HARMONI SOSIAL
Jurnal Pendidikan IPS

Harmoni Sosial: Jurnal Pendidikan IPS
Vol. 13, No. 1, 2026, pp. 134-151
ISSN : 2356-1807 (print) | 2460-7916 (online)
http://journal.uny.ac.id/index.php/hsjpi

Socio-economic empowerment strategies for post-mining communities through village-owned enterprises and local agricultural commodities in Lahat, Indonesia

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ARTICLE INFO

Article History
Received;
May 13, 2026
Revised;
June 25, 2026
Accepted;
July 24, 2026

Keywords
Local agricultural; commodities; post-mining transitions; sustainable; livelihoods.

ABSTRACT

The transition of coal-mining areas toward the post-mining phase requires community empowerment strategies that reduce dependence on the extractive sector while rebuilding locally grounded livelihood assets and institutions. This study aimed to formulate priority strategies for a post-mining Community Empowerment Program based on Village-Owned Enterprises (Badan Usaha Milik Desa, BUMDes), local agricultural commodities, and reclaimed land in Lahat Regency, Indonesia. The field assessment was concentrated in May 2026 and organized as an intensive sequential case-study campaign combining strategic-factor questionnaires, directed interviews, field observation, document review, and cross-source validation. Twenty-five purposively selected key informants were treated as an expert-judgment panel rather than a statistical sample, with representation from village governments, BUMDes, community/farmer groups, mining companies, and local-government technical agencies. The empirical assessment identified village-specific commodity bases: coffee in Lubuk Betung, paddy in Prabumenang and Talang Sawah, and rubber in Gunung Agung and Senabing, with oil palm, livestock, and durian as complementary options. The IFAS and EFAS scores were 2.687 and 1.982, respectively, placing the case in the ST strategic position. QSPM prioritized the preparation of a post-mining PPM blueprint integrating local commodity value chains, BUMDes institutional strengthening, environmentally conditional use of reclaimed land, social-conflict mitigation, and livelihood-capital development. The findings indicate that a BUMDes-led blueprint can function as an institutional mechanism for connecting local assets with early mine-closure transition planning, provided that productive use of reclaimed land is preceded by biophysical suitability and safety assessment.

INTRODUCTION

Coal mining is an extractive activity that can accelerate local economic growth through job creation, expanded supporting services, improved infrastructure access, and stronger regional supply chains. However, these benefits are temporal because coal is a non-renewable resource and the mine life cycle will ultimately enter phases of declining production, closure, and post-mining transition. During this phase, villages surrounding mining areas may transform their operations. Therefore, mine closure should not be understood merely as the final stage of technical reclamation, but as a regional transformation process that must sustain economic, social, and ecological functions after extractive activities cease (Measham et al., 2024). Community involvement in mine-closure processes also shapes whether people see the change as a transition opportunity or a threat to local livelihoods (Svobodova et al., 2026).

Post-mining land-use planning is a key component of this transition because former mining land cannot immediately be treated as productive space without considering biophysical conditions, legal status, recovery level, and ecological risk. Land-use planning is a key component of this transition because former mining land cannot immediately be treated as productive space without considering biophysical conditions, legal status, recovery level, and ecological risk. Studies on post-mining land use show that possible uses may include agriculture, agroforestry, renewable energy, conservation, recreation, environmental education, and combinations of productive and conservation functions, depending on landscape characteristics (Pagouni et al., 2024). Land-use assessment should also be conducted regionally and through multi-stakeholder processes because mining impacts often extend beyond village administrative boundaries and are linked to interregional socio-economic networks (Worden et al., 2024). Integrating the Sustainable Development Goals into post-mining land-use selection is essential so decisions pursue economic value while also maintaining social justice, ecosystem protection, and community resilience (Simpson et al., 2025).

International mine-closure guidance similarly treats closure as an iterative process that should be integrated into the mine life cycle rather than postponed until operations cease. Early closure planning is expected to connect environmental rehabilitation, social transition, economic diversification, stakeholder engagement, and long-term governance (ICMM, 2019). This principle is especially important in mining-dependent rural regions, where delayed livelihood planning can transfer closure risks directly to households and village institutions.

In Indonesia, post-mining challenges extend beyond land restoration to include institutional governance, certainty of empowerment programs, community readiness, and equitable distribution of benefits. Communities around mines often depend directly or indirectly on company activities through employment, transport services, consumption-related enterprises, and social program support. When mining activity declines, this dependence can become a vulnerability without livelihood diversification and local institutions that can manage alternative economic resources. Post-mining community readiness depends on adaptive capacity, willingness to change, organizational capability, and the quality of community engagement in planning processes (Sutrisno et al., 2023). Evaluations of factors influencing community readiness show that post-mining environmental strategies become more effective when linked to behavioural change, institutional support, and access to productive resources. Community willingness to change should also be understood as social capital that participatory spaces must facilitate, rather than as automatic acceptance of company programs (Sutrisno et al., 2024).

Mining-company Community Empowerment Programs occupy a strategic position as a bridge between corporate obligations, village development planning, and communities' economic-transition needs. However, PPM implementation is often suboptimal when it is interpreted as annual social assistance, ceremonial activities, or short-term charity disconnected from the post-mining agenda. Sustainable empowerment requires a shift from charity-oriented programs toward empowerment-oriented transition programs through business incubation, capacity building, social investment, market partnerships, and measurable impact monitoring. Studies

on CSR in Indonesian mining areas show that program effectiveness depends strongly on the perceptions and involvement of different stakeholder groups, not merely on the amount of funding disbursed (Muhammad et al., 2024). The CSR and sustainable-development literature also emphasizes that corporate programs must link to structural changes in the local economy so they do not remain short-term social-legitimacy instruments (Arrawatia et al., 2026; Joshi et al., 2025).

