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Subordinated Ecologies and Livelihood Transformation in Post-Mining Bangka Belitung: Community Dynamics in a Post-Extractive Landscape

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ABSTRACT

The long-standing tin mining industry in the Bangka Belitung Islands has left a legacy of complex ecological crises, including thousands of abandoned mining pits (kolong), land degradation, and the dislocation of local livelihoods. This study examines how local communities reconstruct their livelihood strategies within a post-extractive landscape characterized by ecological subordination, institutional fragmentation, and asymmetrical power relations. Employing a descriptive qualitative approach through content and critical discourse analysis of policy documents, institutional reports, scholarly publications, and online media coverage, the research traces how national development narratives, policy frameworks, and media representations contribute to the socio-ecological marginalization of post-mining areas in Bangka Belitung. The findings reveal that although community initiatives, such as pit reclamation, participatory agro-tourism, and freshwater aquaculture, are emerging, these efforts are often constrained by unclear land access, weak institutional support, and structural exclusion in land governance. Livelihood transformation in post-mining contexts is not linear but unfolds through politicized processes marked by spatial conflict, community agency, and contested resource control. The study underscores the need for recovery policies that are not merely technocratic, but socially and ecologically transformative, positioning local communities as principal actors. The practical implications point to reforming post-mining governance in a contextualized, participatory, and locally grounded manner to achieve long-term sustainability and ecological justice in extractive-affected regions.

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1. Introduction

Since the 1990s, countries in the Global South have experienced a surge in extractivism as part of post-neoliberal global economic configurations. Pressures for economic growth, market liberalization, and a shift in development orientation toward raw material exports have positioned mining industries as central pillars of national economic policy in many developing nations. In this context, resource extraction-based development has not only been seen as a rational policy choice but also reflects entrenched structural dependencies on global markets and transnational capital (A. J. Bebbington et al., 2018; Gudynas, 2013). Modern extractivism, characterized by its technocratic and legal-formal features, often justifies large-scale resource exploitation at the expense of ecological sustainability and spatial justice. Countries like Indonesia function as resource frontiers for global economic interests, while local communities in mining regions are frequently excluded from decision-making processes and the distribution of development benefits.

The tin mining industry in the Bangka Belitung Islands clearly manifests extractive economic dominance in Indonesia. Since the colonial era, this region has served as one of the world's primary tin producers, with significant consequences for local environments and societies. Centuries of tin mining on Bangka Island have caused the degradation of tens of thousands of hectares of land, exerting immense pressure on local ecosystems (Irvani et al., 2018). Although the industry contributes substantially to state revenue and job creation, it has also left a legacy of ecological destruction and profound social disruption. The proliferation of abandoned mining pits (*kolong*), declining soil quality, and the loss of ecological functions illustrate a structural and cumulative environmental crisis.

At the national level, Indonesia has long prioritized the extractive sector as a foundation of economic development. However, this reliance on primary commodities such as tin, coal, and nickel has also introduced structural vulnerabilities commonly called the "resource curse." This phenomenon not only entrenches short-term economic orientations but also fuels agrarian conflicts, environmental degradation, and the weakening of agrarian production systems vital to local livelihoods (Hill & Pasaribu, 2022; Rachman, 2015). Large-scale extractive projects have often reinforced asymmetrical power relations between the state, corporations, and communities, further exacerbating spatial inequalities.

In Bangka Belitung, the legacy of colonial extractivism has evolved into a contemporary form of extraction. Resource extraction takes two primary forms: legal-formal operations through licensed mining concessions and informal small-scale mining (*tambang rakyat*, or TI). As of 2020, more than 12,000 abandoned mining pits were recorded across the region, most of which remain unreclaimed, both ecologically and socially (WALHI Kepulauan Bangka Belitung, 2024). Land fragmentation, declining environmental carrying capacity, and ecological vulnerability have become part of everyday life in post-mining communities. Moreover, these pits often become flashpoints for horizontal and vertical conflict due to unclear ownership status and weak governance.

Beyond an ecological crisis, the transformation of landscapes in Bangka Belitung has triggered profound changes in social structures and livelihood systems. The shift from agrarian

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to extractive land use has disrupted local food security and fostered dependence on unsustainable mining activities. Many residents who previously relied on agriculture have transitioned to small-scale, informal mining, which is legally precarious and economically unstable (Mongabay Indonesia, 2022). When tin prices fluctuate or mining operations cease, communities face economic disorientation and the erosion of stable livelihood foundations. In such conditions, livelihood transitions are complex and shaped by the interplay between local resilience, global market pressures, and weak institutional support.

