



Research article

Evaluating factors influencing community readiness for post-mining environmental development strategies

Agung Dwi Sutrisno^{a,b}, Chun-Hung Lee^b, Sapta Suhardono^c, I Wayan Koko Suryawan^{b,d,*}^a Department of Mining Engineering, Institut Teknologi Nasional, Jl. Babarsari, Caturtunggal, Depok, Sleman, Yogyakarta, 55281, Indonesia^b Department of Natural Resources and Environmental Studies, College of Environmental Studies and Oceanography, National Dong Hwa University, Hualien, 97401, Taiwan^c Environmental Sciences Study Program, Faculty of Mathematics and Natural Sciences, Universitas Sebelas Maret, Surakarta, 57126, Indonesia^d Department of Environmental Engineering, Faculty of Infrastructure Planning, Universitas Pertamina, Jalan Sinabung II, Terusan Simprug, Jakarta, 12220, Indonesia

ARTICLE INFO

Keywords:

Post-mining transition
 Community readiness
 Environmental development strategies
 Corporate resource stewardship
 Strategic environmental governance
 Community capacity building

ABSTRACT

This research delves into the complex factors that affect how ready a community is to embrace new environmental development strategies, which could significantly change the region's social and economic fabric. Using a structured questionnaire, exploratory factor analysis and logistic regression analysis, the study assesses how corporate practices in resource management, environmental governance, efforts to enhance community capabilities, and various demographic factors influence the community's willingness to adapt to change. Despite its intentions to benefit both the mining operations and the community, corporate resource management appears to have a paradoxical impact on the community's willingness to pursue new environmental paths. This negative impact can be attributed to the dependency it creates. Effective corporate resource management can lead to a community becoming heavily reliant on the stability and benefits provided by the mining company. This dependency fosters a sense of security and satisfaction with the status quo, making community members less inclined to explore or support new and potentially disruptive environmental strategies. The stability provided by the mine's resource management practices may inadvertently anchor the community to existing economic structures, reducing their impetus to seek alternative livelihoods or adapt to new socioeconomic conditions. However, it is essential to consider the limitations of this finding. One limitation is the potential bias in community perceptions, where immediate benefits from corporate resource management overshadow long-term considerations for sustainable development. Additionally, the context-specific nature of this study means that these findings may not be universally applicable to all mining communities.

1. Introduction

In the verdant highlands of West Java, Indonesia, lies Bantar Karet Village, home to a community intrinsically linked to the fortunes of the gold mine. This mine has operated since Antam began exploration activities in 1974 and commenced gold mining production in 1994 (Council, 2014; Sutrisno et al., 2023). The village has been the backdrop to a symbiotic relationship between the mine and the local population. This relationship has been the cornerstone of the region's socioeconomic framework for decades. Before the establishment of the mine, the local economy was characterized by rudimentary infrastructure and limited commercial activity (Sutrisno et al., 2023). The advent of mining

operations brought about a transformative influx of opportunities and facilities (Litvinenko, 2020; Kamalaldin et al., 2021). These residents have witnessed firsthand the evolution of their village: dirt paths turned into paved roads, the rise of local businesses like food stalls and laundry services, and a generally enhanced quality of life attributable to the mine's corporate social responsibility (CSR) initiatives. The socialization of the mine closure plan in 2018 marked a pivotal shift in the community's trajectory (Sutrisno et al., 2023). The post-mining plan transformed the erstwhile mining area into a GeoEcoEduTourism site, comprising the tourist area and an underground mining museum (Hasibuan and Taopik, 2019; Rohaendi and Herlinawati, 2024). The vision extends to integrating these developments with the Pongkor National

* Corresponding author. Department of Environmental Engineering, Faculty of Infrastructure Planning, Universitas Pertamina, Jalan Sinabung II, Terusan Simprug, Jakarta, 12220, Indonesia

E-mail addresses: agung.sttnas@gmail.com (A.D. Sutrisno), chlee@gms.ndhu.edu.tw (C.-H. Lee), sapta.suhardono@staff.uns.ac.id (S. Suhardono), i.suryawan@universitaspertamina.ac.id (I.W.K. Suryawan).

<https://doi.org/10.1016/j.jenvman.2024.121823>

Received 30 March 2024; Received in revised form 5 June 2024; Accepted 8 July 2024

Available online 14 July 2024

0301-4797/© 2024 Elsevier Ltd. All rights reserved, including those for text and data mining, AI training, and similar technologies.

Geopark (Kusumoarto et al., 2021), aspiring to join the UNESCO Global Geopark Network. The goal is multifold to provide educational avenues, bolster the local economy, and elevate social and tourism profiles. Despite the formal license expiration in 2021, mining activities have persisted due to an application for an extension until 2031. This extension was based on promising exploration results indicating the continued productivity of the location. While this extends the operational phase, it also prolongs the community's uncertainty regarding their future post-mining.

Studies have extensively explored the economic and environmental consequences of mining operations (Castilla-Gómez and Herrera-Herbert, 2015; Lechner et al., 2017; Agboola et al., 2020; Marimuthu et al., 2021; Worlanyo and Jiangfeng, 2021). Yet, a considerable void remains in understanding how communities like Bantar Karet Village anticipate, prepare for, and ultimately navigate the transition following mine closure. One significant area of understudied terrain lies in the adaptability of mining-dependent communities to new socioeconomic strategies post-mine closure. The literature often overlooks the granular, localized processes by which such communities absorb and operationalize the changes brought about by ceasing mining activities. The specificity of these processes in varying cultural and social contexts, such as that of Bantar Karet, needs more thorough investigation to truly grasp the adaptability mechanisms at play.

The concept of CSR in the extractive industries has been discussed extensively, particularly in developing countries. These discussions often highlight both the potential and the limitations of CSR practices. For instance, multinational mining and oil and gas companies have embraced CSR to address criticisms of their performance in Latin America, sub-Saharan Africa, and Asia. However, these initiatives often remain superficial and fail to deliver substantial community benefits, underscoring the complexity and limitations of CSR in these contexts (Hilson, 2012). In Indonesia, the socio-economic impacts and sustainability of historical mining activities, such as the tin mining on Singkep Island, reveal long-term economic and environmental consequences (Syahrir et al., 2020). This case study illustrates how tin mining, once a major economic driver, led to severe unemployment and economic collapse after its closure, highlighting the need for better resource governance and economic diversification during active mining periods to avoid such outcomes. Similarly, the analysis of CSR at African mines indicates that contemporary CSR strategies often mimic past practices aimed at placating local communities rather than fostering genuine development (Hilson et al., 2019). The study of large-scale mines in sub-Saharan Africa shows that despite rebranding these efforts as CSR, the outcomes remain minimal due to underlying economic and political dynamics. This highlights the need for a more integrated and responsible approach to CSR that truly addresses community needs and promotes sustainable development. The critique of the single-actor strategic model points out the flaws in approaches that prioritize corporate interests over social responsibilities. They argue for a reinvigorated debate on CSR (Owen and Kemp, 2023), emphasizing the need for multiple actors to address the broader socio-economic impacts of mining. This perspective is particularly relevant in transitioning mining communities, where the interplay between corporate actions and community development must be carefully balanced. The need for a repertoire of CSR practices in the extractive industries is further underscored by studies highlighting successful examples of stakeholder engagement and innovation (Turcotte and Lachance, 2023). These studies demonstrate how companies can effectively collaborate with local communities and innovate to implement CSR practices that bring tangible benefits. For instance, case studies of two mining and two forestry companies in Quebec illustrate how collaborative approaches can enhance CSR outcomes and promote sustainable development.

The concept of resource enclave in developing countries, particularly in the context of gold mining, has been critically examined in light of the global pandemic (Hilson et al., 2024). The persistence of enclave-based operations that fail to integrate with local economies underscores the

challenges of achieving meaningful CSR. The study suggests that to overcome these challenges, mining companies must adopt more inclusive and integrated approaches that align with broader economic and social goals (Hilson et al., 2024). Furthermore, while CSR initiatives are widely promoted to facilitate this transition, empirical evidence assessing the direct impact of these initiatives on community development and transition readiness is sparse (Nikadimovs, 2023; Roh et al., 2023). There is a particular need to evaluate the effectiveness of CSR efforts from the community's perspective. Do they genuinely empower residents for the looming post-mining scenario, or are they seen as merely superficial efforts by the company to maintain a positive public image? Longitudinal aspects of community dynamics as they relate to the life cycle of mining operations also remain underexplored. Many studies capture a post-mining transition (Nehring and Cheng, 2016; Bainton and Holcombe, 2018; Agboola et al., 2020; Gao et al., 2021), but the evolution of community perceptions and readiness is not well-documented as they inch closer to mine closure. This evolving readiness, colored by both anticipation and trepidation, requires a deeper dive to understand how and when communities start to realign their expectations and livelihood strategies. The intricate web of demographic variables and their interconnections with community attitudes toward the post-mining economy is another aspect not fully addressed in existing research. The complexity of factors such as employment status in the mine, marital status, and education level can profoundly influence the willingness and ability of individuals and households to adapt to new economic conditions. However, how these factors shape the community's readiness for change is still not sufficiently understood. Moreover, the literature on economic development in post-mining contexts often misses the mark on detailing the practicality and implementation of alternative economic pursuits (Ferraz, 2012; Hundloe, 2021), such as GeoEcoEduTourism, proposed for Bantar Karet. The feasibility, challenges, and success stories associated with such innovative economic transitions warrant more attention to guide future developments in similar mining communities.

The research aims to fulfill several interlinked objectives with an in-depth evaluation of the community's perceptions of the mining company's CSR initiatives and the impact these initiatives have had on their quality of life and willingness to embrace change as the mine transitions to closure. It looks to decipher the intricate layers of readiness within the community to adapt to new socioeconomic strategies post-mining, examining the influence of various factors such as CSR effectiveness, demographic characteristics, and individual engagement with developmental programs provided by the mining company. Community readiness refers to the extent to which a community is prepared and willing to engage in new socioeconomic activities and strategies post-mining. It involves the community's overall preparedness to transition from a mining-dependent economy to other economic activities, considering various social, economic, and psychological factors. Community readiness can be measured through surveys assessing attitudes, beliefs, intentions towards new economic activities, participation in training and development programs, and overall confidence in the community's ability to adapt to change. Post-mining environmental development strategies encompass the policies, plans, and actions designed to manage and repurpose former mining sites for sustainable economic and ecological use. These strategies aim to mitigate environmental degradation caused by mining activities and promote alternative land use development that benefit the community and environment. Operationalizing these strategies involves evaluating the effectiveness of reclamation projects, integrating new land uses such as eco-tourism or agriculture, and engaging community stakeholders in planning and implementation processes.