PPM governance is also relevant to the social-license-to-operate literature. Social legitimacy in mining is not created by formal compliance alone; it depends on continuous community engagement, perceived procedural fairness, credible benefit sharing, and the ability of companies to respond to local expectations and conflict risks (A. C. Kemp et al., 2011; D. Kemp & Owen, 2013; Prno & Slocombe, 2012). In this sense, a post-mining PPM blueprint is not merely a corporate program document but a mechanism for translating regulatory obligations into negotiated and measurable transition commitments.

BUMDes are relevant as institutional nodes in post-mining PPM strategies because they are mandated to manage village assets, develop business units, strengthen local economies, and distribute benefits to communities. In the post-mining transition, BUMDes can function as commodity aggregators, partnership managers, connectors to capital access, and institutions that ensure particular groups do not capture economic programs. Nevertheless, the formal existence of BUMDes does not automatically guarantee good economic and social performance. Entrepreneurial orientation can improve BUMDes financial and social performance when supported by open innovation and the capacity to absorb external knowledge (Wulandari & Wardani, 2024). A systematic review of BUMDes also confirms that successful BUMDes-based empowerment requires strong governance, managerial competence, and partnership networks (Harinurdin et al., 2025). Determinants of BUMDes performance in Indonesia include managerial capability, institutional strengthening, accountability, and a consistent policy ecosystem (Indrawanto et al., 2025; Soegiharto et al., 2026).

This study is theoretically anchored in the Sustainable Livelihoods Framework (SLF). Sustainable livelihoods depend on households' and communities' access to, and ability to combine, multiple forms of capital within institutional and market contexts (Boudreaux & Nikolaev, 2019; Ocasio et al., 2020). For the present study, human capital includes skills and adaptive capacity; social capital includes farmer groups, trust, and multi-stakeholder networks; natural capital includes agricultural resources, water, and environmentally safe reclaimed land; physical capital includes productive infrastructure and post-harvest facilities; and financial capital includes household income, PPM financing, business capital, and market access. Mine closure can weaken several of these capitals simultaneously. BUMDes is therefore conceptualized as an institutional mechanism that can connect and transform livelihood capitals through aggregation, business incubation, financing linkages, processing, and market partnerships. At the same time, SWOT-QSPM is used as the strategic prioritization tool within this broader livelihood-transition framework.

Lahat Regency represents a critical case of coal-dependent regional development. Regional statistics indicate that mining and quarrying accounted for approximately 52.38% of the regency's gross regional domestic product in 2025, while the poverty rate remained 13.69%, demonstrating that a large extractive contribution does not automatically translate into household economic resilience (Wijayanti et al., 2026). This study focuses on five Ring 1 villages: Lubuk Betung in Merapi Selatan, Prabumenang in Merapi Timur, Gunung Agung in Merapi Barat, Senabing in Lahat, and Talang Sawah in Lahat Selatan. Their principal local economic bases are heterogeneous: coffee is prominent in Lubuk Betung, paddy in Prabumenang and Talang Sawah, and rubber in Gunung Agung and Senabing, with oil palm, livestock, and durian providing complementary options. Publicly available mine information does not provide a uniform village-level closure year across these locations; accordingly, the study does not impose a speculative closure date but treats mine closure as a foreseeable transition risk that requires preparation during the operational period. This combination of high coal dependence, persistent social vulnerability, distinct village livelihood profiles, and

uncertain closure timing makes Lahat a relevant case for testing an early, locally differentiated post-mining transition strategy.

Based on this background, this study aimed to formulate priority strategies for developing a post-mining PPM based on leading commodities, BUMDes, and reclaimed land in Lahat Regency. The analysis used SWOT-QSPM because it enables identification of internal and external factors, development of alternative strategies, and determination of priorities based on each strategy's relative attractiveness. This approach was selected so that the resulting recommendations would not be merely descriptive, but would also provide a measurable decision-making basis for preparing a post-mining PPM blueprint.

METHOD

Research Design, Location and Period

This study employed a case-study design with a mixed quantitative-qualitative approach. The case-study design was selected because post-mining PPM strategies are strongly influenced by local characteristics, the history of village-company relations, community livelihood structures, BUMDes capacity, and the condition of available reclaimed land. The quantitative approach calculated weights, ratings, IFAS-EFAS scores, SWOT coordinates, Attractiveness Scores (AS), and Total Attractiveness Scores (TAS). The qualitative approach interpreted the strategic meaning of S-W-O-T factors, examined the social context behind the numerical values, formulated alternative strategies, and derived policy implications. Using SWOT-QSPM aligns with strategic decision-making because it links internal and external factor diagnosis with systematically comparable implementation priorities (Wahmil et al., 2025).

The research was conducted in May 2026 in five Ring 1 villages surrounding coal-mining operations in Lahat Regency, South Sumatra Province: Lubuk Betung, Prabumenang, Gunung Agung, Senabing, and Talang Sawah. The one-month field window was organized as a deliberately intensive, sequential strategic assessment rather than a seasonal production survey. The sequence comprised: (1) review and consolidation of village, PPM, BUMDes, commodity, reclamation, and environmental documents; (2) administration of strategic-factor assessments to the key-informant panel; (3) directed interviews and field observation to explain and verify the questionnaire judgments; and (4) cross-source validation before the IFAS-EFAS and QSPM matrices were finalized. This design was feasible within May 2026 because the study measured current strategic conditions and institutional judgments, while commodity-production and regional baseline information was obtained from existing village and official records rather than repeated seasonal measurements. The unit of analysis was the post-mining community-empowerment system, encompassing interactions among mining companies, village governments, BUMDes, community/farmer groups, local business actors, and technical agencies.