Over recent decades, the economies of many developing nations have been marked by the dominance of the extractive sector as the backbone of national development. This model depends on exploiting natural resources, minerals, forests, and agrarian land, to drive economic growth, attract foreign investment, and balance trade accounts. Within the framework of global political economy, developing countries function as resource peripheries, raw material supply zones for industrial capital centers in the Global North (Acosta, 2013; Bridge, 2004). As a result, national development strategies tend to prioritize export quantification over socio-ecological sustainability at the local level. Extractive economies reproduce global power asymmetries and perpetuate new forms of coloniality embedded in growth policies. The state often serves as the principal facilitator for corporate access to extractive spaces, frequently at the expense of local community rights and ecological integrity (A. Bebbington et al., 2008).

Tin mining activities in Bangka Belitung have caused massive ecological damage. Thousands of open-pit mines remain scattered across the region, many of which have not undergone proper reclamation. According to the provincial Department of Energy and Mineral Resources, by 2020, more than 12,000 abandoned pits were recorded, with most lacking clear ecological recovery plans (WALHI Kepulauan Bangka Belitung, 2024). These pits have reduced land productivity, contaminated water sources, and posed safety hazards to nearby residents.

Land degradation has also spread extensively. The Bangka Belitung Environmental Agency reported that 167,104 hectares of land in the region are classified as critical out of a total land area of 1.6 million hectares, reflecting severe pressure on the islands' ecological capacity (Timelines.id, 2023). In addition to soil fertility loss, mining has contributed to the destruction of mangrove ecosystems, increased coastal sedimentation, and a decline in local biodiversity, all of which exacerbate the region's ecological vulnerability.

As formal mining operations decline, many community members have lost their primary sources of income. Due to the lack of viable alternative economic options, many former miners have turned to illegal mining as their only remaining livelihood strategy. This practice accelerates environmental degradation, incites community-level conflict, and exposes residents to legal and safety risks.

In a 2024 hearing, Indonesia's House of Representatives (Commission VI) revealed that Bangka's illegal tin mining networks allegedly involve a broad coalition of actors, including state officials and local elites, which has weakened law enforcement efforts (RI, 2024). This situation perpetuates economic dependency on illegal mining and hinders initiatives to transition toward more sustainable economic sectors.

In many post-mining areas, unequal access to land remains a critical issue. Much of the abandoned mining land lacks clear legal status or is embroiled in disputes among communities, corporations, and government agencies. One notable case occurred in Tanjung Labu Village, Lepar Pongok District, South Bangka Regency, where residents rejected mining activities due to lacking community consultation in permitting and spatial planning processes. A case study by Ferdian et al. found that mining operations by CV SR Bintang Babel proceeded without socialization or consent from the local population, most of whom depend on agriculture and

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fisheries (Ferdian et al., 2022). This situation triggered social conflict between pro- and anti-mining groups and exposed the weak implementation of Free, Prior, and Informed Consent (FPIC) principles in local resource governance.

Conversely, several community-led initiatives to rehabilitate abandoned pits or develop agricultural and aquaculture activities on post-mining land have lacked adequate institutional support. Limited access to financing, technical assistance, and policy backing remain key constraints in developing sustainable alternative livelihoods. Many corporate social responsibility (CSR) and recovery programs are top-down and fail to meaningfully involve local actors, resulting in minimal impact on community socio-ecological resilience.

The socio-ecological crisis in post-mining Bangka cannot be understood merely as a technical failure of reclamation or weak environmental regulation. It is a manifestation of what Martinez-Alier refers to as ecological subordination (Martinez-Alier, 2002), a condition in which ecological interests are systematically marginalized to serve capital accumulation and short-term economic priorities (A. J. Bebbington et al., 2018). Within this framework, nature is not regarded as a living system with intrinsic value but an object of exploitation subjected to extractivist logic.

In response to mining-related disruptions, local communities in Bangka have demonstrated various forms of livelihood transformation through adaptive strategies such as land reclamation, economic diversification, and social organization. These processes reflect community agency in navigating structural pressures, highlighting that residents are not merely victims but active agents in redefining their futures (de Haan & Zoomers, 2005). However, such agency operates within unequal power structures that often constrain rational choices and push some actors into illegal practices as a form of forced adaptation.