2. Method

2.1. Study location and sample

The research was carried out to evaluate the perceptions and attitudes of the Bantar Karet Village community in the Nanggung Subdistrict of Bogor Regency in the West Java Province of Indonesia (Fig. 1). The study aimed to understand the community's readiness to adapt to new strategies post-mining in light of the company's plans to transform the mining area into a GeoEcoEduTourism site. The transition plan includes converting the former mining area into the Cikaret tourist area (Kawaci) and establishing an underground mining museum to provide educational, economic, and social benefits while promoting tourism development with the Pongkor National Geopark. To conduct a comprehensive quantitative analysis that accurately reflects the community's views on adapting to these new post-mining strategies. It was determined that a minimum sample size of 400 individuals was necessary. This calculation was based on ensuring the study could achieve a 5% margin of error, which is standard for ensuring statistical reliability and representativeness in social science research (Suryawan et al., 2023; Tehupeiory et al., 2023). By selecting 420 participants, the study exceeded the minimum requirement, enhancing the robustness of its findings and ensuring a reliable representation of the community's perspective. Measures taken to mitigate respondent bias included ensuring the anonymity of respondents and employing statistical reliability and validity tests, along with key informant qualitative interviews, to ensure data accuracy (Phan et al., 2023; Suryawan and Lee, 2024). The findings represent the community's views on adapting to new post-mining strategies.

2.2. Research design

The questionnaire, central to the research methodology, was meticulously crafted to capture a nuanced understanding of the community's attitudes towards the CSR initiatives of the Pongkor Gold Mine. With a particular focus on the post-mining era, the questionnaire was divided into sections containing Likert scale questions. This scale typically ranges from 'strongly agree' to 'strongly disagree', allowing the research to quantify the community's perceptions and readiness for change.

To ensure the robustness of the research design, the questionnaire was developed based on similar methodologies used in prior studies. For instance, public awareness and perception towards conservation efforts were measured using structural equation modeling in the study of the Mauritian flying fox (Ramesh and Chandr, 2021). Similarly, a structured survey examined the determinants of locals' willingness to participate in human-elephant conflict management in the Dong Nai Biosphere Reserve, Vietnam (Nguyen et al., 2023). In line with these studies, our research employed Exploratory Factor Analysis (EFA) to identify the underlying factors influencing community perceptions and readiness. This method was also used to develop and validate the pro-nature conservation behaviour scale, which involved psychometric scale development through consultation with wildlife and biodiversity experts (Barbett et al., 2020). Additionally, the influence of consumers' intention factors on willingness to pay for renewable energy was examined using a structural equation modeling approach (Irfan et al., 2021). Assessing consumers' willingness to accept/waste to energy programs is a similar approach to understand end-users' perspectives (Suryawan et al., 2023). The meticulous crafting of the questionnaire, Likert scale questions, and applying EFA and structural equation modeling techniques align our research with these established methodologies, ensuring a comprehensive and reliable analysis of the community's attitudes towards CSR initiatives and their readiness for post-mining economic transitions.

The questionnaire items were developed and validated through several steps. Initially, a pilot test was conducted with a sample of 50 community participants to ensure the questions' clarity and relevance.

Feedback from the pilot test was used to refine the questionnaire, improving its reliability and validity. The final version included closed-ended Likert scale and open-ended questions to capture qualitative insights and clarify respondents' perspectives. Measures taken to mitigate respondent bias included ensuring the anonymity of respondents and employing statistical reliability and validity tests, along with key informant qualitative interviews, to ensure data accuracy. The findings represent the community's views on adapting to new post-mining strategies.

Table 1 presents a subset of these indicators, each carefully defined and associated with questions to measure specific CSR and environmental management aspects. For instance, the indicator "Enhancing expertise and skills" was explored through questions assessing the extent to which the community agrees with the mining company's impact on improving environmental practices and community development. This reflects a dual interest in enhancing operational efficiency and fostering sustainable community growth. The "Effective information distribution" indicator gauges the mining company's communications transparency. This aspect of CSR is critical as it establishes the level of trust and the strength of the relationship between the company and its stakeholders. A well-informed community is empowered to engage actively with the company and partake in shared decision-making processes. "Access to financial resources" measures the company's role in contributing to economic development through CSR initiatives. The corresponding question investigates community perceptions of the adequacy of financial resources provided by the mining company for supporting socio-economic and environmental initiatives. "Collaborative engagement" captures the essence of stakeholder cooperation. The questions here probe the perceived effectiveness of the mining company's partnerships and whether these collaborations have led to better environmental and community outcomes. Similarly, the indicators "Engagement in legacy planning" and "Implementation of legacy initiatives" relate to the community's perspective on the company's long-term environmental conservation efforts and the effectiveness of actual projects on the ground.

2.3. Hypothesis development

In the ongoing exploration of the community dynamics around Antam Pongkor Gold Mining, the study extends to model the determinants of the community's inclination towards embracing new strategies in the imminent post-mining landscape. This facet of the research is encapsulated in Fig. 2, which presents a conceptual framework that hypothesizes potential influences on the desire to adopt new strategies following the cessation of mining activities. The framework outlines a series of hypotheses that interlink the community's perceptions of corporate practices and their circumstances with their readiness to accept and implement new approaches to socioeconomic development. In each pathway from the identified factors to the desired outcome, the community's willingness to adopt new strategies is framed within a hypothesis, predicting the direction and nature of the relationship.

The conceptual framework serves as a foundation for the empirical analysis, aiming to validate these hypotheses through statistical testing. It outlines the postulated associations between the independent variables comprising both attitudinal and demographic factors and the dependent variable, which, in this case, is the community's desire to adapt new strategies for the post-mining era. The indicators depicted in Fig. 2, derived from an extensive survey using a structured questionnaire, include corporate resource stewardship, strategic environmental governance, and community capacity building. These critical elements influence the community's sustainable development and corporate engagement perspective.

Hypothesis H1. Corporate resource stewardship and the desire to adapt new strategies.

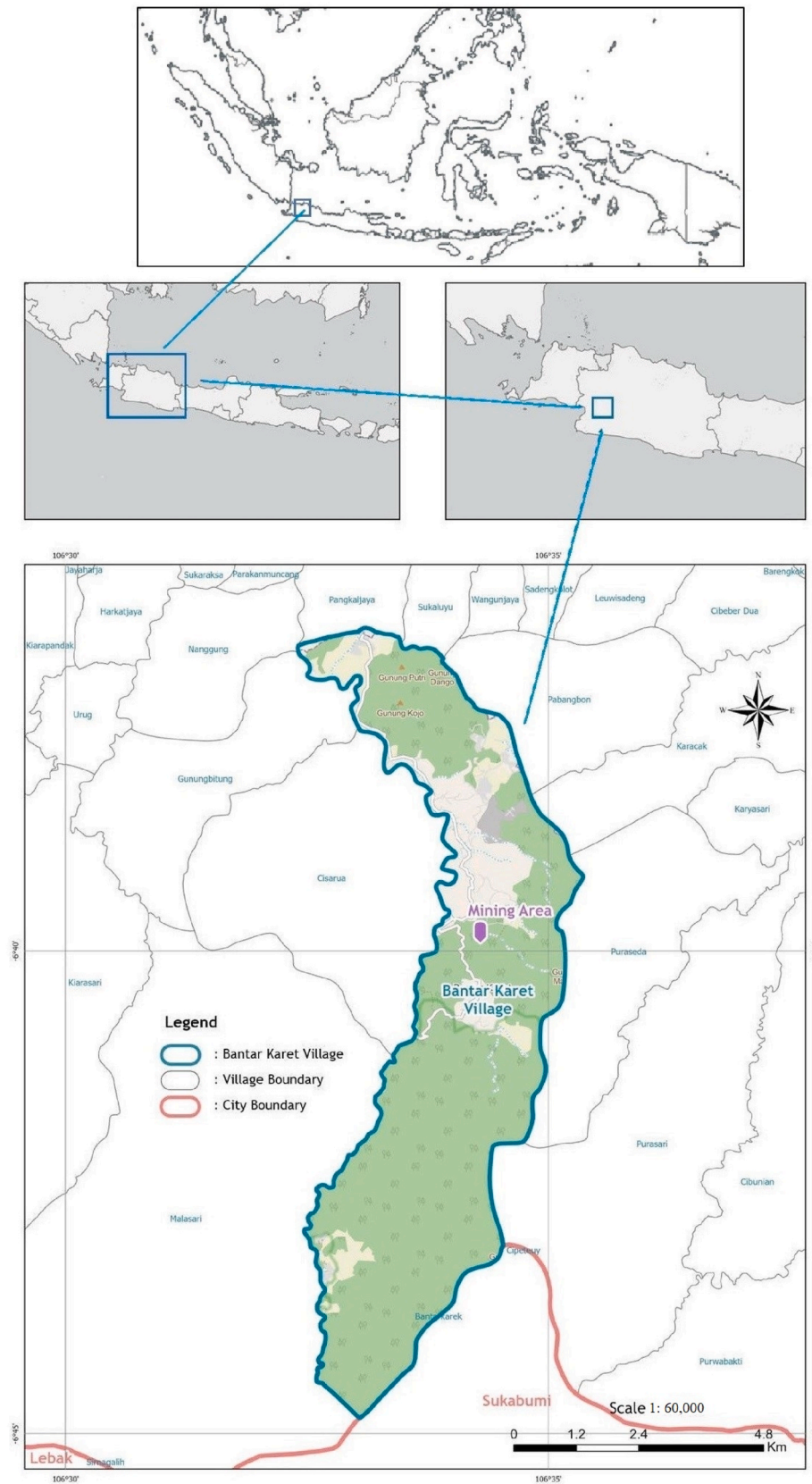


Fig. 1. The geographic location of the gold mine and Bantar Karet Village, Indonesia (Sutrisno et al., 2023). (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

Table 1
Survey item questions on community perceptions of mining operations and CSR initiatives.

No	Indicator	5-Likert Scale Question	Description	Relevance to Environmental Management	Relevance to CSR
1	Enhancing expertise and skillsets	To what extent do you agree that the mining company's investment in enhancing expertise and skillsets has improved environmental practices and community development?	Vital for the continuous improvement of practices that protect the environment and for fostering the growth and education of the community.	Critical for improving environmental strategies and practices.	Essential for building capacity and ensuring sustainable community development.
2	Effective information distribution	How strongly do you agree that the mining company effectively distributes information, ensuring transparency and integrity in its environmental and community relations?	It is key to transparency in environmental stewardship and upholding the mining company's image of integrity with stakeholders.	Promotes informed decision-making and transparency in environmental issues.	Demonstrates accountability and openness in community relations.
3	Access to financial resources	How much do you agree that the mining company provides sufficient financial resources to support proactive environmental initiatives and community socioeconomic programs?	Enables proactive environmental initiatives and funds programs that benefit the socioeconomic status of the local communities.	Enables investment in environmental innovations and sustainable practices.	Funds CSR initiatives and supports local economic development.
4	Collaborative engagement	How much do you agree that the mining company's collaborative efforts with other organizations have led to better environmental outcomes and stronger community relationships?	Measures the success of joint efforts that tackle environmental issues and the company's ability to foster strong, cooperative community relationships.	Enhances environmental outcomes through shared knowledge and resources.	Strengthens community ties and collaborative partnerships.
5	Engagement in legacy planning	To what extent do you agree that the mining company's involvement in legacy planning reflects a commitment to long-term environmental conservation and community prosperity?	Signifies the company's foresight in environmental conservation post-mining and its dedication to the enduring prosperity of the community.	Ensures responsible management and restoration of mining sites.	Reflects commitment to the long-term well-being of communities after mining activities end.
6	Implementation of legacy initiatives	How strongly do you agree that the mining company's post-mining initiatives have been effective in environmental restoration and in providing lasting benefits to the community?	Assesses the effectiveness of environmental remediation after mine closure and the lasting impact of the company's social responsibility efforts.	Assesses the effectiveness of environmental restoration efforts.	Measures the impact of CSR strategies on sustainable community transitions.
7	Improvement in expertise and skills	To what extent do you agree that the mining company's efforts to improve employee knowledge and skills are enhancing environmental management and community educational opportunities?	Monitors the company's and its workforce's progression in adopting more sophisticated environmental practices and enhancing educational opportunities for community members.	Evaluates the advancement of environmental knowledge within the sector.	Gauges the success of educational and development programs provided by the mining company.
8	Strengthening community ties	How strongly do you agree that the mining company's efforts have fostered a united community approach to environmental challenges?	It is crucial for creating a united approach to environmental challenges and building a supportive network within the community.	Facilitates a cooperative approach to environmental challenges.	Fundamental for fostering a sense of community and social responsibility.
9	Solidarity among community members	How much do you agree that the sense of solidarity among community members has been strengthened as a result of the mining company's social responsibility activities?	Reflects the effectiveness of the company's efforts in fostering a collaborative spirit in managing environmental concerns and nurturing a strong community.	Reflects on the collaborative health of environmental management efforts.	Indicators of the depth of social connections enhanced by CSR activities.