Respondents and Respondent Selection Technique

Respondents were selected purposively because SWOT-QSPM requires informed judgments from actors who understand field conditions, institutional authority, local economic potential, social risks, PPM implementation, and reclamation. The panel consisted of 25 key informants, with five representatives from each of five stakeholder groups: village government, BUMDes/village economic institutions, community-farmer-business groups, mining companies, and local-government technical agencies. The panel was designed for expert judgment and strategic prioritization, not for statistical inference to the population of Lahat Regency; therefore, expertise, direct involvement, and balanced stakeholder representation were the sampling criteria. Comparable international SWOT-QSPM applications have also relied on bounded expert panels—for example, (Budihardjo et al., 2023) used questionnaires completed by 20 experts to formulate and prioritize strategic alternatives. In the present study,

equal representation across the five stakeholder groups reduced the risk that one institutional category would dominate the strategic diagnosis solely because of group size.

Respondent criteria included direct experience or authority related to village management, BUMDes, company PPM, leading commodities, business groups or farmer groups, land reclamation, community social relations, or technical policy; knowledge of problems and potentials in villages surrounding mines; ability to assess weights, ratings, and strategic attractiveness; and willingness to participate in data clarification. Respondent groups consisted of village governments, BUMDes managers or village economic institutions, community/farmer/business-group representatives, mining-company representatives related to PPM or reclamation, and local-government technical agencies related to community empowerment, environmental management, agriculture, or development planning.

Table 1. Respondent groups and their information contributions

Respondent group	Main criteria	Information contribution	Role in the analysis
Village government (5 persons)	Understood village planning and village-company relations	Village development priorities, use of village autonomy, and institutional needs	Validation of opportunity factors and program-integration direction
BUMDes/village economic institutions (5 persons)	Involved in managing village business units	Institutional capacity, capital needs, governance, and business opportunities	Assessment of institutional strengths and weaknesses
Community/farmer/business groups (5 persons)	Had experience or interest in local enterprises	Leading commodities, business aspirations, conflict risks, and training needs	Validation of social strengths and capacity barriers
Mining companies (5 persons)	Related to PPM, CSR, reclamation, or community relations	PPM policy, reclamation plans, partnerships, and program support	Assessment of PPM opportunities and post-mining threats
Local-government technical agencies (5 persons)	Had authority for facilitation or regulation	Policies, program support, capital access, and environmental protection	Validation of external opportunities and policy risks

Data Types, Sources, and Collection Techniques

Primary data consisted of respondents' assessments of internal factors, external factors, and the attractiveness of alternative strategies. Respondents completed a SWOT-QSPM questionnaire with indicators of strengths, weaknesses, opportunities, threats, and alternative ST strategies. The questionnaire was designed to obtain relative-importance weights, ratings of actual conditions, and strategic attractiveness values. Targeted interviews strengthened the primary data by exploring the reasons behind respondents' assessments, particularly regarding leading-commodity potential, BUMDes functions, PPM patterns, social conflict, digital marketing, and reclaimed-land utilization.

Secondary data were obtained from village planning documents, company PPM records, BUMDes institutional information, community-empowerment records, local commodity-potential data, regional statistics, and reclamation or environmental-management documents. We operationalized triangulation as a convergence check rather than simple parallel collection. We compared questionnaire scores with directed-interview explanations, field observations, and documentary evidence. When company, government, and community interpretations diverged—for example, regarding PPM effectiveness, partnership quality, conflict, or reclaimed-land readiness—we revisited the discrepancy against interview notes and documentary/observational evidence and retained it as an interpretive issue rather than automatically averaging it away. Factor wording was then clarified with key informants before

entry into the final SWOT matrices. This protocol kept numerical judgments traceable to the qualitative and documentary context from which they were derived.

SWOT-QSPM Analysis Stages

The analysis was conducted in stages so that the relationship among field data, strategic factors, alternative strategies, and implementation priorities could be traced. The first stage involved inventorying strategic factors based on observations, interviews, and documents. The second stage validated the factors with key informants to ensure their relevance to the Lahat Regency context. The third stage involved weighting, rating, and preparing IFAS-EFAS matrices. The fourth stage determined SWOT coordinates. The fifth stage involved developing the strategy matrix. The sixth stage was QSPM analysis of priority strategic alternatives.

Aggregation was conducted in two analytically distinct steps. First, factor assessments were tabulated at the village level after clarification of the contributing stakeholder evidence. For each strategic factor i, the final rating reported in Table 3 was calculated as the arithmetic mean of the five village-level ratings, $r_i = (\Sigma\, r_{iv})/5$, where v denotes the five study villages. Second, factor importance was converted into a normalized weight, $w_i = I_i/(\Sigma\, I_i)$, separately for the internal and external matrices, so that total internal weights and total external weights each equaled 1.000. Thus, rating and weight were not treated as interchangeable measures: the rating represented the assessed condition/system response, whereas the weight represented relative strategic importance. In QSPM, each factor-strategy pair received a panel-validated Attractiveness Score (AS) from 1 to 4, and TAS was calculated as $w_i \times AS$. This procedure made judgment consolidation reproducible while preserving equal representation of the five village cases.

