVs at 15% and 18%, and a negative NPV at 20%, with an IRR of approximately 18.81%. Thus, the base-case feasibility conclusion is robust across a substantial range of required returns, but it would not hold if the applicable opportunity cost of capital exceeded the project's IRR. Conversely, the upside scenario of 20% higher revenue and 15% lower cash operating costs raises NPV to IDR 1,577,014,929, showing the potential value of simultaneous market development and operational-efficiency initiatives.

These findings are consistent with agro-industrial studies showing that sensitivity analysis can identify the operating conditions that materially affect investment feasibility (Manurung et al., 2026; Safitri et al., 2025; Vilani et al., 2024). In the Cho-Sik case, the switching-value results sharpen this interpretation because the project can tolerate a substantially larger proportional increase in cash operating costs than a proportional decline in revenue before NPV reaches zero. This asymmetry is particularly relevant to the cocoa supply-chain and market conditions of Sikka and East Nusa Tenggara.

Local cocoa-processing enterprises depend on cocoa beans supplied by regional farmers, while the continuity, quality, price, and availability of these inputs may be exposed to production and supply-chain risks. Indonesian cocoa evidence demonstrates asymmetric price transmission along the supply chain, while broader agricultural supply-chain research identifies market, production, disease, weather, and procurement-related risks as material sources of investment uncertainty (Ridha et al., 2022; Zhai et al., 2023). Cocoa-specific studies further show that pest and disease pressures, farm management, input availability, and production conditions can materially influence yield and supply performance (Asante et al., 2022; Scudder et al., 2022). Evidence from cocoa-processing enterprises in Sikka indicates that market reach remains relatively limited, with challenges related to product recognition, customer segmentation, distribution channels, competition with established chocolate brands, and the relatively high cost of distribution in an archipelagic region such as NTT (Krisyanti et al., 2025; Rumba et al., 2024). These external conditions can affect sales volume, pricing power, production continuity, and ultimately realized revenue. Comparable cocoa value-chain research also demonstrates that price governance, sourcing arrangements, producer incentives, actor coordination, and supply-chain management can influence the resilience of cocoa production and downstream value creation (Adams & Carodenuto, 2023; Boysen et al., 2023; Gupta et al., 2024; Rodriguez et al., 2023).

Accordingly, the 15% revenue reduction examined in the sensitivity analysis

should be interpreted as a stress-testing scenario rather than an observed historical revenue decline. Nevertheless, it represents an economically plausible combination of market and supply-chain pressures. For example, higher or more volatile cocoa-bean prices may intensify competition for raw materials or constrain production if procurement cannot be maintained, while seasonal quality deterioration may reduce usable supply and finished-product output. At the downstream level, limited market penetration, competition from established brands, and high inter-island distribution costs may restrict sales growth or reduce pricing flexibility. A sufficiently strong combination of these pressures could translate into lower realized revenue. Because the model shows that a revenue reduction of approximately 10.45% is sufficient to eliminate the base-case NPV, such supply-chain and market disruptions have direct implications for value creation. Revenue stabilization should therefore be treated as a core financial-risk-management priority rather than solely as a marketing objective.

From a theoretical perspective, the study supports a value-based view of investment evaluation while extending its managerial interpretation. Financial feasibility analysis can function not only as a mechanism for classifying an investment as feasible or infeasible, but also as a framework for identifying the operational conditions under which value is created or destroyed. This improvement-oriented perspective links investment appraisal with controlling, monitoring, and risk-management functions.

For the Regional Government of Sikka and Cho-Sik management, the practical implication is that sustaining project value requires active revenue management and disciplined cash-cost control. Priorities include strengthening market penetration, maintaining product quality, improving production-capacity utilization, reducing waste, improving procurement and supply-chain efficiency, and regularly comparing realized revenue and cash costs against the feasibility thresholds identified in the sensitivity analysis.

From a supply-chain perspective, Cho-Sik management and the Regional Government of Sikka should strengthen coordination with local cocoa producers and producer organizations to improve raw-material supply security, particularly given COSIK's reliance on locally sourced cocoa and partnerships with regional farmers (Krisyanti et al., 2025). Evidence from cocoa and broader agri-food value chains indicates that supplier-development interventions, inter-organizational coordination, sourcing practices, and information transparency can support operational efficiency, value-chain coordination, and supply-chain resilience (Bai et al., 2022; Gupta et al., 2024; Kusi et al., 2026; Marschner et al., 2026; Zhao et al., 2023).

