

Feasibility Study of a Citronella Oil Bioadditive Enterprise: Transforming PT Arutmin Indonesia Kintap Mine's CSR Program into an Independent Business Unit

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Keywords:

Business Feasibility Study; Social Enterprise; Corporate Social Responsibility; Citronella Oil Bioadditive; SROI.

ABSTRACT

The energy sector in Indonesia remains heavily dependent on coal, which contributes significantly to greenhouse gas (GHG) emissions. Amid global efforts toward energy transition and climate change mitigation, extractive industries, including mining companies, are encouraged to improve operational efficiency, particularly in fuel utilization. This study aims to evaluate the feasibility of transforming the citronella oil bioadditive Corporate Social Responsibility (CSR) program of PT Arutmin Indonesia Kintap Mine into an independent business unit managed by BUMDesa Berkah Mulia. Using an applied qualitative research approach, this study evaluates legal, market, technical, managerial, and financial aspects, as well as sustainability impacts through Social Return on Investment (SROI) analysis. The results indicate that the business unit has promising market potential through a captive market scheme, with estimated demand exceeding 5,000 liters/month. From a technical perspective, a sustainable production target of 88 liters/month was established to achieve the operational break-even point. Financial projections based on a five-year cash flow analysis (2026–2030) under a moderate scenario demonstrated a positive Net Present Value (NPV) of IDR 24,764,518 and an Internal Rate of Return (IRR) of 10.68%. The business unit was considered feasible as a social enterprise model, with a significant social impact indicated by an SROI ratio of 2.68:1, meaning that every IDR 1 invested generated a social impact value of IDR 2.68. This study recommends establishing a Limited Liability Company (PT) structure to mitigate operational risks and implementing a minimum raw material price strategy to protect farmers.

INTRODUCTION

The energy sector in Indonesia remains heavily dominated by coal utilization, which contributes significantly to greenhouse gas (GHG) emissions. Amid global efforts toward energy transition and climate change mitigation, extractive industries, including mining companies, are encouraged to improve operational efficiency, particularly in fuel utilization. PT Arutmin Indonesia Kintap Mine faces a dual challenge: adapting to the energy transition agenda while preparing for the post-mining economic independence of local communities

prior to the expiration of its Special Mining Business License (IUPK) in 2030. Failure to establish community independence at an early stage may potentially result in social and economic challenges within the operational area.

As a strategic mitigation initiative, the company initiated an innovative CSR program called “Terangi Simantap” in Bukit Mulia Village, a Ring 1 area consisting of 32.47% arid marginal land. The program empowers local communities to cultivate citronella (*Cymbopogon nardus*), a highly adaptive plant suitable for post-mining land rehabilitation that also has significant economic value when processed into essential oil. Through further processing, the essential oil is fractionated into a bioadditive (Bio-EOF), which has been technically proven to improve diesel fuel efficiency for the company’s heavy operational equipment by 5%–13% (Fitri et al., 2024).

To reduce funding dependency and ensure the long-term sustainability of the post-mining program, the management of the bioadditive production unit is planned to be fully transferred to BUMDesa Berkah Mulia (Darmawan, 2022). The transformation from a cost-center social program into an independent, profit-oriented business unit (Sari & Ilham, 2024) requires comprehensive business feasibility validation (Istiyani & Lisaputra, 2022; Ronyastra et al., 2024; Sutrisno et al., 2024).

Previous studies have examined the feasibility of citronella cultivation on post-mining land (Juliarti et al., 2021) and the potential for economic improvement through essential oil production at the community level (Amarullah et al., 2023). Other studies have highlighted the transformation of CSR into Creating Shared Value (CSV) (Abdurahman, 2024) and the importance of multi-aspect business feasibility studies in minimizing investment risks (Saratian et al., 2025; Andrew, 2022). Nevertheless, a research gap remains, as no previous study has comprehensively evaluated the commercialization feasibility of transforming a CSR program into a renewable energy-based social enterprise within a post-mining context. Therefore, this study aims to evaluate the business feasibility of the BUMDesa bioadditive business unit from legal, market, technical, managerial, and financial perspectives, while validating its social impact using the Social Return on Investment (SROI) approach to formulate a sustainable business model.

Fundamentally, Corporate Social Responsibility (CSR) represents the commitment of the business sector to contribute to sustainable economic development by balancing economic, social, and environmental dimensions (Abdurahman, 2024; Dyllick & Muff, 2020). Conventional CSR practices are often criticized for being temporary and lacking sustainability (Jamali et al., 2020), which has encouraged the evolution toward the Creating Shared Value (CSV) concept introduced by Porter and Kramer (2011). Unlike reactive CSR approaches, CSV integrates social and environmental challenges into core business strategies to generate economic value for companies while simultaneously creating social value for communities (Abdurahman, 2024; Crane et al., 2019; Spitzeck et al., 2021; Van Tulder & Keen, 2018).