Table 2. Stages of SWOT-QSPM analysis

Stage	Focus	Operational description
Stage 1	Inventory of strategic factors	Field and documentary data were classified into strengths, weaknesses, opportunities, and threats. Internal factors were aspects relatively controllable by villages, BUMDes, communities, and PPM partners; external factors were policy, market, social, and environmental conditions affecting program success.
Stage 2	Factor validation by respondents	Initial factors were clarified with key respondents to ensure that each indicator was relevant to the Lahat Regency context, understandable, and directly related to post-mining PPM.
Stage 3	Factor weighting	Each validated factor received an importance value that was normalized within the internal or external matrix: $w_i = I_i/(\Sigma\, I_i)$. Total internal weights and total external weights each equaled 1.000.
Stage 4	Rating assignment	Ratings described the actual condition or system response. The value reported in Table 3 is the arithmetic mean of the five village-level ratings for each factor, ensuring equal contribution of the five study villages.
Stage 5	Preparation of IFAS and EFAS	The score of each factor was calculated by multiplying its weight by its rating. IFAS represented the total score of internal factors, whereas EFAS represented the total score of external factors.
Stage 6	Determination of SWOT coordinates	The X coordinate was calculated as the total strength score minus the total weakness score, whereas the Y coordinate was calculated as the total opportunity score minus the total threat score. Quadrant position determined the main strategic direction.
Stage 7	Preparation of the SWOT strategy matrix	Alternative strategies were grouped into SO, WO, ST, and WT strategies. Because this study was positioned in Quadrant II, ST strategies became the main basis for priority selection.

Stage 8	QSPM analysis	Alternative ST strategies were reviewed against the validated factor set and assigned panel-synthesized Attractiveness Scores (AS) on a scale of 1 to 4. TAS = weight × AS, and the strategy with the highest total TAS was selected as the priority.

Formulae and Interpretation Criteria

For each factor i, we aggregated the village-level condition ratings as an arithmetic mean: $r_i = (\Sigma r_{iv})/5$. We normalized relative-importance values as $w_i = I_i/(\Sigma I_i)$, separately for IFAS and EFAS. We then calculated the weighted factor score as $score_i = w_i \times r_i$. IFAS and EFAS were obtained by summing the weighted scores of internal and external factors, respectively. SWOT coordinates were calculated as X = total strength score - total weakness score and Y = total opportunity score - total threat score; Quadrant I = SO, Quadrant II = ST, Quadrant III = WO, and Quadrant IV = WT.

In the QSPM, TAS values were calculated using the formula: TAS = weight x AS. The Attractiveness Score was assigned on a scale from 1 to 4, where 1 = not attractive, 2 = moderately attractive, 3 = attractive, and 4 = highly attractive. The strategy with the highest total TAS was considered the most strategically attractive because it best addressed key internal and external factors simultaneously.

RESULT AND DISCUSSION

RESULT

Internal and External factor characteristics

The IFAS results produced a total internal score of 2.687, consisting of a strength score of 1.547 and a weakness score of 1.140 (Table 3). The positive gap of 0.407 indicates that local strengths exceeded internal weaknesses. However, these strengths should be viewed as initial livelihood capital that still requires institutional organization, financing, capacity building, and market access to support a sustainable post-mining transition (He et al., 2025; Li & Huang, 2026). The strongest internal factor was the availability of leading commodities based on local potential, with a score of 0.507 (Table 3). This indicates that post-mining economic transition is more likely to succeed when it builds on existing community assets, knowledge, and production experience. Leading commodities can support livelihood diversification when strengthened through product standardization, value-chain development, institutional integration, and market access, which are important for maintaining household food security, income, and economic stability in mining-affected areas (Haile et al., 2024; Rudolph & Zenda, 2025).

In S1, "leading commodities" refers to concrete, village-specific economic assets rather than an abstract commodity category. Triangulation of village profiles, local-economic records, interviews, and field observations showed that Lubuk Betung is primarily coffee-oriented, supported by paddy and rubber; Prabumenang is paddy-oriented, with rubber and livestock as supporting options; Gunung Agung and Senabing are primarily rubber-oriented, complemented by oil palm and livestock; and Talang Sawah combines paddy and coffee, with durian as a distinctive local fruit commodity. These commodities are strategically relevant because they build on existing community knowledge and production experience and can be upgraded through value addition rather than created as entirely new livelihood systems. Current market channels remain dominated by primary-commodity sales and relatively limited local processing, indicating a role for BUMDes as an input and product aggregator, post-harvest and quality-management facilitator, packaging/branding platform, partnership broker, and connector to wider markets. Accordingly, the blueprint should be village-specific: coffee upgrading is more appropriate for Lubuk Betung, paddy intensification and processing for Prabumenang and Talang Sawah, and rubber revitalization with complementary livestock or oil-palm activities for Gunung Agung and Senabing.

The formation of BUMDes and village institutions was another major strength, with a score of 0.320, followed by the availability of reclaimed mining land, with a score of 0.260 (Table 3). BUMDes can serve as an institutional hub for partnerships, product aggregation, and transparent benefit distribution, but its performance depends on entrepreneurship, innovation,