To fully understand these dynamics, an interdisciplinary approach is needed. This approach integrates environmental sociology, which examines society–nature relations within power contexts, with political ecology, which maps economic domination over ecological space, and development studies, which analyze social transformation processes amid global inequality. This combined framework enables a more comprehensive reading of post-extractive landscapes while revealing opportunities and constraints for building community-based sustainability.

This study aims to analyze how local communities in Bangka respond to the socio-ecological disruptions left by tin mining activities and to examine the adaptive strategies they have developed to reconstruct livelihoods in post-mining areas. The focus lies on the interaction between community-based livelihood practices, local institutional configurations, and power dynamics that shape the social-ecological structure of post-extractive territories.

Theoretically, this article contributes to the study of ecological subordination and livelihood transformation through the lens of environmental sociology and political ecology, emphasizing the empirical context of Indonesia. Rather than merely documenting community vulnerability, it highlights collective capacities and social agency in generating socio-ecological innovations amid structural pressures.

The study's findings are relevant for formulating more participatory, context-sensitive, and community-driven post-mining land recovery policies, placing local actors at the forefront of long-term sustainability agendas.

2. Literature Review

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2.1. Extractivism and Ecological Subordination

Extractivism has become a dominant feature of economic development in countries of the Global South, where natural resources are intensively exploited to serve national growth agendas and meet global market demands (Acosta, 2013; Gudynas, 2013). Within the framework of political ecology, extractivism is understood not merely as an economic activity but as an institutionalized power relation in which the state acts as a primary facilitator of capital interests, often at the expense of social and ecological sustainability (A. J. Bebbington et al., 2018; Hanson et al., 2003). This model creates structural inequalities between centers of capital accumulation and zones of exploitation, what Bridge refers to as "resource peripheries" (Bridge, 2004).

The concept of ecological subordination explains how natural systems are systematically undermined in favor of capital accumulation and short-term economic gains. Martinez-Alier characterizes this process as part of a "political ecology of conflicts," where tensions between ecological sustainability and economic expansion lead to the marginalization of nature's intrinsic value (Martinez-Alier, 2002). In such contexts, nature is reduced to a socially neutral resource, with little regard for its interconnections with local livelihood systems, cultural meanings, and community rights to space and territory (Gardner & Escobar, 1996).

Studies from Latin America and Africa demonstrate that ecological subordination directly disrupts local livelihood systems, especially in post-extractive contexts. For example, Perreault documents how mining communities in Bolivia experience shifts in labor structures and increasing reliance on informal economic survival strategies (Perreault, 2014). Li observes a similar pattern in Indonesia, where nickel mining in Sulawesi has reshaped power relations between corporations, the state, and local populations, while simultaneously impeding community initiatives to develop alternative economies (Li, 2014).

In the Indonesian context, mining sector governance is often legitimized through national development narratives that emphasize economic growth, but its actual implementation reveals regulatory complexity and unequal access to resources. Spiegel highlights how decentralization and mining law reforms have affected labor inequalities in Indonesia's small-scale mining sector, particularly impacting communities dependent on informal mining (Spiegel, 2012). Liao and Zhang further compare mining governance models in Indonesia and the Philippines, showing how differences in political systems and economic policies have led to divergent trajectories in the development of extractive industries in both countries (Liao & Zhang, 2024).

Although a substantial body of research has examined the socio-ecological impacts of extractivism, fewer studies have explored in depth how local communities adapt and reconstruct livelihoods in post-extractive settings, particularly through the lens of environmental sociology. This study seeks to address that gap by examining community agency within the context of ecological subordination, and how such agency is mobilized to reconfigure livelihood practices and social structures amid structural constraints and ecological uncertainty.

2.2. Livelihood Transformation and Local Community Agency

Livelihood transformation refers to the dynamic process through which individuals or communities alter their economic strategies, social relations, and resource access in response to structural or ecological changes (Ellis, 2000; Scoones, 1998). In post-extractive contexts, such transformations are often non-linear and unfold under economic pressure, regulatory uncertainty, and environmental degradation conditions. The Sustainable Livelihoods Framework (SLF) emphasizes the significance of five key assets, natural, human, social,

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financial, and physical capital, that interact to shape a community's adaptive capacity for developing viable livelihood strategies (Chambers & Conway, 1992).

However, a growing body of research underscores that the success of livelihood transformation is closely tied to the agency of local communities, that is, their collective ability to act within and against constraining social structures. Drawing on structuration theory (Giddens, 2004), communities are not merely passive recipients of structural dominance but possess the capacity to respond, negotiate, and even transform oppressive conditions. This agency is often expressed through creative adaptation, local innovation, and collective solidarity, including in community-based ecological rehabilitation efforts (Adger, 2010; Berkes & Ross, 2013).