H1 posits a negative relationship between the perception of corporate resource stewardship and the willingness to adapt new strategies. Resource stewardship refers to the prudent and responsible management of assets and resources (Ngan et al., 2021; Wei et al., 2024). In communities where mining operations have historically provided stability and security, high levels of stewardship could lead to satisfaction with the status quo, reducing the perceived need for change (Cacciuttolo and Atencio, 2023). This hypothesis suggests that if the mining company is seen as managing its resources responsibly, providing for community needs, and securing employment, the impetus for desiring new strategies might be diminished, as the current situation may be viewed as satisfactory or preferable.

Hypothesis H2. Strategic environmental governance stewardship and the desire to adapt new strategies.

H2 proposes a positive relationship between engagement in strategic environmental governance and the desire to adapt new strategies. Strategic environmental governance involves a company's long-term planning and policy-making processes to manage environmental impacts (Van Assche et al., 2020; Koskimaa et al., 2021; Ogunkan, 2022). This hypothesis is based on the premise that when a company is perceived as taking proactive and strategic environmental actions, it

fosters trust and cooperation from the community. Trust in the company's environmental stewardship can encourage a community to be more receptive to new initiatives (Hur et al., 2020; Camilleri, 2022), particularly those that align with sustainability goals, because they anticipate that such strategies will be managed with foresight and responsibility.

Hypothesis H3. Community capacity building and the desire to adapt new strategies.

H3 hypothesizes a positive relationship between community capacity building and the willingness to embrace new strategies. Community capacity building encompasses efforts to enhance individuals' skills, knowledge, and abilities within the community (Antwi-Agyei and Stringer, 2021). Empirical evidence supports the idea that when communities are equipped with knowledge and skills (Kmieciak, 2021; Nguyen et al., 2022), they are more likely to engage in adaptive behaviors as they can better understand and contribute to new development strategies. Such communities are poised to proactively seek opportunities beyond the mining lifecycle. This aligns with the concept that empowerment through education and skill development is a cornerstone of sustainable community development (Suryawan and Lee, 2023; Suryawan et al., 2024).

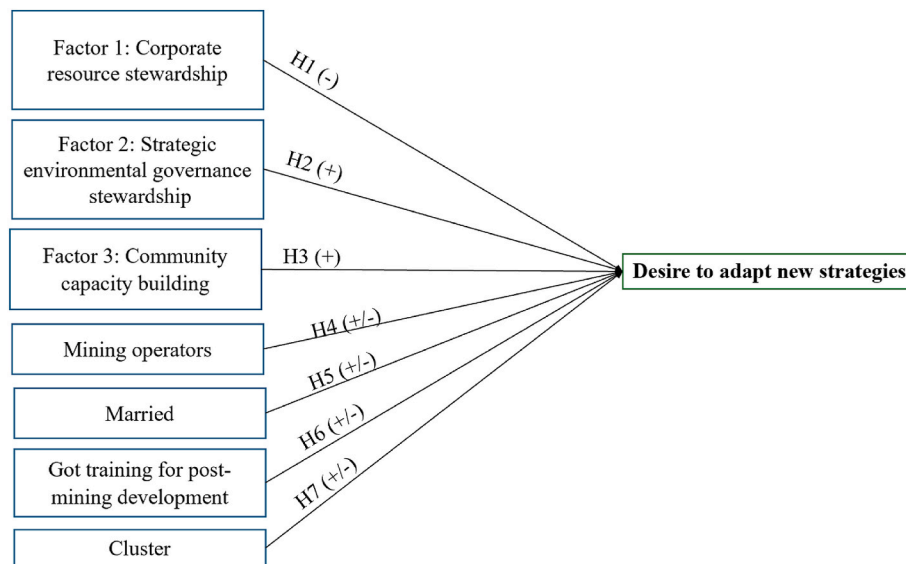


Fig. 2. Conceptual model of factors influencing community readiness for post-mining transition.

Hypothesis H4. Mining operators and the desire to adapt new strategies.

The relationship between being a mining operator and the desire to adapt new strategies is not hypothesized to be positive or negative. Mining operators may resist changes that could affect their livelihood, or conversely, they may favor new strategies that promise long-term sustainability beyond the life of the mine.

Hypothesis H5. Marital status and the desire to adapt new strategies.

Like H4, the impact of marital status on the desire to adapt new strategies is uncertain. Being married may either increase the desire for stability and resistance to change or encourage a desire for new strategies that ensure family security in a post-mining future.

Hypothesis H6. Training for post-mining development and the desire to adapt new strategies.

It is hypothesized that individuals who have received training for post-mining development are more likely to desire to adapt new strategies. Training often increases awareness and understanding of the benefits and necessity of adaptation to new economic conditions.

Hypothesis H7. Cluster membership and the desire to adapt new strategies.

The hypothesis for cluster membership's effect on the desire to adapt new strategies is also undetermined. Depending on the characteristics of each cluster, membership may either positively or negatively influence the desire to adapt new strategies. For instance, a cluster characterized by a strong association with current mining operations may be less inclined to desire change, while a cluster focused on community development may be more open to new strategies.

2.4. Data analysis

Upon collecting various individual responses, Exploratory Factor Analysis (EFA) was deployed as the initial analytical tool. The EFA served to simplify the complex data set by condensing observed variables into fewer underlying factors that represent common themes across the variables. These factors were discerned based on factor loadings and correlations between the observed variables and the potential factor. A minimum threshold of 0.5 for factor loadings was set to ensure that only variables with a moderate to strong relationship with a factor were considered significant. To assess the internal consistency of

the factors, Cronbach's Alpha was computed, with a cutoff of 0.6 deemed acceptable (Rahimnia and Hassanzadeh, 2013; Ni Riordain et al., 2016; Raharjanti et al., 2022; Suryawan and Lee, 2024), indicating a reasonable level of reliability in the factors extracted. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) was utilized to evaluate the suitability of the data for factor analysis. This measure helps to determine if the partial correlations among variables are small, which would be ideal for factor analysis. Alongside KMO, Bartlett's Test of Sphericity was applied to verify that the correlation matrix was not an identity matrix, indicating that factor analysis is appropriate (Nguyen et al., 2023; Suryawan et al., 2023).

Once the factors were extracted, they were interpreted and named based on the common themes among the variables with high loadings on each factor (Mulyana et al., 2024; Suhardono et al., 2024). This involved examining the nature and content of the variables to identify a coherent theme that the factor represents. For example, Factor 1, corporate resource stewardship, was named based on variables related to the company's management of natural and economic resources and its CSR activities. Factor 2, strategic environmental governance, was named for variables related to the company's environmental policies and practices. Factor 3, community capacity building, was named for variables related to initiatives aimed at enhancing the community's skills, knowledge, and competencies. Using these criteria, the EFA process helps simplify complex data into understandable factors that represent key themes influencing the community's perceptions and readiness to adapt to new post-mining strategies.

Following EFA, cluster analysis using the k-means clustering technique was conducted to segment the community into distinct groups based on their responses to the questionnaire items. This method partitions the respondents into clusters with high intra-class similarity and low inter-class similarity. The differences between the clusters in terms of the newly created factor scores were examined using Analysis of Variance (ANOVA), allowing for a nuanced understanding of how different population segments perceive the factors influencing their readiness for post-mining development. A Pearson chi-square (χ^2) test was implemented to examine further the association between the clusters (as identified through k-means analysis) and various demographic characteristics. This was crucial in revealing whether particular demographic segments of the community exhibited greater or lesser propensity towards adopting new strategies. Understanding these associations is critical for crafting CSR initiatives that are finely tuned to address the specific needs and inclinations of different community

groups.

Building upon the factor and cluster analyses, the logistic regression model was used to explore the predictive capacity of the identified factors and demographic variables concerning the community’s readiness to adapt to new strategies. The variables included in the logistic regression model were:

- **Factor 1: Corporate Resource Stewardship:** Represents the company’s management of natural and economic resources and its CSR activities.
- **Factor 2: Strategic Environmental Governance:** Pertains to the company’s environmental policies and practices.
- **Factor 3: Community Capacity Building:** Involves initiatives aimed at enhancing the community’s skills, knowledge, and competencies.
- **Mining Operators:** A demographic group that might have insider knowledge and a vested interest in the mine’s operations.
- **Married:** Marital status, as it might influence stability and openness to change.
- **Received Training for Post-Mining Development:** Indicates whether the respondent has received any training related to post-mining activities.
- **Cluster (dummy variable):** Represents the segmented groups within the community based on their responses to the questionnaire items.

In this regression framework, the coefficients represented the logarithmic odds of the outcome, with positive coefficients indicating a higher probability and negative coefficients indicating a lower probability of the community’s desire to adapt new strategies. Wald tests were employed to determine the statistical significance of each coefficient, where a *p-value* < 0.05 was considered indicative of a substantial influence of the predictor on the outcome. The model’s goodness of fit was scrutinized using the $-2 \text{ Log Likelihood}$, which signifies the disparity between the predicted and observed values; lower values suggest a better-fitting model. The Cox & Snell and Nagelkerke R Square values quantified the variance explained by the model, and a higher value signified greater explanatory power. The model’s predictive power was further validated by the Percentage Correctly Predicted metric, which directly reflects the accuracy of the logistic regression model in predicting individual outcomes.

2.5. Research implications

The methodology adopted in this study facilitated an extensive evaluation of the community’s responses to the mining company’s CSR initiatives and preparedness for post-mining changes. The insights from the research are expected to guide the mining company in tailoring its transition strategy to the community’s needs and aspirations. Given the significance of the Pongkor mine to the local economy and social fabric, understanding these dynamics is critical for ensuring a smooth transition that benefits all stakeholders. The research approach, underscored by the rigorous statistical analysis, also had broader implications for CSR practices in the mining sector. The findings can serve as a benchmark for other mining operations facing similar transitions, providing a model for engaging communities in sustainable development plans. Moreover, the research has the potential to contribute to the academic literature on CSR, offering empirical data on community engagement strategies in the context of mining closure and post-operational redevelopment.