governance, managerial capacity, accountability, and partnership networks (Harinurdin et al., 2025). Reclaimed land also provides a strategic spatial asset for productive and conservation-oriented activities, although its use requires land-suitability assessment, environmental monitoring, clear access rules, and adaptive governance (Hlaváček & Mata, 2026; Wyrzykowska & Janiszek, 2025). On the weakness side, limited access to capital and technology had the highest score (0.400), followed by weak community human-resource capacity (0.300) (Table 3). These findings show that the main internal constraint is limited transformation capacity, not the absence of local potential. Therefore, technical skills, business literacy, digital capability, access to financing, and market networks must be strengthened so local assets can generate sustainable economic benefits (Lyu et al., 2025; Tang & Tang, 2025).
The productive use of reclaimed coal-mining land must nevertheless be treated as conditional rather than automatic. Reclaimed mine soils may exhibit altered soil horizons, compaction, low organic matter and nutrient status, unsuitable pH, unstable hydrological conditions, and potential contamination; Indonesian reclamation experience also emphasizes managing potentially acid-forming materials and acid mine drainage (Brock, 2021; Feng et al., 2023). Consequently, ST2 should follow a biophysical decision sequence: land-safety and slope/stability screening, soil and water-quality testing, assessment of topsoil and organic-matter status, remediation or amendment where required, crop/land-use suitability evaluation, pilot demonstration, and only then scaled cultivation. This sequence prevents the strategy from treating reclaimed land merely as a spatial asset and ensures that farmer groups or BUMDes are not expected to absorb environmental risks that reclamation obligations and technical agencies should first verify and manage.
The EFAS results produced a total external score of 1.982, with an opportunity score of 0.924 and a threat score of 1.059. The negative gap of -0.135 indicates that external threats outweighed opportunities. Although village autonomy, government policy, access to capital, and corporate PPM obligations provide strategic opportunities, social conflict, land-use conversion, environmental degradation, weak marketing innovation, and the absence of an integrated PPM blueprint limit their influence (Table 3). The main opportunities were optimizing village autonomy (0.247) and government policy and capital access (0.212). These opportunities can support local economic planning, BUMDes strengthening, and partnership development, but they require effective coordination among government, communities, business actors, and supporting institutions (Nurasa et al., 2024). In mining areas, CSR effectiveness is also shaped by governance, compliance, and program design quality qual (Mai et al., 2024).
Two external opportunities require particular interpretation because of their very low ratings: O1, the obligation of mining companies to implement PPM (1.4), and O5, strengthening BUMDes and partnerships (1.2). In the rating system used here, a low opportunity rating does not mean the regulatory or institutional opportunity is unimportant; rather, it indicates that the current local system responds weakly to, or captures only a small share of, that opportunity. The values therefore reveal an implementation gap: formal PPM obligations and the institutional availability of BUMDes have not yet been consistently translated into long-term productive programs, integrated village-company planning, market partnerships, and measurable post-mining livelihood outcomes. This gap is consistent with the simultaneous identification of charity-oriented PPM and weak BUMDes governance as internal weaknesses, and it provides a substantive explanation for why a binding, cross-actor blueprint emerges as the priority strategy.
The most serious threat was social conflict (0.306), followed by land-use conversion and environmental degradation (0.259). These findings show that post-mining strategies must combine community participation, transparent benefit distribution, and conflict-mitigation mechanisms (Yusriadi, 2025). Reclaimed-land use must also be aligned with ecological restoration, ecosystem-service protection, soil and water management, and stronger reclamation obligations (Listiyani et al., 2023; Shi et al., 2023; Solangi & Alyamani, 2025).

Table 3. Summary of key IFAS and EFAS strategic factors

Code	Strategic factor	Weight	Rating	Score
Strengths				
S1	Availability of leading commodities based on local potential for development	0.133	3.8	0.507
S2	Formation of BUMDes and village institutions	0.100	3.2	0.320
S3	Villages are in the Ring 1 coal-mining area	0.100	2.2	0.220
S4	Strong community willingness to establish farmer groups or joint business centers	0.133	1.8	0.240
S5	Availability of reclaimed mining land for conversion into productive land	0.100	2.6	0.260
Weaknesses				
W1	Community livelihoods remain dependent on the coal-mining sector	0.067	2.2	0.147
W2	BUMDes institutional governance remains weak	0.067	2.0	0.133
W3	PPM patterns still tend to be charity-oriented	0.067	2.4	0.160
W4	Weak human-resource capacity among village communities	0.100	3.0	0.300
W5	Limited access to capital and technology	0.133	3.0	0.400
Opportunities				
O1	Obligation of coal-mining companies to implement PPM	0.118	1.4	0.165
O2	Government policies and access to capital	0.088	2.4	0.212
O3	Optimization of village autonomy	0.088	2.8	0.247
O4	Post-mining land utilization and local wisdom	0.088	1.8	0.159
O5	Strengthening BUMDes institutions and partnerships	0.118	1.2	0.141
Threats				
T1	A coal-mining PPM blueprint is not yet available	0.088	1.4	0.124
T2	Coal-mining activity is temporary	0.088	2.0	0.176
T3	Weak marketing innovation and digitalization	0.088	2.2	0.194
T4	Land-use conversion and environmental degradation	0.118	2.2	0.259
T5	Social conflict in the community	0.118	2.6	0.306
Total IFAS		1.000	-	2.687
Total EFAS		1.000	-	1.982

SWOT position

SWOT coordinates were obtained from the difference between strength and weakness scores for the internal axis and the difference between opportunity and threat scores for the external axis. The calculation results showed an X value of 0.407 and a Y value of -0.135. The positive X and negative Y placed the strategy in Quadrant II, the ST strategy. This position indicates that the target area has internal strengths that can be used, while at the same time it faces relatively serious external threats. Therefore, the most relevant strategy is not uncontrolled expansion, but a strategy that uses local strengths to withstand, reduce, or transform threats into a more controlled transition agenda.

The strategic meaning of Quadrant II is that the program should not merely pursue opportunities, but must use leading commodities, BUMDes, the Ring 1 village position, community willingness to establish business groups, and reclaimed land to anticipate the limited life of mining, social conflict, environmental degradation, weak marketing innovation, and the absence of a PPM blueprint. This direction is consistent with the view that post-mining transition requires institutional and social readiness, not only the completion of physical work on former mining land (Measham et al., 2024). A multi-stakeholder approach to post-mining land use also emphasizes that strategic decisions must integrate the interests of communities,

governments, companies, and the environment within a single planning framework (Worden et al., 2024).