The sustainability of such programs depends significantly on active community participation and a sense of ownership among local stakeholders (Luqmania et al., 2022).

A business feasibility study is a systematic evaluation process used to determine whether a business initiative is viable for implementation by assessing legal, market and marketing, technical/operational, management and human resource, and financial aspects (Saratian et al., 2025; Andrew, 2022). This evaluation involves several key components. First,

the legal aspect ensures compliance with regulations, licensing requirements, and the legality of the business entity structure to mitigate potential risks (Kasmir & Jakfar in Andrew, 2022). Second, the market aspect evaluates market potential by establishing Segmenting, Targeting, and Positioning (STP) strategies, as well as the 4P marketing mix (Kotler & Keller in Saratian et al., 2025). The company's strategic position within industry competition is also assessed using Porter's Five Forces analysis framework (Salsabila & Ribhan, 2025). Third, the technical aspect examines location suitability, production technology selection, facility layout, and operational capacity of production equipment (Sulianto in Andrew, 2022). Fourth, the management and human resource aspect evaluates organizational structure readiness, recruitment processes, training programs, and workforce competencies required to operate the business (Sunarto in Saratian et al., 2025). Fifth, the financial aspect measures economic feasibility through cash flow projections, Payback Period (PP), Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index (PI), and sensitivity analysis (Saratian et al., 2025).

The Sustainable Business Model extends conventional business concepts by incorporating the Triple Bottom Line principles (Profit, People, and Planet) into the company's value proposition and operational framework (Elkington in Diantoro et al., 2024; Sebrina et al., 2024). To ensure that such a model generates measurable and accountable impacts, the Social Return on Investment (SROI) method is applied to quantify and monetize intangible outcomes related to economic, social, and environmental dimensions relative to the investment value provided (Yana & Nainggolan, 2023; Matoati et al., 2023).

The novelty of this research lies in several key aspects. First, this study integrates comprehensive business feasibility analysis—including legal, market, technical, managerial, and financial aspects—with sustainability impact assessment using the SROI methodology within a single research framework. Second, this research focuses on transforming a CSR program into an independent business unit in a post-mining context, representing a unique case study that remains limited in existing literature. Third, this study applies the social enterprise concept to a post-CSR commercial entity, thereby bridging the gap between corporate social responsibility initiatives and community-owned business ventures. Fourth, this research introduces SROI as a forward-looking validation instrument during the feasibility study stage rather than solely as a retrospective evaluation tool.

METHOD

This study employed an applied qualitative research approach supported by descriptive quantitative analysis for financial and impact evaluations. The research focused on assessing the feasibility of the Citronella Oil Bioadditive Business Unit managed by BUMDesa Berkah Mulia, located in the Ring 1 mining area of PT Arutmin Indonesia Kintap Mine, Tanah Laut Regency.

Primary data were collected through field observations and in-depth interviews. Informants were selected using purposive sampling, involving 10 key informants representing three main perspectives to minimize bias: internal company stakeholders (PT Arutmin Indonesia management), local program implementers (BUMDesa director and farmers group leader), and independent validators (experts in chemical engineering, law, and finance).

Secondary data were obtained from company operational documents, program reports, and relevant literature.

Qualitative data were analyzed using the Miles and Huberman interactive model, which includes data collection, data reduction, data display, and conclusion drawing. Interview transcripts were processed through coding techniques using NVivo 15 Plus software to classify feasibility aspects related to legal, technical-operational, and human resource management dimensions. Market feasibility was evaluated by mapping the strategic position using Porter's Five Forces framework, supported by Segmenting, Targeting, and Positioning (STP) strategies and the Marketing Mix (4P).

The economic feasibility analysis evaluated investment viability using capital budgeting methods, including Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PP), Profitability Index (PI), and Break-Even Point (BEP) indicators. The financial model was complemented by sensitivity analysis under 10% and 20% fluctuation scenarios to assess business resilience against potential changes in raw material costs and selling prices. Furthermore, to evaluate the sustainability performance of transforming the Corporate Social Responsibility (CSR) program into an independent social enterprise, this study applied the Social Return on Investment (SROI) method. The SROI analysis was used to quantify and monetize economic, social, and environmental impact values into a measurable impact ratio. The credibility of the research findings was ensured through source and method triangulation.

RESULTS AND DISCUSSION

Non-Financial Feasibility Study

Based on data triangulation results, the non-financial feasibility of the BUMDesa Berkah Mulia business unit can be reviewed through several main aspects. From the legal and legality aspect, BUMDesa Berkah Mulia needs to consider separating the business unit through a spin-off mechanism by forming a subsidiary in the form of a Limited Liability Company (PT). The establishment of a PT entity is an important mitigation step to limit legal liability and protect village assets from potential business risks, especially those related to chemical management and industrial machinery use. Thus, the legality aspect is declared feasible, provided the business separation is genuinely implemented.