3. Result

The results presented in [Table 2](#) from the Exploratory Factor Analysis (EFA) suggest a data structure where variables are organized into three distinct factors based on their intercorrelations. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) indicates the proportion of variance among variables that might be common variance. The value of 0.549, although above the acceptable limit of 0.5, is not as high as one

Table 2

EFA results: factor loadings and reliability scores for survey constructs.

Variable	Factor loadings	Eigenvalues	% of variance	Cronbach Alpha
Factor 1: Corporate resource stewardship		2.317	22.529	0.662
Enhancing expertise and skillsets	0.846			
Effective information distribution	0.817			
Access to financial resources	0.581			
Collaborative engagement	0.535			
Factor 2: Strategic environmental governance		2.079	22.380	0.954
Engagement in legacy planning	0.964			
Implementation of legacy initiatives	0.955			
Factor 3: Community capacity building		1.525	20.872	0.687
Improvement in expertise and skills	0.851			
Strengthening community ties	0.779			
Solidarity among community members	0.710			
KMO and Bartlett’s Test				
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.549			
Bartlett’s Test of Sphericity	<i>p-value</i> < 0.001			

would prefer, typically aiming for a value closer to 0.5 or higher to confirm that the sample is suitable for conducting a factor analysis ([Emin Öcal et al., 2007](#); [Tahar et al., 2010](#); [Awang et al., 2015](#)). Despite the KMO value not being as high as typically desired, it still indicates that the sample is adequate for factor analysis. Moreover, Bartlett’s Test of Sphericity is statistically significant ($p < 0.01$), confirming that the correlation matrix is appropriate for factor analysis. Although the KMO value is on the lower end of the acceptable range, it does not invalidate the analysis. It is important to consider that factor analysis can still be performed with KMO values close to 0.5, especially when supported by significant Bartlett’s Test results. This scenario is common in exploratory research where the primary goal is identifying potential underlying structures rather than confirming a well-established model.

The first factor, “Corporate Resource Stewardship,” comprises four variables with significant factor loadings. The loadings range from 0.535 for “Collaborative engagement” to 0.846 for “Enhancing expertise and skillsets,” indicating that each variable has a moderate to strong relationship with this underlying factor. This factor alone explains 22.529% of the total variance in the dataset, making it a prominent theme that potentially encompasses aspects of how corporations manage their resources and engage with stakeholders responsibly. However, the Cronbach’s Alpha for this factor is 0.662. Although Cronbach’s Alpha is at low acceptability ([Rahimnia and Hassanzadeh, 2013](#); [Raharjanti et al., 2022](#)), it suggests some degree of internal consistency, and these items collectively represent the construct but with room for tightening the coherence of items. The second factor, “Strategic Environmental Governance,” shows very strong loadings, with both variables scoring above 0.95. This factor has a substantial eigenvalue of 2.079 and explains another 22.380% of the variance.

Moreover, Cronbach’s Alpha is 0.954, indicating an excellent level of internal consistency among the items in this factor. This suggests that “Engagement in legacy planning” and “Implementation of legacy initiatives” are not only closely related to each other but also form a highly reliable construct, which could be interpreted as a measure of how

strategic planning and actions are undertaken by organizations to govern their environmental impact and ensure sustainability. The third factor, “Community Capacity Building,” is associated with three variables concerning the development and empowerment of the community. With loadings above 0.7 and an eigenvalue of 1.525, it accounts for 20.872% of the variance. The internal consistency, as measured by Cronbach’s Alpha, is 0.687, which is considered acceptable but indicates room for improvement in how consistently these items measure the concept. This factor reflects the social aspect of corporate responsibility, focusing on how the development of skills, relationships, and solidarity within the community are fostered. For comparison, (Raharjanti et al., 2022), reported that the Cronbach’s alpha of the intuitive scale all scored above 0.6 (0.78–0.81) with an overall internal consistency of 0.83. Meanwhile, the rational scale had an alpha of 0.43–0.83, with an overall internal consistency of 0.62. Both scales had acceptable overall internal consistency (Waqar et al., 2024). Moreover, the corrected item-total correlation and Cronbach’s alpha if item deleted ranged from 0.571 to 0.855 (Singh et al., 2023). This further illustrates that while higher Cronbach’s alpha values are desirable, values above 0.6 are generally acceptable, especially in exploratory research contexts.

Table 3 presents the mean scores of three clusters across three factors identified in an Exploratory Factor Analysis (EFA). These clusters represent different profiles or groups within the data, each showing distinct characteristics regarding corporate resource stewardship, strategic environmental governance, and community capacity building. The F-values are statistically significant ($p < 0.001$) for all three factors, indicating real and significant differences between the clusters. The Mean Square values indicate the variance within the clusters for each factor, with Factor 1 and Factor 3 showing exceptionally high values, which indicates that these factors contribute strongly to the differences between clusters. A p -value < 0.001 indicates that the observed differences among clusters are highly unlikely to have occurred by chance, affirming the distinctness of the cluster profiles with the three factors. The resource-conscious integrators cluster has a high mean score on Factor 1, indicating this group is characterized by a strong emphasis on managing and efficient use of corporate resources and stakeholder engagement. This cluster appears to be well-aligned with the principles of stewardship and integration of corporate resources in their CSR activities. The community-focused innovator’s cluster has a very high mean score on Factor 3, which suggests this group emphasizes empowering the community and fostering development. This may reflect a commitment to CSR initiatives that support community growth, education, and social cohesion, indicating that this cluster’s entities might prioritize social aspects of sustainability. The “Operational minimalists” cluster has negative mean scores across all factors, with the most negative mean score on Factor 1.

Table 4 meticulously details the distribution of several demographic and professional attributes across three distinct clusters, each representing different CSR and environmental management approaches within the mining sector. The table encapsulates the variables’ associations with each cluster, determined by the Pearson χ^2 test, providing a deeper understanding of the factors that correlate with cluster membership. The desire to adapt new strategies demonstrates a noteworthy

trend. Most respondents within the Resource-conscious integrators and Operational minimalists, specifically 203 members from each, show a proactive stance towards adapting new strategies, which translates to 48.33% for both clusters. The association between this desire and cluster membership is statistically significant, indicated by a Pearson χ^2 value of 7.532 with a p -value of 0.023. This suggests that the individuals in these clusters are more likely to be change-oriented, ready to embrace innovation, and may also be in environments that necessitate or encourage adaptation and innovation as a part of their operational ethos.

Turning to the variable of being mining operators, it is notable that again, an equivalent number (203) and percentage (48.33%) of Resource-conscious integrators and operational minimalists are operators, with the difference not reaching statistical significance (p -value = 0.068). This hints at a homogeneity between these two clusters regarding their professional roles within the mining sector. Gender distribution offers a compelling insight, with a substantial divide observed. The Resource-conscious integrators cluster is predominantly female, while the Community-focused innovators have the most minor proportion of females. The operational minimalists lie in between but lean towards a higher male membership. This gender distribution is highly significant (p -value < 0.001) according to the Pearson χ^2 test, emphasizing a stark gender-based differentiation in CSR and environmental management approaches within the mining sector.

Marital status is another demographic feature explored, albeit with no significant association with cluster membership (p -value = 0.368). Most respondents in all three clusters are single, suggesting that marital status does not play a discernible role in clustering patterns related to CSR approaches in this context. The age distribution reveals significant associations with the clusters. The Pearson χ^2 test results in a highly significant p -value < 0.001 , indicating a strong relationship between age and cluster membership. The Resource-conscious integrators are primarily composed of individuals aged 40–49, suggesting that mid-career professionals tend to gravitate toward this cluster. The Community-focused innovators show a broader age distribution, with a notable presence of those above 60, implying that this cluster may include individuals who bring a wealth of experience and possibly a long-term perspective to CSR. The Operational minimalists are predominantly younger, with the majority falling in the 30–39 age bracket. This suggests that this cluster may consist of professionals still establishing their approaches and positions regarding CSR and environmental management.

Education levels are demonstrably aligned with the clusters. Resource-conscious integrators consist largely of individuals with senior school education, indicating that higher education is not a prerequisite for CSR and environmental management involvement within this group. The community-focused innovators, however, are significantly more likely to hold bachelor’s degrees, and none with Master’s degrees or above, signaling that a higher educational background may influence this cluster’s innovation and community engagement approach. The Pearson χ^2 test corroborates this with a p -value < 0.001 . Monthly income, with a Pearson χ^2 test yielding a p -value < 0.001 , indicates a highly significant correlation with cluster membership. Most

Table 3
Cluster analysis to post-mining strategies.

Factor	Cluster			Mean Square	F
	Resource-conscious integrators (n = 219)	Community-focused innovators (n = 92)	Operational minimalists (n = 109)		
Factor 1: Corporate resource stewardship	0.664	−0.087	−1.261	135.296	380.156***
Factor 2: Strategic environmental governance	0.201	−0.197	−0.237	9.259	9.64***
Factor 3: Community capacity building	−0.416	1.618	−0.531	154.728	588.994***

Note: *** = p -value > 0.01 .

Table 4
Demographic distribution of survey respondents by cluster segmentation.

Variable		Resource-conscious integrators (n = 219)		Community-focused innovators (n = 92)		Operational minimalists (n = 109)	
Desire to adapt new strategies	No	16	3.81%	3	0.71%	13	3.10%
	Yes	203	48.33%	89	21.19%	96	22.86%
Pearson $\chi^2 = 7.532$; df = 2; <i>p-value</i> = 0.023							
Mining operators	No	16	3.81%	3	0.71%	13	3.10%
	Yes	203	48.33%	89	21.19%	96	22.86%
Pearson $\chi^2 = 5.387$; df = 2; <i>p-value</i> = 0.068							
Gender	Female	123	29.29%	21	5.00%	63	15.00%
	Male	96	22.86%	71	16.90%	46	10.95%
Pearson $\chi^2 = 33.075$; df = 2; <i>p-value</i> < 0.001							
Marital status	Single	163	38.81%	75	17.86%	81	19.29%
	Married	56	13.33%	17	4.05%	28	6.67%
Pearson $\chi^2 = 2.001$; df = 2; <i>p-value</i> = 0.368							
Age	20–29	0	0.00%	4	0.95%	9	2.14%
	30–39	76	18.10%	38	9.05%	57	13.57%
	40–49	108	25.71%	35	8.33%	42	10.00%
	50–59	35	8.33%	9	2.14%	0	0.00%
	60 above	0	0.00%	6	1.43%	1	0.24%
Pearson $\chi^2 = 59.880$; df = 8; <i>p-value</i> < 0.001							
Higher education	Senior high school and below	121	28.81%	36	8.57%	50	11.90%
	Bachelor's degree	80	19.05%	56	13.33%	52	12.38%
	Master's degree and above	18	4.29%	0	0.00%	7	1.67%
Pearson $\chi^2 = 20.031$; df = 4; <i>p-value</i> = 0.000							
Monthly income	IDR 1,000,000 below	42	10.00%	8	1.90%	30	7.14%
	IDR 1,000,000 - IDR 3,000,000	109	25.95%	10	2.38%	47	11.19%
	IDR 3,000,001 - IDR 6,000,000	46	10.95%	66	15.71%	15	3.57%
	IDR 6,000,000 above	22	5.24%	8	1.90%	17	4.05%
Pearson $\chi^2 = 105.598$; df = 6; <i>p-value</i> < 0.001							
Got training for post-mining development	No	169	40.24%	42	10.00%	81	19.29%
	Yes	50	11.90%	50	11.90%	28	6.67%
Pearson $\chi^2 = 31.964$; df = 2; <i>p-value</i> < 0.001							

*1 USD= IDR 15.880 (March 30, 2024).

community-focused innovators earn between IDR 3,000,001 and IDR 6,000,000, which may reflect the economic status that enables or corresponds with the ability to focus on community development aspects of CSR.