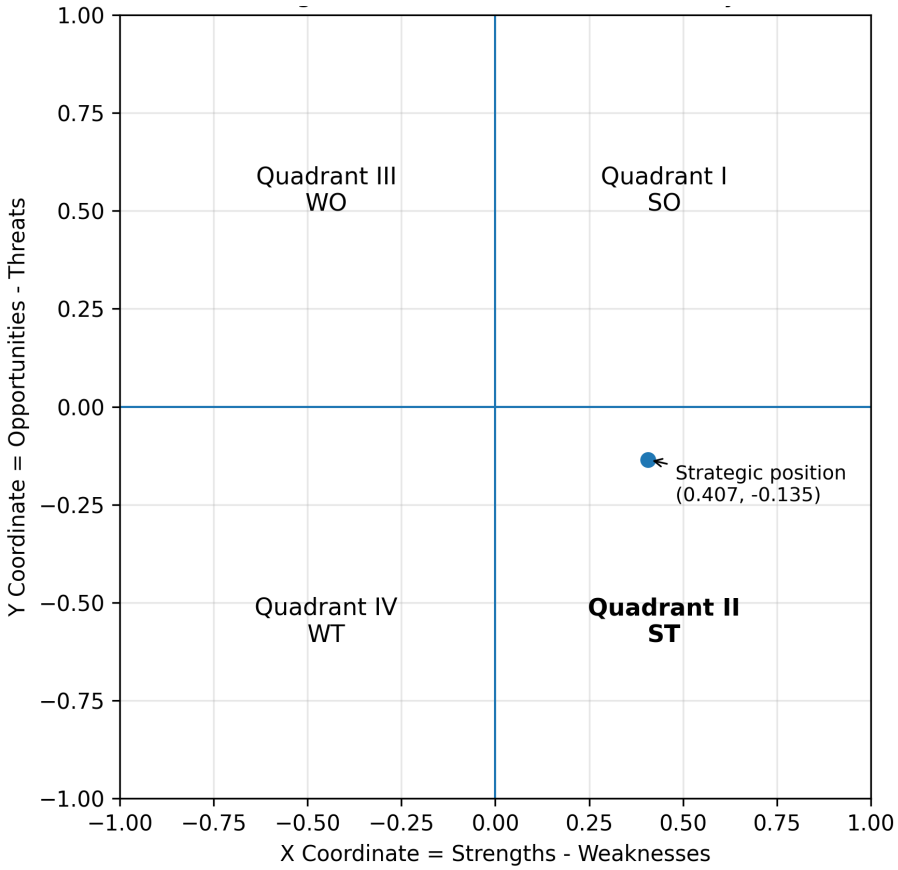

Figure 1. SWOT position based on IFAS and EFAS coordinates

SWOT strategy matrix

The SWOT matrix shows the spectrum of possible strategies. SO strategies use strengths to exploit opportunities; WO strategies improve weaknesses through opportunities; ST strategies use strengths to address threats; and WT strategies minimize weaknesses while avoiding threats. Although all alternatives were formulated, the SWOT position showed that the ST group became the main basis for priority selection through QSPM. In this context, the ST strategy is not a passive defensive strategy but an adaptive strategy that uses local assets to reduce post-mining socio-ecological risks (Table 4).

Table 4. SWOT strategy matrix

Internal/external factors	Opportunities (O)	Threats (T)
Strengths (S)	SO strategies 1. Develop leading-commodity clusters based on BUMDes and company PPM partnerships. 2. Optimize productive reclaimed land through local commodities, capital access, and village autonomy. 3. Establish joint business centers or farmer groups based on local wisdom to expand the village economy.	ST strategies 1. Prepare a post-mining PPM blueprint based on leading commodities and BUMDes institutions to anticipate the end of mining activities. 2. Utilize reclaimed mining land as an environmentally friendly productive area based on farmer groups or business centers to reduce land-use conversion and environmental degradation.

		3. Strengthen Ring 1 partnerships among companies, villages, BUMDes, and communities to mitigate social conflict and develop alternative economies. 4. Develop digital marketing and product innovation for local commodities through BUMDes or business groups to strengthen post-mining competitiveness.
Weaknesses (W)	WO strategies 1. Transform PPM patterns from charity assistance into programs for human-resource capacity building, capital access, and technology adoption. 2. Strengthen BUMDes governance through SOPs, business training, accountability, and support for financing access. 3. Reduce dependence on mining through productive-business incubation and income-source diversification.	WT strategies 1. Improve human-resource capacity and BUMDes governance to reduce dependence on mining and the risk of social conflict. 2. Direct PPM toward measurable business incubation to address the absence of a blueprint, technological limitations, and the temporary nature of mining. 3. Develop environmental-protection schemes and participatory land-use mechanisms to prevent damage and post-mining land conversion.

DISCUSSION

Strategy priorities based on QSPM

The QSPM analysis focused on four alternative ST strategies because the SWOT position was located in Quadrant II. The QSPM results showed that ST1 obtained the highest TAS value, 6.690. This strategy involves preparing a post-mining PPM blueprint based on leading commodities and BUMDes institutions to anticipate the end of mining activities. The highest TAS value indicates that ST1 is best positioned to address key factors simultaneously, particularly the strengths of local commodities and BUMDes and the threats associated with the absence of a blueprint, the temporary nature of mining, and social conflict (Table 5). Good transition planning must connect land-use selection, social sustainability, community readiness, and institutional governance (Jiskani et al., 2026). Institutional integration and community behavior are also prerequisites so that post-mining strategies do not remain technical designs but are accepted and implemented by local actors (Svobodova et al., 2026).