The positive base-case NPV should therefore not be interpreted as a guarantee of future performance. Rather, it establishes that the investment is economically defensible under the stated projections while simultaneously showing that continued feasibility depends on maintaining sufficient revenue and controlling operating cash expenditures. An additional managerial implication arises from the limited formalization of Cho-Sik's accounting records. The absence of a complete accounting system constrains routine performance monitoring and increases reliance on reconstructed financial information for investment evaluation. This concern is consistent with SME accounting research showing that the quality and timeliness of accounting information and information systems can materially support financial performance, decision-making, and reporting quality (Perdana et al., 2022; Sassi & Damak-Ayadi, 2023). Strengthening bookkeeping procedures, cost classification, asset

registers, sales documentation, cash-recording procedures, and periodic financial reporting should therefore become an integral part of the business-improvement agenda.

CONCLUSION, SUGGESTIONS, AND LIMITATIONS

This study concludes that the Cho-Sik cocoa-processing investment is financially feasible under the stated five-year base-case assumptions. Using reconstructed financial information, the appraisal produces a positive NPV of IDR 432,163,693 and a Payback Period of approximately 3.39 years. However, feasibility is conditional rather than absolute. Revenue is the dominant risk factor: a 15% revenue decline makes NPV negative, while an equivalent increase in cash operating costs does not. The lower revenue switching threshold further confirms that preserving revenue performance is more critical to value creation than absorbing a comparable proportional increase in operating costs.

The findings have direct managerial and policy implications for Cho-Sik and the Regional Government of Sikka as the enterprise owner. Cho-Sik should strengthen standardized bookkeeping, cost classification, asset registers, sales and cash documentation, and periodic financial reporting so that future investment decisions can rely progressively on recorded rather than reconstructed financial information. The Regional Government should institutionalize minimum financial-recording and performance-monitoring requirements for the enterprise and periodically review realized revenue and cash costs against the feasibility thresholds identified in this study. Given the importance of revenue stability and the enterprise's dependence on locally supplied cocoa, local-government support should also strengthen raw-material security through closer coordination with cocoa farmers and producer groups, improved supply planning and quality assurance, and procurement arrangements that reduce exposure to seasonal supply and price disruptions.

The findings should be interpreted within several limitations. The analysis relies on reconstructed management-based financial data rather than complete audited financial statements, and the 10% discount rate is an analytical hurdle rate rather than an empirically estimated project WACC. Tax cash flows, terminal or salvage values, working-capital recovery, and unit-level variable-cost behavior were not modeled because sufficiently documented inputs were unavailable. Accordingly, the reported NPV represents a conditional pre-tax, no-terminal-value feasibility estimate within a five-year evaluation horizon rather than a complete life-cycle valuation of the investment.

Future research should update the feasibility model using systematically recorded realized financial and operational data, estimate a project-specific cost of capital, explicitly incorporate taxes, working-capital changes, and residual asset values, and extend the projection horizon. Further studies should also examine quantity-price-cost relationships and apply probabilistic risk techniques such as Monte Carlo simulation. Integrating social, environmental, institutional, and regional-development outcomes would provide a broader assessment of the sustainability of government-owned agro-industrial investment.

Statement on AI Use

The authors used generative artificial intelligence (AI)-based tools only for language-related assistance, including English language editing, grammar checking, and

improvement of clarity and readability. AI tools were not used to generate, fabricate, or manipulate research data, financial calculations, statistical results, interpretations, or references. All substantive research decisions, data reconstruction, analysis, interpretation, and final manuscript content were independently reviewed and verified by the authors, who take full responsibility for the accuracy and integrity of the work.

Conflicts of Interest

The authors declare that they have no conflicts of interest that could have influenced the design, conduct, analysis, interpretation, or reporting of this study.

Author Contributions

Maria Helena Chandra: conceptualization, research design, financial-data reconstruction, data analysis, interpretation of findings, methodological review, data validation, manuscript preparation, and critical revision of the manuscript. Emanuel Jimmy Weking: data collection, documentary verification, interpretation of findings, and critical revision of the manuscript. Rikardus Gonzales Wea Libu: data collection support, documentary verification, interpretation of findings, and critical revision of the manuscript. All authors reviewed and approved the final version of the manuscript and accept responsibility for the integrity of the work.

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Data Availability and Transparency Statement

The financial and operational data used in this study were reconstructed from non-public Cho-Sik management records and relevant institutional documentation obtained under research permission and confidentiality conditions. The manuscript reports the reconstruction procedures, projection assumptions, cash-flow construction, and sensitivity parameters required to reproduce the reported calculations. Access to the underlying source documents is subject to permission from the data-owning institutions.

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