Local communities have initiated diverse livelihood recovery efforts in various post-mining areas of the Bangka Belitung Islands by repurposing former mining lands. For example, in Bukit Kijang Village, Namang District, Central Bangka Regency, residents have engaged in community empowerment programs to convert post-mining land into productive agricultural plots. These programs seek to enhance community participation in land restoration, though they continue to face challenges such as low social capital and limited active involvement (Hayati et al., 2022).

Similarly, in Penyamun Village, Bangka Regency, local communities, in collaboration with PT Refined Bangka Tin (RBT) and the regional agricultural office, have developed an agro-tourism site on reclaimed mining land. This initiative, managed through a local cooperative, seeks to establish a community-led eco-tourism landscape. However, its success remains highly dependent on institutional support and secure access to land (Rahmawan, 2020).

These examples illustrate that the viability of such initiatives hinges not only on community motivation but also on institutional backing, legal clarity regarding land tenure, and power relations that determine the degree to which communities can meaningfully participate in decision-making. In many cases, subordination to formal political-economic structures constrains communities' ability to pursue sustainable alternatives.

The theory of adaptive capacity in social-ecological systems emphasizes that a community's resilience to socio-ecological disruptions is shaped not solely by material resources but also by the strength of social networks, local knowledge, and the capacity to learn from crisis experiences (Folke et al., 2005). Within this perspective, livelihood strategies in Bangka must be understood as contextually shaped processes involving trial and error, collective experimentation, and articulating new post-mining identities.

This study employs a combined environmental sociology and political ecology framework to examine how community agency operates within ecologically subordinated and institutionally fragmented landscapes. Accordingly, the analysis extends beyond the types of economic strategies adopted to include the power dynamics, spatial conflicts, and structural conditions that shape the scope and limits of collective action.

2.3. Political Ecology in Post-Mining Studies

Political ecology has emerged as a critical approach for examining the interplay between power, natural resources, and socio-ecological conflict. It developed in response to conventional ecological approaches that tend to depoliticize environmental issues and overlook the structural dimensions of ecological degradation (Robbins, 2012). Rather than viewing environmental crises as technical failures or the result of local negligence, political ecology interprets them as the outcomes of unequal power relations among states, corporations, and communities. It

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frames core analytical questions around "who gets what, where, how, and why?" to expose inequities in access to and control over natural resources (Bailey & Bryant, 2005).

In the context of extractive industries, political ecology highlights how resource-based development, particularly mining, often produces "landscapes of injustice," where local communities bear the ecological burdens while political and economic elites capture economic benefits (A. Bebbington et al., 2008). Ecological transformations caused by mining are not only material but also symbolic and political, altering social relations, lived spaces, and community production structures. In Indonesia, this framework has been widely used to analyze how legal and illegal mining policies give rise to new regimes of power that deepen community subordination to extractive capitalist logics.

Specifically in Bangka Belitung, tin mining practices have created spatial configurations that are both subordinated and fragmented. The numerous abandoned mining pits (*kolong*) represent physical degradation and ongoing conflict among communities, state actors, and economic interests. These post-mining areas exist within legal vacuums and lack inclusive, long-term rehabilitation planning. Within a political ecology lens, such conditions reflect processes of dispossession, systematic removals of community rights to their living spaces through regulatory frameworks, land policies, and dominant development narratives (Hall et al., 2011).

Moreover, the concept of slow violence (Nixon, 2014) is particularly relevant in understanding the long-term, indirect, and often invisible harms mining activities generate. Issues such as the loss of access to clean water, soil degradation, livelihood insecurity, and increased social vulnerability in post-mining regions constitute a form of structural violence that accumulates over time and gradually erodes the community's capacity to live sustainably.

Political ecology thus offers a sharper analytic lens to understand that ecological subordination is not a natural consequence but a deliberate outcome of political-economic strategies. By linking environmental problems with issues of power, knowledge control, and institutional actors' roles, political ecology is an essential analytical tool for interrogating the complex dynamics of post-extractive regions such as Bangka.

2.4. Critique of Top-Down Approaches in Ecological Restoration

Ecological restoration in post-mining regions is often implemented through technocratic, top-down approaches that prioritize technical aspects such as revegetation or water management. These methods frequently neglect the social, cultural, and economic dimensions of local communities, disregarding the adaptive knowledge and practices developed over generations by those who have long inhabited these areas (Clewell & Aronson, 2013)In many cases, restoration projects follow a project-based logic driven by externally imposed deadlines and success indicators, which results in limited responsiveness to local dynamics.