On the other hand, the resource-conscious integrators and operational minimalists show more distribution across income categories, suggesting a varied economic demographic within these clusters. Training for post-mining development is another variable with a clear and significant link to cluster membership (*p-value* < 0.001). Equal numbers of resource-conscious integrators and community-focused innovators have received training that aligns with their forward-thinking and strategic approaches to CSR and environmental management. Operational minimalists are less likely to receive such training, which may indicate their more fundamental or operational focus.

Table 5 outlines a logistic regression analysis to ascertain the influences on the desire to adapt new post-mining strategies. The model provides a variety of statistical measures that offer insights into which factors may significantly impact this desire. The model's constant is significantly positive (B = 4.031, *p-value* < 0.001), indicating that the odds of desiring to adapt new strategies are generally high across the sample when all other variables are at zero. The model properties metrics provides a mixed picture. The -2 Log-likelihood is relatively high at 419.428, indicating that the model does not fit the data perfectly. However, the Cox & Snell R Square and Nagelkerke R Square values suggest that the model has moderate explanatory power, explaining approximately 9.4% and 14.2% of the variance in the desire to adapt new strategies. The model correctly predicted 76.7% of cases, suggesting a reasonable prediction accuracy, which is considered acceptable based on the literature (Kakembo et al., 2007; McDonnell et al., 2020; Dzisi and Lugada, 2021).

In the logistic model, the coefficient for Factor 1, Corporate resource stewardship, is negative at -0.428. This suggests that those who score higher on corporate resource stewardship have a slightly lower likelihood of wanting to adapt new post-mining strategies. However, this

Table 5
Logistic regression analysis of predictors influencing community readiness for post-mining transition.

Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Factor 1: Corporate resource stewardship	-0.428	0.232	3.411	1	0.065	0.652
Factor 2: Strategic environmental governance	0.214	0.139	2.373	1	0.123	1.239
Factor 3: Community capacity building	0.333	0.138	5.786	1	0.016	1.394
Mining operators	-2.319	1.045	4.925	1	0.026	0.098
Married	-0.651	0.274	5.629	1	0.018	0.522
Got training for post-mining development	0.752	0.329	5.229	1	0.022	2.122
Cluster (dummy variable)	-0.341	0.253	1.817	1	0.178	0.711
Constant	4.031	1.139	12.532	1	<0.001	56.314
Model Properties						
-2 Log likelihood	419.428					
Cox & Snell R Square	0.094					
Nagelkerke R Square	0.142					
Percentage Correct	76.7%					

result is on the significance threshold with a *p-value* of 0.065, just above the conventional cutoff for statistical significance of 0.05. Factor 2, Strategic environmental governance, yields a positive coefficient of 0.214, which indicates a positive association with the desire to adapt new strategies. However, with a *p-value* of 0.123, this association is not statistically significant, suggesting that strategic environmental governance may not have a decisive influence on the desire to adapt new strategies within the scope of this analysis. The coefficient for Factor 3, Community capacity building, is 0.333 and is statistically significant with a *p-value* of 0.016. This indicates a clear association where higher scores in community capacity building relate to a greater likelihood of desiring new post-mining strategies. This aligns with the understanding

that those invested in the community may be more inclined to seek and support new strategies that could benefit post-mining development.

The role of being a mining operator appears to have a substantial negative influence, with a coefficient of -2.319 and a significant p -value of 0.026 . This suggests that mining operators are significantly less likely to want to adapt new post-mining strategies compared to those who are not operators. Marital status also shows a significant negative coefficient of -0.651 (p -value = 0.018), indicating that those who are married are less likely to express a desire to adapt new strategies compared to those who are not married. Receiving training for post-mining development shows a positive coefficient of 0.752 with a p -value of 0.022 , suggesting that training is associated with a higher likelihood of desiring to adapt new strategies. This could reflect the impact of training on raising awareness and understanding of the benefits of new strategies. The dummy variable for cluster membership has a negative coefficient (-0.341). Still, it is not statistically significant (p -value = 0.178), suggesting that cluster membership does not have a solid differentiating impact on the desire to adapt new strategies within this model.

4. Discussion

Fig. 3 presents a conceptual model mapping various factors and demographic characteristics to the community's desire to adapt to new strategies post-mining. This model is a statistical representation and a mirror reflecting the community's pulse aspirations, hesitations, and readiness to embrace change. It depicts how distinct factors and demographics impact the community's disposition towards adapting new socioeconomic strategies as they transition from a mining-based economy. Factor 1, corporate resource stewardship, lies in the mining company's ability to manage natural and economic resources to benefit its operations and the community. Contextual factors specific to the Bantar Karet Village community are also important. The community's cultural norms emphasize cohesion and mutual support, strengthened by the mining company's provision of jobs and infrastructure. This long-term reliance on the company has made residents more resistant to change, as they have become accustomed to the stability provided by the mine. Historically, this dependency on mining has anchored the community to its current state, making them hesitant to explore new economic

opportunities.

This stewardship has traditionally been seen as a core element of the company's CSR activities, aiming to create sustainable value. In the conceptual model, this factor initially showed a negative association with the community's desire for change, posing an intriguing scenario where good stewardship may inadvertently anchor a community to existing conditions, thus reducing their impetus to seek new opportunities beyond mining. This could be because effective stewardship ensures community benefits such as employment and infrastructure development (Kanwal et al., 2020), leading to a reliance on the status quo. Communities that experience a high level of corporate stewardship might feel less compelled to alter their socioeconomic trajectory, potentially perceiving the changes that come with mine closure as disruptive. This nuanced relationship is echoed in the literature, where mining communities often face a paradox: the better the mine's performance in terms of resource stewardship, the more dependent the community may become on its continued operation (Bridge, 2004; Hira and Busumtwi-Sam, 2018; Lawrence and Moritz, 2019). Yet, when corporate resource stewardship interacts with other factors, particularly strategic environmental governance and community capacity building, its role in influencing the desire to change becomes more complex. In a holistic context, effective stewardship can lay the groundwork for a smooth transition by ensuring the community has the economic stability and trust in the company's management needed to adapt to new realities. This multi-layered impact of corporate stewardship is evident in comparative studies, such as those conducted in mining communities in Ghana, which demonstrate that financial stability provided by the mine can foster community resilience and openness to transition when appropriately channeled (Hilson and Okoh, 2013; Eslamishoar, 2021).

The second factor, strategic environmental governance, refers to the policies, strategies, and actions undertaken by the mining company to manage its environmental impacts responsibly and sustainably. Additionally, the community's historical experiences with the environmental impacts of mining have shaped their trust in environmental governance. Effective environmental management by the mining company has built trust and assured residents that their environment will be protected post-mining. This trust is crucial for the community's willingness to support and adapt to new strategies that ensure long-term environmental health. When considered in isolation, the hypothesis that a more strategic approach to environmental governance would lead to a higher desire for change among the community members was not statistically significant. This could suggest that while the community values environmental stewardship, it may not directly translate to an immediate desire to adopt new strategies, especially if their immediate implications are unclear or lack tangible benefits (Satterfield et al., 2013; Fraser and Kunz, 2018). However, the subtlety of this factor's influence lies in its capacity to build trust and a sense of long-term security, which are critical components in any transition phase. For instance, a study in the Alcoa of Australia mining industry showed that strategic environmental initiatives contribute to a culture of innovation and adaptation by nurturing trust between the company and the community (McDonald and Young, 2012). In Bantar Karet, even if the factor did not emerge as significant on its own, its presence is a necessary condition that underpins the community's readiness to transition, providing a platform upon which adaptability can be built. Strategic environmental governance is crucial because it addresses the long-term environmental sustainability of the area (Koskimaa et al., 2021; Vanhulst and Beling, 2021; Li et al., 2024; Sun et al., 2024), ensuring that the community can thrive in a post-mining scenario. By implementing strategic environmental policies, the mining company demonstrates a commitment to the community's future well-being, which helps to alleviate fears and build confidence in the transition process. This, in turn, makes community members more willing to engage with new strategies that promise a sustainable and stable future.

Factor 3, community capacity building, highlights the role of development programs and initiatives to enhance the community's

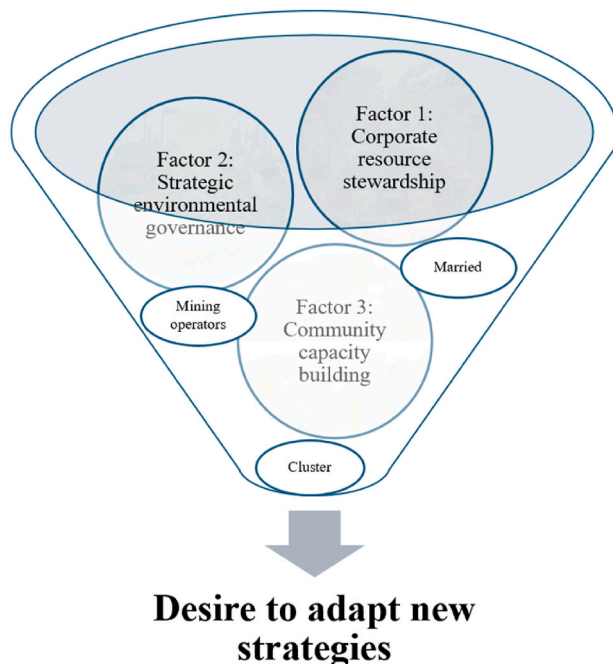


Fig. 3. Conceptual framework depicting the influences on community readiness for post-mining transition.

skills, knowledge, and competencies. This factor was found to have a significant positive relationship with the community's desire to adapt new strategies. Such capacity-building efforts are particularly relevant in the context of mine closure, as they prepare community members to pursue alternative livelihoods and support economic diversification. Cultural practices of mutual aid and collective effort have historically made the community resilient. Capacity-building initiatives by the mining company, such as training and education programs, have further enhanced these traits. These efforts are crucial in preparing residents for alternative livelihoods, making them more adaptable and ready to embrace new economic strategies once mining operations cease.