The priority of ST1 confirms that the main problem in post-mining PPM is not merely the lack of technical programs, but the absence of a planning framework that is binding, measurable, and agreed upon by multiple stakeholders (Table 5). Without a blueprint, PPM risks becoming sporadic, disconnected from village development plans, difficult to evaluate, and prone to shifting with short-term interests. A blueprint is needed to regulate objectives, actors, priority commodities, institutional models, financing schemes, reclaimed-land utilization, performance indicators, and conflict-mitigation mechanisms. Post-mining performance measurement needs to include economic, social, and environmental dimensions so that program success is not assessed only by the number of activities or the absorption of budgets (Arratia-Solar et al., 2022).

The second-ranked strategy was ST3, with a TAS of 6.298, namely strengthening Ring 1 partnerships among companies, villages, BUMDes, and communities (Table 5). This strategy is important because social conflict was the highest threat in the EFAS. Ring 1 partnerships need to be designed as joint working forums with agendas, communication rules, grievance mechanisms, and transparent benefit-sharing systems. The third-ranked strategy was ST2, with a TAS of 6.239: utilizing reclaimed land as an environmentally friendly productive area based

on farmer groups or business centers. The potential use of reclaimed land will be more acceptable when communities perceive direct economic benefits while environmental safety remains controlled (Poudyal et al., 2024). The fourth-ranked strategy was ST4, with a TAS of 5.765, namely digital marketing and product innovation for local commodities. Digitalization remains important, but it will be more effective after products, institutions, and the blueprint have been strengthened first (Tang & Tang, 2025).

Table 5. QSPM results for alternative ST strategies

Code	Alternative ST strategy	Total TAS	Rank
ST1	Prepare a post-mining PPM blueprint based on leading commodities and BUMDes institutions to anticipate the end of mining activities.	6.690	1
ST3	Strengthen Ring 1 partnerships among companies, villages, BUMDes, and communities to mitigate social conflict and strengthen alternative economies.	6.298	2
ST2	Utilize reclaimed mining land as an environmentally friendly productive area based on farmer groups or business centers to reduce land-use conversion and environmental degradation.	6.239	3
ST4	Develop digital marketing and product innovation for local commodities through BUMDes or business groups to strengthen post-mining competitiveness.	5.765	4

The main finding of this study is that the priority strategy is preparing a post-mining PPM blueprint, not a single technical program. The blueprint serves as a socio-ecological transition instrument that integrates economic, institutional, environmental, and social objectives. In this framework, leading commodities function as the economic base, BUMDes as institutional nodes, reclaimed land as spatial assets, communities as production actors, companies as financing and facilitation partners, and local governments as policy directors and sustainability supervisors. This supports the view that mine closure should be managed as a regional transition process requiring long-term governance and meaningful community participation (Measham et al., 2024).

Viewed through the SLF, the strategic factors describe disconnected livelihood capitals. Local commodities and environmentally suitable reclaimed land represent natural capital; BUMDes, farmer groups, and cross-actor trust represent social and institutional capital; community skills are human capital; productive infrastructure and processing facilities are physical capital; and PPM funding, business finance, household income, and market access represent financial capital. The priority blueprint adds value by creating rules and sequencing for converting these separate assets into viable livelihood strategies. In this interpretation, SWOT-QSPM is not the theoretical contribution by itself; it is the decision-support mechanism used to prioritize an institutional pathway for rebuilding and connecting livelihood capitals before and after mine closure (Arhin et al., 2022; Gukurume & Tombindo, 2023).

A post-mining PPM blueprint should include commodity mapping, actor mapping, institutional arrangements, reclaimed-land utilization plans, financing schemes, human-resource capacity building, conflict-mitigation mechanisms, and monitoring and evaluation systems. These components are needed to ensure post-mining programs are not fragmented but connected to local economic potential, institutional readiness, environmental safeguards, and measurable development outcomes. Theoretically, the findings strengthen the post-mining sustainability perspective that combines institutional governance with community behavioral readiness. Post-mining transition depends not only on funds and land availability, but also on community capacity to organize, build trust, manage conflict, and adapt to livelihood changes. Therefore, institutional and behavioral aspects must be integrated so that strategies are implementable and aligned with local needs, capacities, and aspirations (Herdiyanti et al., 2026).

The transferable contribution of this study is therefore not the replication of Lahat's commodity list in other mining regions, but the governance architecture used to organize transition:

diagnose threatened and available livelihood capitals, identify locally embedded value chains, verify reclaimed-land suitability, assign responsibilities among companies, governments, village institutions and communities, prioritize strategies transparently, and monitor social, economic and environmental outcomes. This sequence can be adapted to other resource-dependent developing regions facing planned or abrupt mine closure, while the specific commodities, land uses, institutions, and risk thresholds remain context dependent.

Practically, the study encourages a shift from charity-oriented PPM toward empowerment-oriented transition programs. Social assistance may still support vulnerable groups, but PPM should focus on business incubation, institutional strengthening, technology access, management training, and market expansion. BUMDes-based empowerment can be sustainable with open innovation, organizational learning, entrepreneurial orientation, product innovation, and accountable governance (Wulandari & Wardani, 2024). Community involvement should follow a staged process, from needs and risk mapping to strategy formulation, implementation, and evaluation. This approach strengthens legitimacy, reduces conflict, and increases community ownership of post-mining programs. Well-designed participation and strong social capital can prevent mine closure from becoming a source of social tension while supporting productive activities through trust, cooperation, and clear collective rules (Yusriadi, 2025). Reclaimed land should be treated as a transition asset rather than merely a mine-closure obligation. When properly managed, it can support production, education, conservation, and local economic innovation. However, its utilization requires suitability assessment, monitoring, legal certainty, ecological safeguards, and cross-sectoral planning to prevent environmental damage and tenure conflict (Szewczyk-Świątek, 2025).