Studies from Indonesia reveal that many mine reclamation programs are largely administrative and formalistic, designed primarily to fulfill corporate legal obligations rather than to promote long-term sustainability or community engagement. For example, in the Bangka Belitung Islands Province, only 1.59% of the total area under mining permits (IUP) has undergone reclamation. This figure highlights the mismatch between the number of licenses issued and the scale of environmental degradation caused by mining operations. This indicates that reclamation efforts are often ineffective and fail to involve local communities as key actors. Consequently, many reclaimed sites are rehabilitated only superficially, without genuinely restoring their ecological or social functions (Syahrudin, 2021).

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Technocratic restoration approaches rely solely on ecological indicators, such as vegetation cover or soil stability, without accounting for livelihood dimensions, local agency, or distributive justice. Political ecology scholars have critiqued this, arguing that every restoration process must interrogate who decides, who benefits, and who is marginalized (Büscher & Fletcher, 2020; Robbins, 2012). Ecological restoration insensitive to power relations and social structures risks reproducing existing inequalities and deepening the subordination of local communities in their territories.

As an alternative, participatory approaches to ecological restoration emphasize the importance of involving local communities in the planning, implementing, and evaluating recovery efforts. These approaches recognize that communities possess local ecological knowledge and social capacities that can form the foundation of more sustainable and contextually grounded restoration practices (Berkes, 2009). In post-mining areas like Bangka, practices like collective management of abandoned pits, cultivation on marginal lands, and small-scale aquaculture adaptation exemplify local innovations often overlooked by conventional restoration frameworks.

Thus, critiques of top-down ecological restoration are not solely about technical effectiveness but are fundamentally concerned with representation, legitimacy, and ecological justice. Restoration should be understood as a social and political process that places communities as active subjects, not merely as passive recipients of technical interventions. In the case of Bangka Belitung, approaches rooted in local agency and multi-actor collaboration are essential for building long-term sustainability in post-extractive landscapes.

3. Research Methodology

This study adopts a descriptive qualitative approach, utilizing content analysis and critical discourse analysis of secondary documents to investigate the dynamics of ecological subordination and livelihood transformation in the post-tin mining regions of Bangka Belitung. This approach was selected to explore how development narratives, ecological crises, and community adaptation strategies are represented across various textual sources and how power relations shape the trajectory of these transformations.

The data were drawn from three main categories: (1) peer-reviewed academic publications indexed in Scopus, SINTA, or Google Scholar, with a specific focus on extractivism, resource politics, ecological crises, mine reclamation, and livelihood transformation in Indonesia; (2) policy documents and institutional reports issued by government agencies and non-governmental organizations; and (3) online news articles from national media outlets reporting on current events, mining-related conflicts, citizen initiatives, and post-mining policy narratives. All sources were selected purposively based on thematic relevance, institutional credibility, and publication period, specifically between 2010 and 2024.

The analysis was conducted using thematic coding combined with critical discourse analysis. The analytical process involved three main stages: identifying core narratives related to ecological subordination, spatial conflicts, and community adaptation; organizing themes into key issues, including (a) national development narratives and extractive economies, (b) ecological crises in post-mining Bangka, (c) livelihood transformation and community agency, and (d) critiques of top-down approaches in ecological restoration; and interpreting discourse structures to uncover how power relations, the exclusion of local knowledge, and state or media framings shape understandings of ecological and social issues in the study area.

To enhance the validity of the findings, triangulation was employed by cross-referencing information across the three document categories. Interpretations were carried out reflexively to

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minimize bias, drawing on theoretical insights from environmental sociology and political ecology. A primary limitation of this study is the absence of direct engagement with field subjects; however, this was balanced by a detailed analysis of narrative representation and discourse structures within the selected texts.

4. Results and Discussion

4.1. Development Narratives and Ecological Subordination

An analysis of Indonesia's 2020–2024 National Medium-Term Development Plan (RPJMN) reveals that extractive industries, particularly mineral and coal mining, remain central to the national strategy for reducing poverty and promoting development in resource-rich, underdeveloped regions (Kementerian Perencanaan Pembangunan Nasional/Badan Perencanaan Pembangunan Nasional, 2020). However, the RPJMN provides limited attention to ecological restoration in areas affected by mining activities, including in the Bangka Belitung Islands, which have a long history of tin exploitation dating back to the colonial era. Although the document articulates a rhetorical commitment to sustainable development and ecological function enhancement, post-mining land rehabilitation is framed almost exclusively through technocratic terms. There is no explicit reference to landscape-based or community-driven restoration approaches tailored to tin-mining regions.