The significant impact of community development on fostering adaptability is reinforced in studies from South African mining regions, where the success of transition strategies has been strongly linked to the level of investment in the community's human capital (Hägele et al., 2022; Nel et al., 2023). These studies demonstrate that when communities receive targeted training and educational programs, they are better equipped to handle the socioeconomic shifts that accompany mine closures. Capacity-building initiatives give community members a broader vision of their potential roles in a post-mining economy (Everingham et al., 2022; Dychkovskiy et al., 2024; Worden et al., 2024). Training programs, educational initiatives, and skill development workshops can mitigate the economic shock of mine closure by enabling residents to envisage and work toward a future that is not solely dependent on mining. This forward-thinking approach ensures that the community is not left behind when mining operations cease but is prepared to proactively engage with new economic models (Volintiru and Nicola, 2024). The coal mining regions in Appalachia offer a comparative perspective, where community transition to post-mining economies has been successful in places where comprehensive community capacity building was undertaken (Betz et al., 2015; Engle, 2019; Fletcher et al., 2023). These programs provided immediate skills and employment opportunities and helped communities develop long-term strategies for sustainable development.

Mining operators also play a crucial role as a demographic group that may resist change due to potential job losses. They often possess insider knowledge about the mine's operational lifespan and may have first-hand information about the viability of post-mining plans. When merged with the broader pressing reality of a mine's closure, their unique perspective can influence the community's outlook on adapting to new strategies (Roemer and Haggerty, 2021). Moreover, while not a significant predictor individually, marital status is a socio-demographic lens influencing the perceived need for stability or change. Studies show that marital status affects risk aversion and openness to change, with married individuals often seeking stability (Aumeboonsuke and Caplanova, 2023). This demographic characteristic could dampen the inclination towards embracing new strategies, as married individuals may prioritize economic stability over potential but uncertain new opportunities. Considering the cluster variable, which represents the k-means clustering of community responses, its lack of individual significance might suggest that within-group differences are not potent enough to independently predict the desire for change. However, clusters can represent sub-groups within the community that share similar attitudes and experiences. Their collective influence on readiness for change can be significant when interacting with other variables, indicating that while individual demographics may not show strong predictive power alone, their combined effects in group dynamics are substantial. Mining operators' resistance to post-mining strategies is rooted in job security concerns, risk aversion, and the disruption of established economic roles. Their insider knowledge and cautious perspective can significantly shape community attitudes towards new socioeconomic strategies, highlighting the importance of addressing their concerns in the transition planning process.

The overall picture that emerges from the model is that the community's readiness for post-mining strategies results from a confluence of different but interrelated factors. This aligns with findings from other

mining communities across different contexts. In essence, this study adds to the body of literature by demonstrating that the cumulative impact of multiple factors shapes a community's readiness for change rather than isolated influences. This holistic understanding is crucial for mining companies and policymakers, suggesting that strategies for fostering adaptability in post-mining economies must be comprehensive, inclusive, and sensitive to the interconnected nature of these influences. The study's findings advocate for an integrative approach to designing transition strategies that leverage CSR initiatives, environmental governance, and community empowerment to build a cohesive and dynamic model for change (León-Fernández et al., 2018; McLennan and Banks, 2019). In environmental management, the research indicates a pressing need for policies that advocate for a seamless integration of environmental stewardship within mining operations. This integration must satisfy current regulatory compliance and proactively consider the community's long-term environmental health and sustainability. There is a call for mining companies to develop comprehensive environmental plans that include clear post-mining land use objectives and community welfare considerations (Everingham et al., 2018). Such forward-thinking approaches to environmental management can lay a solid foundation for transitioning to new post-mining economies, as evidenced by the success of post-mining land use planning in regions such as the Rhineland coalfields in Germany (Gerwin et al., 2023). The initiatives outlined in Table 6 illustrate various strategies to increase community capacity and maintain economic stability post-mining:

Turning to CSR, the research findings have critical implications for policy development. Policies must encourage mining companies to view CSR initiatives not as optional add-ons but as integral to their operational framework. This means investing in community capacity-building efforts beyond immediate operational interests to foster long-term resilience and adaptability. Capacity building is crucial for equipping communities with the skills and knowledge to navigate post-mining transitions effectively (Everingham et al., 2020; Chidzingu and Wafer, 2024). Furthermore, policies should prompt mining companies to

Table 6
Various strategies to increase community capacity and maintain economic stability post-mining

Initiative	Description	Benefits
Vocational training programs (Pearson et al., 2015; Béglise and Supeno, 2023)	Offering vocational training in fields such as renewable energy, agriculture, and small-scale manufacturing.	Develops new marketable skills for alternative livelihoods (e.g., solar panel technicians, organic farmers).
Small business development workshops (Bainton and Macintyre, 2013; Marot and Harfst, 2021; Akbar et al., 2021)	Providing workshops on entrepreneurship and small business management, including training on business planning, marketing, financial management, and accessing microfinance.	Fosters entrepreneurship and self-reliance, enabling community members to start and manage their own businesses.
Community-based tourism initiatives (Baihaqi and Islami, 2022; Syafrini et al., 2023)	Developing eco-tourism and heritage tourism projects that leverage natural and cultural assets of the region, including training as tour guides, hospitality staff, and local artisans.	Tourism creates new employment and income opportunities (e.g., underground mining museums, GeoEcoEduTourism parks).
Agricultural diversification projects (Mbilima, 2021; Handono et al., 2023)	Implementing agricultural projects that promote crop diversification and sustainable farming practices, with training on permaculture, aquaponics, and organic farming.	Enhances food security and provides alternative income sources through innovative and sustainable agricultural techniques.

implement CSR initiatives closely aligned with the community's evolving needs and aspirations. This calls for a dynamic approach to CSR, one that actively involves community input in the planning and execution of CSR activities. CSR policies co-created with community stakeholders are more likely to be relevant, effective, and sustainable (Maas and Reniers, 2014; Baumgartner, 2014). There is an essential need for policy frameworks that facilitate the diversification of local economies post-mine closure. These implications suggest that mining companies adopt comprehensive sustainability reporting frameworks encompassing detailed accounts of their CSR activities, community engagement efforts, and post-mining environmental strategies. Such frameworks should align with international guidelines like the Global Reporting Initiative (GRI) (Halkos and Nomikos, 2021; Ivic et al., 2021), ensuring transparency, accountability, and stakeholder engagement. Enhanced sustainability reporting can drive mining companies towards more responsible and community-focused practices, ultimately supporting the long-term sustainability of the environment and the local communities affected by mining operations.

5. Conclusion

The conclusion drawn from this study centers on the intricate and multi-dimensional nature of the community's readiness to transition from a mining-dependent economy to diversified post-mining opportunities. The study has shown that corporate resource stewardship, while essential, may paradoxically reduce the community's impetus for seeking new socioeconomic strategies if the community becomes too content or dependent on the status quo. Strategic environmental governance, albeit not a significant predictor in isolation, when synergized with other factors, contributes to a culture of trust and long-term environmental consideration, which is essential for community acceptance and support for transition strategies. Community capacity building emerged as a crucial factor with a clear positive correlation, indicating that empowering the community with education and skills fosters adaptability and resilience.

These conclusions suggest that a successful transition for a community facing the closure of its primary economic engine, the mine, requires a comprehensive, integrated approach. The findings advocate for establishing a solid foundation of trust through responsible environmental stewardship and transparent communication while investing in the community's capacity to grow and adapt. Furthermore, the research highlights the necessity for nuanced policy development that appreciates the complex social, economic, and environmental factors. Policies and CSR initiatives must be flexible and responsive to the needs and voices of the community, ensuring that as the mining chapter closes, a new narrative of sustainable development and diversified economic opportunities can be authored. In the broader context, this study provides a template for other mining operations approaching the end of their life cycle. It offers insights into strategic planning, community engagement, and CSR practices that can lead to positive outcomes for mining companies and the communities they impact.

CRedit authorship contribution statement

Agung Dwi Sutrisno: Resources, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Chun-Hung Lee:** Supervision, Methodology, Investigation. **Sapta Suhardono:** Visualization, Writing – original draft, Writing – review & editing. **I Wayan Koko Suryawan:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence

the work reported in this paper. Additionally, the authors declare that there is no competing interest associated with the grant received for this research. This research was funded by the National Science and Technology Council (NSTC), Taiwan, under grant number 109-2628-M-259-001-MY3.

Data availability

Data will be made available on request.

References

- Agboola, O., Babatunde, D.E., Isaac Fayomi, O.S., et al., 2020. A review on the impact of mining operation: monitoring, assessment and management. *Results Eng* 8, 100181. <https://doi.org/10.1016/j.rineng.2020.100181>.
- Akbar, D., Rolfe, J., Lechner, A.M., et al., 2021. Workshop processes to generate stakeholder consensus about post-mining land uses: an Australian case study. *J. Environ. Plann. Manag.* 64, 334–358. <https://doi.org/10.1080/09640568.2020.1764341>.
- Antwi-Agyei, P., Stringer, L.C., 2021. Improving the effectiveness of agricultural extension services in supporting farmers to adapt to climate change: insights from northeastern Ghana. *Clim Risk Manag* 32, 100304. <https://doi.org/10.1016/j.crm.2021.100304>.
- Aumeboonsuke, V., Caplanova, A., 2023. An analysis of impact of personality traits and mindfulness on risk aversion of individual investors. *Curr. Psychol.* 42, 6800–6817. <https://doi.org/10.1007/s12144-021-02015-9>.
- Awang, Z., Afthanorhan, A., Mohamad, M., Asri, M.A.M., 2015. An evaluation of measurement model for medical tourism research: the confirmatory factor analysis approach. *Int. J. Tourism. Pol.* 6, 29–45. <https://doi.org/10.1504/IJTP.2015.075141>.
- Baihaqki, U., Islami, P.Y.N., 2022. Mapping creative amenities to develop tourism potentials in a post-mining area: a case study of Bantar Karet village, Bogor Regency, Indonesia. *Indones. J. Geogr.* 54, 327–332.
- Bainton, N., Holcombe, S., 2018. A critical review of the social aspects of mine closure. *Resour. Pol.* 59, 468–478. <https://doi.org/10.1016/j.resourpol.2018.08.020>.
- Bainton, N.A., Macintyre, M., 2013. "My land, my work": business development and large-scale mining in Papua New Guinea. In: McCormack, F., Barclay, K. (Eds.), *Engaging with Capitalism: Cases from Oceania*. Emerald Group Publishing Limited, pp. 139–165.
- Barbett, L., Stuppel, E.J.N., Sweet, M., et al., 2020. Measuring actions for nature—development and validation of a pro-nature conservation behaviour scale. *Sustainability* 12.
- Baumgartner, R.J., 2014. Managing corporate sustainability and CSR: a conceptual framework combining values, strategies and instruments contributing to sustainable development. *Corp. Soc. Responsib. Environ. Manag.* 21, 258–271. <https://doi.org/10.1002/csr.1336>.
- Bélisle, R., Supeno, E., 2023. Lifelong learning in validation of prior learning within vocational mining training in Québec (Canada). *PLA Insid out an Int J theory. Res Pract Prior Learn Assess.*
- Betz, M.R., Partridge, M.D., Farren, M., Lobao, L., 2015. Coal mining, economic development, and the natural resources curse. *Energy Econ.* 50, 105–116. <https://doi.org/10.1016/j.eneco.2015.04.005>.
- Bridge, G., 2004. Contested terrain: mining and the environment. *Annu. Rev. Environ. Resour.* 29, 205–259.
- Cacciottolo, C., Atencio, E., 2023. In-pit disposal of mine tailings for a sustainable mine closure: a responsible alternative to develop long-term green mining solutions. *Sustainability* 15.
- Camilleri, M.A., 2022. Strategic attributions of corporate social responsibility and environmental management: the business case for doing well by doing good. *Sustain. Dev.* 30, 409–422. <https://doi.org/10.1002/sd.2256>.
- Castilla-Gómez, J., Herrera-Herbert, J., 2015. Environmental analysis of mining operations: dynamic tools for impact assessment. *Miner. Eng.* 76, 87–96. <https://doi.org/10.1016/j.mineng.2014.10.024>.
- Chidzungu, T., Wafer, A., 2024. Can Social Impact Assessments (SIAs) be a sustainable strategy to address the skills development gap and community sustainability challenges in Just Energy Transition (JET) policy decision-making? Evidence from the South African mining communities of Krie. *S. Afr. Geogr. J.* 106, 89–108. <https://doi.org/10.1080/03736245.2023.2214537>.
- Council, C.E., 2014. *Annual Report 2018*. Prince Edward Island Marketing Council.
- Dychkovskiy, R., Saik, P., Sala, D., Cabana, E.C., 2024. The current state of the non-ore mineral deposits mining in the concept of the Ukraine reconstruction in the post-war period. *Miner. Econ.* <https://doi.org/10.1007/s13563-024-00436-z>.
- Dzisi, E.K.J., Lugada, T., 2021. Modeling the potential shift from motorcycles (boda bodas) to bicycles among young people on a Ugandan university campus. *Sci African* 12, e00741. <https://doi.org/10.1016/j.sciaf.2021.e00741>.
- Emin Öcal, M., Oral, E.L., Erdis, E., Vural, G., 2007. Industry financial ratios—application of factor analysis in Turkish construction industry. *Build. Environ.* 42, 385–392. <https://doi.org/10.1016/j.buildenv.2005.07.023>.
- Engle, E.W., 2019. "Coal is in our food, coal is in our blood": everyday environmental injustices of rural community gardening in Central Appalachia. *Local Environ.* 24, 746–761. <https://doi.org/10.1080/13549839.2019.1640668>.