Policy implications and implementation recommendations

The main policy implication is the need to position PPM as a post-mining transition roadmap rather than merely an annual corporate obligation. Mining companies need to align PPM with reclamation plans, mine-closure plans, village development plans, and community livelihood needs. Village governments need to ensure that the PPM blueprint is integrated into village planning documents so that programs are not separated from local development agendas. BUMDes should be positioned as business managers and benefit aggregators, but only after strengthening governance and accountability. Best practices of BUMDes show that the success of village institutions is strongly influenced by governance quality, human-resource capacity, and support from the business ecosystem (Kusmulyono et al., 2023). Determinants of BUMDes performance also reinforce the importance of managerial facilitation and consistent policy support (Indrawanto et al., 2025).

The priority strategy should be implemented gradually. The short-term stage should focus on strategy consolidation, validating village-potential data, mapping actors, and preparing a blueprint. The short- to medium-term stage should focus on strengthening BUMDes and business groups. The medium-term stage should focus on developing leading commodities and productive use of reclaimed land. The medium- to long-term stage should focus on digital marketing, conflict mitigation, environmental monitoring, and sustainability evaluation. This staged approach is important because post-mining transition requires a realistic implementation sequence rather than a list of programs that operate without integration (Table 6). Community-readiness evaluation should also be conducted periodically so that strategies can be adjusted to changing community needs and capacities (Measham et al., 2024).

This study has several limitations. First, SWOT-QSPM depends on respondent assessments and strategic conditions at the time of the study; therefore, the results need to be updated if policy, market conditions, mine-closure plans, or community social dynamics change. Second, this study did not examine the financial feasibility of each leading commodity in detail, so commodity strategies should be supported by cost-benefit analysis, value-chain analysis, and market projections. Third, this study has not included in-depth technical biophysical testing of reclaimed land, such as soil quality, water availability, land stability, and crop suitability. Fourth, respondents were purposively selected as key informants; thus, the results should be

understood more as expert-judgment-based strategic recommendations than as statistical generalizations.

The concentrated May 2026 field campaign should therefore be interpreted as a cross-sectional strategic assessment. Its intensive sequential design was appropriate for eliciting and validating current multi-stakeholder judgments, but it does not capture seasonal fluctuations in commodity production, market conditions, water availability, or longitudinal changes in stakeholder perceptions. Future validation should repeat key assessments across seasons and at major mine-closure planning milestones.

Future research can combine SWOT-QSPM with business-feasibility analysis, spatial mapping of reclaimed land, commodity value-chain analysis, and sustainability-monitoring models. Spatial-data integration is important to ensure that land-use directions are consistent with biophysical conditions. Financial analysis is needed to ensure that leading commodities are not only potential but also economically feasible. Monitoring models are required so that the PPM blueprint does not remain merely a document but becomes an evaluation instrument that can be periodically updated.

Table 6. Implementation recommendations for the priority strategy

Stage	Focus	Main activities	Key actors	Initial indicators
Short term	Strategy consolidation	Validate village potential, determine priority commodities, prepare the post-mining PPM blueprint, map actors, and designate priority Ring 1 villages.	Companies, village governments, BUMDes, community groups, technical agencies	The blueprint is agreed upon, included in the PPM work plan, and supported by performance indicators.
Short to medium term	Institutional strengthening	Prepare BUMDes SOPs, provide governance training, bookkeeping, business plans, capital access, and Ring 1 partnership forums.	BUMDes, companies, village facilitators, village governments, academics	Business units have organizational structures, business plans, and accountability mechanisms.
Medium term	Productive programs	Develop leading commodities, conduct technical-financial feasibility tests, utilize suitable reclaimed land, and establish productive business centers.	BUMDes, farmer groups, business groups, companies, relevant agencies	Increased production, sales, local labor absorption, and business-unit income.
Medium to long term	Threat mitigation	Develop digital marketing, monitor social conflict, supervise the environment, control land-use conversion, and evaluate sustainability.	Local governments, companies, BUMDes, communities, supervisory institutions	Reduced conflict complaints, expanded markets, and periodic monitoring reports.

CONCLUSION

This study shows that post-mining community empowerment in Lahat should be designed as a livelihood-transition system rather than as a collection of annual PPM activities. The practical foundation is a portfolio of village-specific agricultural value chains—coffee in Lubuk Betung, paddy in Prabumenang and Talang Sawah, and rubber in Gunung Agung and Senabing — complemented by oil palm, livestock, and durian, organized through strengthened BUMDes and linked to mine-closure planning. Under the Sustainable Livelihoods Framework, the proposed blueprint connects natural capital (local commodities and environmentally safe land), human capital (skills and adaptive capacity), social capital (farmer groups, trust, and partnerships), physical capital (productive and post-harvest infrastructure), and financial capital (PPM financing, business capital, income, and market access). Productive use of reclaimed land should proceed only after soil, water, stability, and safety conditions have been technically verified.

The broader contribution is an adaptable governance model for mining-dependent rural regions: begin transition planning before closure, combine expert and stakeholder diagnosis with local livelihood assets, institutionalize responsibilities in a shared blueprint, connect BUMDes or comparable local institutions to value-chain development, and make productive diversification conditional on environmental safeguards and measurable monitoring. Commodities and institutional arrangements will differ by region, but this integration logic can transfer to other resource-dependent developing areas facing planned or sudden mine-closure transitions. In policy terms, PPM should therefore evolve from short-term corporate assistance into a jointly governed transition investment that builds livelihood resilience and socio-ecological capacity beyond the life of the mine.

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