The 2023 Performance Report of the Ministry of Environment and Forestry (KLHK) noted a reduction in the total area of critical lands in Indonesia, from 14.3 million hectares in 2021 to 14.01 million hectares in 2022, indicating a national deceleration in land degradation (Kementerian Lingkungan Hidup dan Kehutanan, 2023). Nevertheless, the report fails to disaggregate data specific to the Bangka Belitung province. It does not outline targeted ecological recovery strategies for the region's thousands of abandoned mining pits (*kolong*). As of 2020, more than 12,000 such pits were scattered across the province, most of which remain unrestored (WALHI Kepulauan Bangka Belitung, 2024). These neglected sites are tangible evidence of ecological dispossession (Hall et al., 2011), where legal and institutional vacuums have stripped local communities of their environmental rights and spatial claims.

An examination of mainstream media coverage further underscores the dominance of extractivist narratives. Reports often emphasize the economic potential of the tin industry while marginalizing discussions on ecological degradation. For instance, a feature article by *Kompas* (March 7, 2023), titled *"Tambang Timah Bangka Belitung: Sejarah, Dampak, dan Asa untuk Masa Depan"*, highlights the historical and economic contributions of tin mining to regional and national development (Kompas.com, 2023). However, the report provides little analysis of the environmental consequences, such as land degradation or spatial inequality in resource governance. In contrast, an investigative piece by Mongabay Indonesia details the severe ecological impacts of tin mining in Bangka Belitung, including deforestation, damage to watershed areas, and threats to local ecosystem sustainability (Mongabay Indonesia, 2021). The report also notes the inadequate reclamation of former mining sites, many of which continue to pose significant ecological and social risks to surrounding communities.

These findings reveal a disjuncture between national development narratives and on-the-ground ecological realities. Natural resources are framed as engines of growth, while ecological dimensions are systematically marginalized in macro-level planning and media discourse. This pattern reflects what Bebbington et al. describe as *ecological subordination*, a condition in which ecological values and sustainability are consistently subordinated to the imperatives of economic accumulation and national development rationality (A. J. Bebbington et al., 2018). The Bangka Belitung case thus exemplifies how state planning, institutional silence, and narrative

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control converge to legitimize extractivist logics while rendering ecological crises politically invisible.

4.2. Socio-Ecological Crisis in Post-Mining Landscapes

An examination of investigative reports and official data underscores the extent to which tin mining in the Bangka Belitung Islands has led to widespread ecological damage and systemic disruption of local livelihood systems. Both legal and illegal mining have left behind thousands of abandoned pits (*kolong*), most of which remain unreclaimed and continue to pose environmental hazards (Mongabay Indonesia, 2023). According to data from the Baturusa–Cerucuk Watershed and Protected Forest Management Agency (BPDASHL), as of 2018, there were 12,607 *kolong* covering over 15,579 hectares across the province, with the highest concentrations in Central and South Bangka Regencies (Mongabay Indonesia, 2022). Investigative reports reveal that many of these pits, particularly in coastal areas like Batu Perahu Beach, have not undergone reclamation, resulting in soil degradation, water contamination, and diminished ecological capacity of agricultural and forest lands (Mongabay Indonesia, 2023).

These dynamics illustrate what previous studies describe as *ecological subordination*, a condition in which nature is treated as an expendable asset in the pursuit of short-term economic gains, with little regard for the long-term well-being of local ecosystems and communities (Gardner & Escobar, 1996; Martinez-Alier, 2002). In this context, natural landscapes are physically degraded and symbolically devalued, reinforcing extractive development logics that prioritize accumulation over sustainability.

The effects of ecological degradation are inseparable from the deterioration of social structures. In areas such as Tanjung Labu, illegal mining operations have triggered intra-community conflict, often involving state actors and local elites, which aligns with political ecology critiques of how power asymmetries deepen social vulnerability in resource frontiers (Bailey & Bryant, 2005; Robbins, 2012). Community testimonies document increasing fragmentation of social cohesion and the erosion of trust, exacerbated by governance vacuums and institutional ambivalence toward post-mining recovery (Patrolihukumindonesia, 2023).