- Eslamishoar, F., 2021. Seeking Methods for Improving Sustainability in the Extractive Sector. EPFL.
- Everingham, J.-A., Rolfe, J., Lechner, A.M., et al., 2018. A proposal for engaging a stakeholder panel in planning post-mining land uses in Australia's coal-rich tropical savannahs. *Land Use Pol.* 79, 397–406. <https://doi.org/10.1016/j.landusepol.2018.08.038>.
- Everingham, J.-A., Svobodova, K., Lèbre, É., et al., 2022. Comparative capacity of global mining regions to transition to a post-mining future. *Extr. Ind. Soc.* 11, 101136 <https://doi.org/10.1016/j.exis.2022.101136>.
- Everingham, J., MacKenzie, S., Svobodova, K., Witt, K., 2020. Participatory processes, mine closure and social transitions. *Cent Soc Responsib Mining, Univ Queensl.*
- Ferraz, M.F.F., 2012. Sustainability beyond Mining: Transformations in Systems for Secondary Beneficiation. University of Johannesburg, South Africa.
- Fletcher, R.A., Long, R.-E., Schumann, W., 2023. *Engaging Appalachia: A Guidebook for Building Capacity and Sustainability*. University Press of Kentucky.
- Fraser, J., Kunz, N.C., 2018. Water stewardship: attributes of collaborative partnerships between mining companies and communities. *Water* 10.
- Gao, M., Xie, J., Gao, Y., et al., 2021. Mechanical behavior of coal under different mining rates: a case study from laboratory experiments to field testing. *Int. J. Min. Sci. Technol.* 31, 825–841. <https://doi.org/10.1016/j.ijmst.2021.06.007>.
- Gerwin, W., Raab, T., Birkhofer, K., et al., 2023. Perspectives of lignite post-mining landscapes under changing environmental conditions: what can we learn from a comparison between the Rhenish and Lusatian region in Germany? *Environ. Sci. Eur.* 35, 36. <https://doi.org/10.1186/s12302-023-00738-z>.
- Hägele, R., Iacobuță, G.I., Tops, J., 2022. Addressing climate goals and the SDGs through a just energy transition? Empirical evidence from Germany and South Africa. *J. Integr. Environ. Sci.* 19, 85–120. <https://doi.org/10.1080/1943815X.2022.2108459>.
- Halkos, G., Nomikos, S., 2021. Corporate social responsibility: trends in global reporting initiative standards. *Econ. Anal. Pol.* 69, 106–117. <https://doi.org/10.1016/j.eap.2020.11.008>.
- Handono, S.Y., Hidayat, K., Purnomo, M., Toiba, H., 2023. Community resilience to natural resource vulnerability due to sand mining through the application of Integrated Farming System (IFS). *J Degrad Min Lands Manag* 10.
- Hasibuan, R.S., Taopik, R., 2019. Perencanaan Ekowisata Di areal PT ANTAM Tbk, Bogor, Jawa Barat. In: *Talanta Conference Series: Agricultural and Natural Resources (ANR)*, pp. 34–43.
- Hilson, A., Hilson, G., Dauda, S., 2019. Corporate social responsibility at African mines: linking the past to the present. *J. Environ. Manag.* 241, 340–352. <https://doi.org/10.1016/j.jenvman.2019.03.121>.
- Hilson, G., 2012. Corporate Social Responsibility in the extractive industries: experiences from developing countries. *Resour. Pol.* 37, 131–137. <https://doi.org/10.1016/j.resourpol.2012.01.002>.
- Hilson, G., Hu, Y., Hilson, A., et al., 2024. Rethinking resource enclivity in developing countries: embedding Global Production Networks in gold mining regions. *J. Econ. Geogr.* 24, 95–116. <https://doi.org/10.1093/jeg/ibad028>.
- Hilson, G., Okoh, G., 2013. In: Campbell, B.K. (Ed.), *Artisanal Mining in Ghana: Institutional Arrangements, Resource Flows and Poverty Alleviation BT - Modes of Governance and Revenue Flows in African Mining*. Palgrave Macmillan UK, London, pp. 138–163.
- Hira, A., Busumtwi-Sam, J., 2018. Mining community benefits in Ghana: a case of unrealized potential. A Proj funded by Can Int Resour Dev Inst.
- Hundloe, T., 2021. In: Hundloe, T. (Ed.), *Sustainability Perspectives: Ecological, Economic and Social BT - Environmental Impact Assessment: Incorporating Sustainability Principles*. Springer International Publishing, Cham, pp. 49–80.
- Hur, W.-M., Moon, T.-W., Kim, H., 2020. When and how does customer engagement in CSR initiatives lead to greater CSR participation? The role of CSR credibility and customer-company identification. *Corp. Soc. Responsib. Environ. Manag.* 27, 1878–1891. <https://doi.org/10.1002/csr.1933>.
- Irfan, M., Elavarasan, R.M., Hao, Y., et al., 2021. An assessment of consumers' willingness to utilize solar energy in China: end-users' perspective. *J. Clean. Prod.* 292, 126008 <https://doi.org/10.1016/j.jclepro.2021.126008>.
- Ivic, A., Saviolidis, N.M., Johannsdottir, L., 2021. Drivers of sustainability practices and contributions to sustainable development evident in sustainability reports of European mining companies. *Discov Sustain* 2, 17. <https://doi.org/10.1007/s43621-021-00025-y>.
- Kakembo, V., Rowntree, K., Palmer, A.R., 2007. Topographic controls on the invasion of *Pteronia incana* (Blue bush) onto hillslopes in Ngqushwa (formerly Peddie) district, Eastern Cape, South Africa. *Catena* 70, 185–199. <https://doi.org/10.1016/j.catena.2006.08.005>.
- Kamalaldin, A., Sjödin, D., Hullova, D., Parida, V., 2021. Configuring ecosystem strategies for digitally enabled process innovation: a framework for equipment suppliers in the process industries. *Technovation* 105, 102250. <https://doi.org/10.1016/j.technovation.2021.102250>.
- Kanwal, S., Rasheed, M.I., Pitafi, A.H., et al., 2020. Road and transport infrastructure development and community support for tourism: the role of perceived benefits, and community satisfaction. *Tourism Manag.* 77, 104014 <https://doi.org/10.1016/j.tourman.2019.104014>.
- Kmieciak, R., 2021. Trust, knowledge sharing, and innovative work behavior: empirical evidence from Poland. *Eur. J. Innovat. Manag.* 24, 1832–1859. <https://doi.org/10.1108/EJIM-04-2020-0134>.
- Koskimaa, V., Rapeli, L., Hiedanpää, J., 2021. Governing through strategies: how does Finland sustain a future-oriented environmental policy for the long term? *Futures* 125, 102667. <https://doi.org/10.1016/j.futures.2020.102667>.
- Kusumoarto, A., Gunawan, A., Machfud, Hikmat A., 2021. Institutional model for ecotourism development in the Gunung Pongkor post-mining area. *IOP Conf. Ser. Earth Environ. Sci.* 879, 12001 <https://doi.org/10.1088/1755-1315/879/1/012001>.
- Lawrence, R., Moritz, S., 2019. Mining industry perspectives on indigenous rights: corporate complacency and political uncertainty. *Extr. Ind. Soc.* 6, 41–49. <https://doi.org/10.1016/j.exis.2018.05.008>.
- Lechner, A.M., McIntyre, N., Witt, K., et al., 2017. Challenges of integrated modelling in mining regions to address social, environmental and economic impacts. *Environ. Model. Software* 93, 268–281. <https://doi.org/10.1016/j.envsoft.2017.03.020>.
- León-Fernández, Y., Gomera, A., Antúnez, M., et al., 2018. Enhancing environmental management in universities through participation: the case of the University of Córdoba. *J. Clean. Prod.* 172, 4328–4337. <https://doi.org/10.1016/j.jclepro.2017.06.103>.
- Li, H., Tang, M., Cao, A., Guo, L., 2024. How to reduce firm pollution discharges: does political leaders' gender matter? *Technol. Forecast. Soc. Change* 204, 123432. <https://doi.org/10.1016/j.techfore.2024.123432>.
- Litvinenko, V.S., 2020. Digital economy as a factor in the technological development of the mineral sector. *Nat. Resour. Res.* 29, 1521–1541. <https://doi.org/10.1007/s11053-019-09568-4>.
- Maas, S., Reniers, G., 2014. Development of a CSR model for practice: connecting five inherent areas of sustainable business. *J. Clean. Prod.* 64, 104–114. <https://doi.org/10.1016/j.jclepro.2013.07.039>.
- Marimuthu, R., Sankaranarayanan, B., Ali, S.M., et al., 2021. Assessment of key socio-economic and environmental challenges in the mining industry: implications for resource policies in emerging economies. *Sustain. Prod. Consum.* 27, 814–830. <https://doi.org/10.1016/j.spc.2021.02.005>.
- Marot, N., Harfst, J., 2021. Post-mining landscapes and their endogenous development potential for small- and medium-sized towns: examples from Central Europe. *Extr. Ind. Soc.* 8, 168–175. <https://doi.org/10.1016/j.exis.2020.07.002>.
- Mbilima, F., 2021. Extractive industries and local sustainable development in Zambia: the case of corporate social responsibility of selected metal mines. *Resour. Pol.* 74, 101441 <https://doi.org/10.1016/j.resourpol.2019.101441>.
- McDonald, S., Young, S., 2012. Cross-sector collaboration shaping Corporate Social Responsibility best practice within the mining industry. *J. Clean. Prod.* 37, 54–67. <https://doi.org/10.1016/j.jclepro.2012.06.007>.
- McDonnell, M., Dill, L., Panos, S., et al., 2020. Verbal fluency as a screening tool for mild cognitive impairment. *Int. Psychogeriatr.* 32, 1055–1062. <https://doi.org/10.1017/S1041610219000644>.
- McLennan, S., Banks, G., 2019. Reversing the lens: why corporate social responsibility is not community development. *Corp. Soc. Responsib. Environ. Manag.* 26, 117–126. <https://doi.org/10.1002/csr.1664>.
- Mulyana, R., Suryawan, I.W.K., Septiariva, I.Y., Prayogo, W., Suhardono, S., Sari, M.M., Arifaningsih, N.N., 2024. An exploration into behavioral determinants of water-saving attitudes and their sociodemographic influences in Jakarta, Indonesia. *Water Conservation and Management* 08 (1), 115–122. <https://doi.org/10.26480/wcm.01.2024.115.122>.
- Nehring, M., Cheng, X., 2016. An investigation into the impact of mine closure and its associated cost on life of mine planning and resource recovery. *J. Clean. Prod.* 127, 228–239. <https://doi.org/10.1016/j.jclepro.2016.03.162>.
- Nel, E., Marais, L., Mqotyana, Z., 2023. The regional implications of just transition in the world's most coal-dependent economy: the case of Mpumalanga, South Africa. *Front. Sustain. Cities* 4.
- Ngan, A.C.H., Sinha, A.K., Saad, H.B., Jaafar, J.B., 2021. Driving resource stewardship to reduce hydrocarbon resource development for sustainability and growth in Sarawak region. *SPE/IATMI Asia Pacific Oil Gas Conf. Exhib. D011S001R006*.
- Nguyen, V.V., Nguyen, H.T.T., Phan, T.T.T., Lee, C.-H., 2023. Determinants of locals' willingness to participate in human-elephant conflict management: evidence from Dong Nai Biosphere Reserve, Vietnam. *Trees, For People* 14, 100435. <https://doi.org/10.1016/j.tfp.2023.100435>.
- Nguyen, V.V., Phan, T.T.T., Chun-Hung, L., 2022. Integrating multiple aspects of human-elephant conflict management in Dong Nai Biosphere Reserve, Vietnam. *Glob. Ecol. Conserv.* 39, e02285. <https://doi.org/10.1016/j.gecco.2022.e02285>.
- Ni Riordain, R., Hodgson, T., Porter, S., Fedele, S., 2016. Validity and reliability of the chronic oral mucosal diseases questionnaire in a UK population. *J. Oral Pathol. Med.* 45, 613–616. <https://doi.org/10.1111/jop.12425>.
- Nikadimovs, O., 2023. Corporate social responsibility—assessment of facilitating and impeding factors for small and medium-sized enterprises in Latvia. *Eur. Integrat. Stud.* 222–241.
- Ogunkan, D.V., 2022. Achieving sustainable environmental governance in Nigeria: a review for policy consideration. *Urban Gov* 2, 212–220. <https://doi.org/10.1016/j.ugj.2022.04.004>.
- Owen, J.R., Kemp, D., 2023. A return to responsibility: a critique of the single actor strategic model of CSR. *J. Environ. Manag.* 341, 118024 <https://doi.org/10.1016/j.jenvman.2023.118024>.
- Pearson, C.A.L., Daff, S., Helms, K., 2015. Indigenous engagement in a vocational educational training programme in Australia. *Responsible Min Case Stud Manag Soc Environ Risks Dev World Englewood, Color Soc Mining, Metall Explor* 115–150.
- Phan, T.T.T., Nguyen, V.V., Thu Nguyen, H.T., Lee, C.-H., 2023. Estimating citizen's adaptive behavior for sustainable plastic waste management based on a choice experiment. *J. Clean. Prod.* 422, 138617 <https://doi.org/10.1016/j.jclepro.2023.138617>.
- Raharjanti, N.W., Wiguna, T., Purwadianto, A., et al., 2022. Translation, validity and reliability of decision style scale in forensic psychiatric setting in Indonesia. *Heliyon* 8, e09810.