From the market and marketing aspect, analysis using the Porter's Five Forces approach shows that the business unit holds a fairly strong competitive position. This is due to its role as a major player in the local area with a relatively low threat of new entrants. Moreover, market access is strengthened through a captive market scheme with PT Arutmin as the off taker. Potential internal demand is estimated to reach 5,000 liters per month, while current maximum machine production capacity is only 176.4 liters per month or about 3.5% of total demand. This condition indicates that the product has a very high market absorption opportunity, thus making the market and marketing aspect fundamentally feasible.

In the technical and operational aspect, citronella cultivation in a 6.25-hectare marginal post-mining land exhibits good agronomic performance, particularly regarding plant resilience and the continuity of raw material supply with a harvest cycle every two weeks. The vacuum fractionation technology used also proves capable of supporting the production process effectively. However, expert observation results highlight the need for improvements

in the factory layout, specifically because the production area is still too open and at risk of weather exposure or potential machine short circuits. Therefore, the technical and operational aspect can be considered conditionally feasible.

Meanwhile, from the management and human resources aspect, a significant skill gap remains between local operator capacity and the operational complexity of chemical fractionation machinery. The transition pattern through PT Arutmin's mentorship is considered an appropriate strategy to strengthen institutional and operational readiness of the business unit. However, for the business unit to run independently, recruiting chemistry experts and conducting competency certifications for village workers is necessary. Accordingly, the management and HR aspect is declared feasible if adequate professional mentorship is provided, particularly in the first year of operation.

Financial Feasibility Study

The financial feasibility analysis was conducted using the Discounted Cash Flow (DCF) approach over a five-year projection period, from 2026 to 2030. Initial investment requirements or capital expenditure (CAPEX) were recorded at IDR 1,181,500,000, entirely sourced from an equity grant scheme through the CSR program. This funding scheme relieves the business unit of loan interest burdens, making the cost structure lighter. Based on calculation results, the Payback Period (PP) is estimated to reach 5.27 years. This timeframe is considered feasible as it remains below the assumed economic asset life of 16 years.

Additionally, the operational Break-Even Point (BEP) is estimated to be reached when the business unit can produce a minimum of 88.25 liters of bioadditive per month, equivalent to 1,059 liters per year. Under a moderate scenario with a 10% discount rate, the Net Present Value (NPV) shows a positive figure of IDR 24,764,518. This result indicates that the project can generate additional economic value after accounting for the base cost of capital. Meanwhile, an Internal Rate of Return (IRR) of 10.68% shows that the project's return rate remains above the applied discount rate. The Profitability Index (PI) of 1.01 also suggests that the project is on the edge of feasibility as its value is greater than one. Academically, these findings demonstrate that the project is not solely oriented toward maximizing corporate profit, but is also aligned with social enterprise principles, as the generated added value is directed more toward improving farmers' welfare.

Sensitivity Analysis

The Sensitivity Analysis shows that the project has a considerably high level of financial vulnerability. A 10% decrease in selling price or a 10% increase in raw material costs has the potential to significantly alter project feasibility, even causing the NPV to become negative. Therefore, the sustainability of the project's financial feasibility is highly determined by price certainty and long-term contract stability through a Fixed Price Agreement scheme with a standby buyer or off-taker.

Sustainability Analysis (SROI)

The success of a Social Enterprise is not only calculated by financial indicators but also measured through the monetization of environmental and community impacts. The accumulative SROI (Social Return on Investment) ratio analysis from 2022 to 2025 shows a figure of 2.68:1. This quantitative data indicates that every IDR 1 of the company's CSR investment can produce a greater benefit value, equivalent to IDR 2.68 in the form of social impacts, local economic strengthening, and environmental restoration.

CONCLUSION

This study concluded that transforming the citronella oil bioadditive CSR program into an independent social enterprise entity managed by BUMDesa Berkah Mulia was feasible. The B2B market prospects were highly promising, supported by guaranteed captive market demand. The financial analysis demonstrated that the business fulfilled investment feasibility criteria based on NPV, IRR, PP, and PI indicators, supported by a grant-based capital structure. The evaluation of sensitivity risk profiles indicated that potential risks could be mitigated through business stability strategies. Furthermore, the business unit was proven to generate a significant social return, reflected by an SROI value of 2.68, validating the successful application of the Creating Shared Value (CSV) concept in post-mining areas.

Based on the analytical findings, several managerial implications should be considered. For BUMDesa Berkah Mulia, business risk segregation through a spin-off mechanism should be implemented by establishing a Limited Liability Company (PT) to protect core village assets from potential business liabilities. In addition, BUMDesa management should establish a minimum production target of 88 liters per month as a Key Performance Indicator (KPI) to maintain operational break-even point achievement. From a supply chain management perspective, implementing a closed-loop supply chain system is recommended to maintain financial feasibility and operational stability amid potential margin fluctuations. Management should also avoid floating pricing mechanisms by implementing a fair base purchase price or floor price agreement for farmer groups, supported by a long-term fixed-price agreement with PT Arutmin Indonesia.

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