From a livelihood perspective, the depletion of tin reserves has forced many former small-scale miners to continue working informally in degraded lands, often without legal protection or occupational safety. This trend reflects what previous studies conceptualize as fragmented and insecure *livelihood transformation*, wherein adaptive strategies emerge under economic scarcity, environmental decline, and limited institutional support (Ellis, 2000; Scoones, 1998). The absence of structured retraining programs, access to productive land, or alternative employment opportunities traps many in a cycle of precarious labor, embodying what some scholars call the "mining poverty trap."

Although the *Sustainable Livelihoods Framework* (Chambers & Conway, 1992) emphasizes the importance of access to assets and social capital, the situation in Bangka Belitung illustrates how both are structurally undermined. In such settings, *community agency*, understood through the lens of structuration theory (Giddens, 2004)is severely constrained. The community's capacity for resilience is not absent, but it is persistently marginalized by institutional neglect and unbalanced power relations that limit participatory restoration and autonomous development efforts.

Media representations reveal a sharp disjunction between national development narratives and local socio-ecological realities. While mainstream coverage highlights the economic contributions of tin mining, it often fails to address the scale and severity of ecological damage

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and social dislocation. This selective framing contributes to what Bebbington et al. refer to as *landscapes of injustice*, wherein local communities disproportionately bear the burdens of environmental degradation. At the same time, profits accrue to distant economic and political elites (A. J. Bebbington et al., 2018).

In sum, the socio-ecological crisis in post-mining Bangka Belitung exemplifies the core concerns of political ecology: the entwined nature of environmental degradation, institutional fragmentation, and community marginalization. It also reinforces the argument that restoration and recovery cannot be reduced to technical fixes but must engage with questions of power, justice, and collective agency in reshaping post-extractive futures.

4.3. Local Community Initiatives: Reclamation, Adaptation, and Institutional Asymmetries

Amid the ecological destruction left behind by extractive operations, several local communities in Bangka have initiated adaptive strategies using what remains of their degraded landscapes. One of the most notable forms of adaptation involves the reclamation of abandoned mining pits (*kolong*) for freshwater aquaculture. In Central Bangka, community groups have transformed former mining voids into fish ponds, supported by the local fisheries agency (ANTARABABEL, 2023). However, only a small portion of these projects has proven sustainable, largely due to limited access to markets and the absence of ongoing technical assistance.

In several post-mining areas of the Bangka Belitung Islands, ecological and social transformations are beginning to take root through integrated reclamation initiatives centered on agroecotourism. A prominent example is *Kampoeng Reklamasi* in Air Jangkang, approximately 15 kilometers from Pangkalpinang. Once a barren expanse of sand heaps, the site has been revitalized into a productive and educational landscape, featuring horticultural gardens, freshwater aquaculture, livestock farming (cattle and horses), and a wildlife rescue center. Supported by PT Timah Tbk and local civil society organizations such as the Alobi Foundation, the area has evolved into both a tourist destination and a biodiversity conservation hub. Through reclamation mechanisms recognized under Ministerial Regulation of the Ministry of Energy and Mineral Resources No. 1827 K/30/MEM/2018 on Guidelines for Mine Reclamation and Closure, this initiative illustrates a form of landscape-level ecological restoration that integrates community empowerment and sustainable land use. Similar projects include Kampoeng Reklamasi Selinsing and the Air Nyatoh Demonstration Farm in Bangka Regency (Kompas.com, 2020).

Despite these successes, significant disparities in institutional support persist. Many communities lack formal tenure over post-mining lands they aim to rehabilitate. Legal uncertainties and overlapping land claims often result in conflict, underscoring structural asymmetries in post-mining governance. These barriers limit the effectiveness of otherwise innovative and adaptive community initiatives. As highlighted in livelihood studies (de Haan & Zoomers, 2005), livelihood transformation is not merely shaped by rational individual choice but emerges from the broader institutional field and embedded power relations.

The cases above affirm the significance of *community agency* in shaping post-extractive futures, a concept central to both structuration theory (Giddens, 2004) and the adaptive capacity framework (Folke et al., 2005). However, agency alone is insufficient without supportive institutional arrangements, legal clarity, and inclusive policymaking. The gap between community innovation and state facilitation reflects what scholars in political ecology critique as development regimes that recognize restoration only when aligned with corporate or state agendas (Büscher & Fletcher, 2020). Unless these structural imbalances are addressed, the

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potential of participatory reclamation to contribute to just and sustainable post-mining transitions will remain constrained.