- Rahimnia, F., Hassanzadeh, J.F., 2013. The impact of website content dimension and e-trust on e-marketing effectiveness: the case of Iranian commercial saffron corporations. *Inf. Manag.* 50, 240–247. <https://doi.org/10.1016/j.im.2013.04.003>.
- Ramesh, V., Chandr, Jaunky V., 2021. Public awareness and perception towards conservation of Mauritian Flying Fox (*Pteropus Niger*): structural equation modelling. *Mater. Today Proc.* 37, 2269–2278. <https://doi.org/10.1016/j.matpr.2020.07.703>.
- Roemer, K.F., Haggerty, J.H., 2021. Coal communities and the U.S. energy transition: a policy corridors assessment. *Energy Pol.* 151, 112112 <https://doi.org/10.1016/j.enpol.2020.112112>.
- Roh, T., Kim, M.-J., Hong, Y., 2023. Does servant leadership decrease bad behaviors? The mediating role of psychological safety and the moderating effect of corporate social responsibility. *Sustainability* 15.
- Rohaendi, N., Herlinawati, H., 2024. Developing sustainable geotourism as post-mining land use programs in Indonesia. *J Degrad Min Lands Manag* 11, 5181–5193. <https://doi.org/10.15243/jdmlm.2024.112.5181>.
- Satterfield, T., Gregory, R., Klain, S., et al., 2013. Culture, intangibles and metrics in environmental management. *J. Environ. Manag.* 117, 103–114. <https://doi.org/10.1016/j.jenvman.2012.11.033>.
- Singh, F., Saini, M., Kumar, A., et al., 2023. Perspective of educational environment on students' perception of teaching and learning. *Learn. Environ. Res.* 26, 337–359. <https://doi.org/10.1007/s10984-022-09428-8>.
- Suhardono, S., Fitria, L., Suryawan, I.W.K., Ulhasanah, N., Sari, M.M., Septiariva, I.Y., Prayogo, W., 2024. Multidimensional factors of community behavioral responses and implications to landfill closures: A case study in Yogyakarta, Indonesia. *Environmental Advances* 16, 100533. <https://doi.org/10.1016/j.envadv.2024.100533>.
- Sun, Z., Sun, X., Dong, Y., 2024. Does negative environmental performance feedback induce substantive green innovation? The moderating roles of external regulations and internal incentive. *Corp Soc Responsib Environ Manag* n/a. <https://doi.org/10.1002/csr.2722>.
- Suryawan, I.W.K., Lee, C.-H., 2023. Community preferences in carbon reduction: unveiling the importance of adaptive capacity for solid waste management. *Ecol. Indic.* 157, 111226 <https://doi.org/10.1016/j.ecolind.2023.111226>.
- Suryawan, I.W.K., Lee, C.-H., 2024. Importance-performance dynamics and willingness to pay in coastal areas for climate-adaptive marine debris management. *Reg Stud Mar Sci* 103596. <https://doi.org/10.1016/j.risma.2024.103596>.
- Suryawan, I.W.K., Septiariva, I.Y., Sari, M.M., et al., 2023. Acceptance of waste to energy (WtE) technology by local residents of Jakarta city, Indonesia to achieve sustainable clean and environmentally friendly energy. *J Sustain Dev Energy, Water Environ Syst* 11, 1004.
- Suryawan, I.W.K., Sianipar, I.M.J., Lee, C.H., 2024. Reshaping marine debris management post-COVID-19: Integrating adaptive attributes for enhanced community engagement. *Ocean & Coastal Management* 253, 107149. <https://doi.org/10.1016/j.ocecoaman.2024.107149>.
- Sutrisno, A.D., Chen, Y.-J., Suryawan, I.W., Lee, C.-H., 2023. Building a Community's Adaptive Capacity for Post-Mining Plans Based on Important Performance Analysis: Case Study from Indonesia. *Land* 12.
- Syafrini, D., Mardhiah, D., Permata, B.D., Saputri, F., 2023. Social capital and cultural heritage tourism development in former mining town, West Sumatra, Indonesia. *Environ. Dev. Sustain.* <https://doi.org/10.1007/s10668-023-04184-y>.
- Syahrir, R., Wall, F., Diallo, P., 2020. Socio-economic impacts and sustainability of mining, a case study of the historical tin mining in Singkep Island-Indonesia. *Extr. Ind. Soc.* 7, 1525–1533. <https://doi.org/10.1016/j.exis.2020.07.023>.
- Tahar, N.F., Ismail, Z., Zamani, N.D., Adnan, N., 2010. Students' attitude toward Mathematics: the use of factor analysis in determining the criteria. *Procedia - Soc Behav Sci* 8, 476–481. <https://doi.org/10.1016/j.sbspro.2010.12.065>.
- Tehupeiory, A., Mulyana, R., Sianipar, I.M.J., et al., 2023. The environmental challenges of urban living: why willingness to pay for apartments matters. *Environ Challenges* 100766. <https://doi.org/10.1016/j.envc.2023.100766>.
- Turcotte, M.-F., Lachance, A., 2023. Towards a repertoire of Corporate Social Responsibility (CSR) practices in the extractive industries. *Extr. Ind. Soc.* 15, 101316 <https://doi.org/10.1016/j.exis.2023.101316>.
- Van Assche, K., Beunen, R., Gruezmacher, M., Duineveld, M., 2020. Rethinking strategy in environmental governance. *J. Environ. Pol. Plann.* 22, 695–708. <https://doi.org/10.1080/1523908X.2020.1768834>.
- Vanhulst, J., Beling, A.E., 2021. Mapping environmental/sustainable governance research in Chile: a bibliometric and network analysis. *Sustainability* 13.
- Volintiru, C., Nicola, S., 2024. Limitations of Coordinative Europeanisation in the Just Transition Mechanism in Romania. *Compet Chang* 10245294241242256.
- Waqar, A., Hannan Qureshi, A., Othman, I., et al., 2024. Exploration of challenges to deployment of blockchain in small construction projects. *Ain Shams Eng. J.* 15, 102362 <https://doi.org/10.1016/j.asej.2023.102362>.
- Wei, A., Zakari, A., Tawiah, V., Aleesa, N., 2024. Cultivating resilient economies through responsible mineral resource trade: does eco-resourcing rebate matter? *Resour. Pol.* 89, 104523 <https://doi.org/10.1016/j.resourpol.2023.104523>.
- Worden, S., Svobodova, K., Côte, C., Bolz, P., 2024. Regional post-mining land use assessment: an interdisciplinary and multi-stakeholder approach. *Resour. Pol.* 89, 104680 <https://doi.org/10.1016/j.resourpol.2024.104680>.
- Worlanyo, A.S., Jiangfeng, L., 2021. Evaluating the environmental and economic impact of mining for post-mined land restoration and land-use: a review. *J. Environ. Manag.* 279, 111623 <https://doi.org/10.1016/j.jenvman.2020.111623>.