4.4. Power Relations and Exclusion in Post-Mining Land Governance

The governance of post-mining landscapes in Bangka illustrates structural power asymmetries between the state, mining corporations, and local communities, a condition deeply rooted in the legacy of extractivism as discussed in the literature (A. J. Bebbington et al., 2018; Hanson et al., 2003). Although former mining lands hold potential for productive and ecological recovery, local communities frequently lack the legal rights or institutional recognition necessary to manage these areas. Many of these lands remain under active mining permits (IUP), even after extraction activities have ceased, reproducing a logic of spatial dispossession typical of extractivist regimes (Bridge, 2004; Hall et al., 2011).

A case from Sijuk Village in Belitung Regency demonstrates this dynamic. Residents who initiated freshwater aquaculture in an abandoned *kolong* (tin pit) were accused of land encroachment by the IUP holder (POSBELITUNG, 2022). This reflects what Hall et al. conceptualize as "structured exclusion," where formal legal instruments serve to delegitimize community-led land use initiatives, despite the absence of active corporate presence (Hall et al., 2011). It also reinforces Martinez-Alier's assertion that ecological subordination involves not only environmental degradation but also the denial of community agency and territorial rights (Martinez-Alier, 2002).

The legal architecture, particularly Law No. 3/2020 on Mineral and Coal Mining, institutionalizes this asymmetry by expanding extractive companies' authority and tenure security while sidelining participatory governance mechanisms. This legal centralization effectively constrains community access to post-mining landscapes, reinforcing the top-down logic critiqued by political ecology scholars (Robbins, 2012). Rather than facilitating community-led restoration, the law perpetuates elite control over resource governance.

At the discursive level, exclusion is reinforced through technocratic reclamation narratives, often orchestrated by state agencies or CSR programs, which ignore local ecological knowledge and diverse village conditions. These standardized, externally-driven interventions, similar to what Büscher and Fletcher critique in fortress conservation models, further entrench dependence on state or corporate actors while eroding grassroots capacity to define post-mining futures (Büscher & Fletcher, 2020). Such narratives frame communities not as environmental stewards but as passive beneficiaries, effectively marginalizing their epistemologies and aspirations (Gardner & Escobar, 1996).

This constellation of legal, institutional, and narrative exclusions exemplifies how post-mining governance in Bangka operates through a hegemonic framework of ecological subordination. Community efforts to reclaim and restore degraded landscapes are obstructed by environmental constraints and structural barriers embedded in the political economy of resource extraction. Adaptive capacity and socio-ecological resilience require material resources, agency, recognition, and enabling institutions (Berkes, 2009; Folke et al., 2005), elements that remain unevenly distributed in post-extractive Indonesia.

In sum, understanding the post-mining governance failures in Bangka necessitates moving beyond technical assessments toward a political ecology perspective that foregrounds the politics of access, the violence of regulatory frameworks, and the symbolic erasure of local agency. Without confronting these deeper relations of power, efforts toward ecological restoration and livelihood transformation will remain partial, exclusionary, and ultimately unsustainable.

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5. Conclusion

This study reveals that livelihood transformation in Bangka Belitung's post-mining landscapes unfolds within a post-extractive context marked by ecological subordination and structural inequality. National development narratives that emphasise economic growth through natural resource extraction have consistently marginalised ecological concerns in macro-level planning and localised governance practices. At the same time, local communities have demonstrated adaptive capacity through reclamation efforts, economic diversification, and innovations rooted in local resource management. However, these grassroots initiatives often lack sufficient institutional support and remain constrained by unequal access to land and the limited recognition of community rights.

From the political ecology and environmental sociology perspective, these findings underscore that post-mining land restoration cannot be separated from its social, economic, and political dimensions. The prevailing top-down approaches have failed to address the complexity of local realities. Community-based, participatory, and context-sensitive recovery strategies are essential to achieving long-term sustainability and ecological justice.

This study's primary limitation is its reliance on document analysis and media representations without the inclusion of primary data such as interviews or field observations. This restricts the depth of analysis regarding micro-level community dynamics and livelihood practices. Furthermore, the geographic focus on Bangka alone cannot capture the broader complexity of post-mining regions across the Bangka Belitung archipelago.

Future research should therefore undertake more extensive fieldwork that incorporates the perspectives of local communities through ethnographic or participatory methods. Such approaches are crucial for uncovering hidden forms of agency, latent conflicts, and sustainability practices that may not be visible in official documents or mainstream media narratives. Additionally, comparative studies across different post-extractive regions in Indonesia would enrich our understanding of ecological and social transformation in the national context.

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The authors have declared no potential conflicts of interest regarding this article's research, authorship, and/or publication.

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