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Regulatory Hierarchy Conflicts and the Regional Autonomy Regime in Bauxite Mining Management in Indonesia

Nanang Suparman[1*], Muhammad Andi Septiadi[1], Yuflih Rizkia Timoty[2], and Faizal Pikri[1]

1. Department of Public Administration, Faculty of Social and Political Science, Universitas Islam Negeri Sunan Gunung Djati, Bandung, Indonesia
2. Department of Business Digital Faculty of Economic and Business, Universitas Pendidikan Indonesia, Bandung, Indonesia

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Abstract

This study aims to analyse the regulatory hierarchy and its implications within the regional autonomy regime in the context of bauxite mining management in Indonesia, with a focus on Tanjungpinang City. Although decentralization grants local governments the authority to manage natural resources, overlapping regulations between central and regional authorities have resulted in governance conflicts, weak enforcement, and substantial environmental degradation. Utilizing a mixed-method approach informed by Kagan's regulatory model, this research integrates field-based environmental assessments including bauxite sediment sampling and post-mining water quality analysis with a normative analysis of mining regulations and governance practices. The findings reveal a dominance of procedural legal frameworks over substantive environmental accountability. Regional autonomy laws tend to prioritize investor interests, often at the expense of community welfare and environmental restoration. Additionally, inadequate local oversight has allowed the continued export of unprocessed bauxite, exacerbating environmental harm. This study contributes new insights by exposing the structural misalignment between regulatory authority and environmental responsibility under Indonesia's current autonomy regime. It underscores the urgent need for regulatory reform that clarifies lines of authority, mandates in-country bauxite processing prior to export, and enforces post-mining reclamation obligations at the regional level. These recommendations aim to support policymakers in designing enforceable and context-sensitive reforms for sustainable bauxite mining governance.

1. Introduction

The mining sector plays a vital role as a significant source of national income, contributing substantially to both tax and non-tax revenues. Since the implementation of the regional autonomy regime alongside a series of decentralization policies mining activities have expanded considerably across various regions in Indonesia. Despite this growth, mining governance in the country remains fraught with challenges. While the industry serves as an important revenue stream for local governments, creates employment opportunities, and is often linked to efforts aimed at enhancing community welfare, numerous studies indicate that its socioeconomic impact in many regions is limited. Moreover, levels of ecological literacy within mining-affected communities remain critically low [1-4].

Empirical evidence suggests that the limited impact of mining is largely attributed to governance challenges, including overlapping regulatory frameworks, weak law enforcement, and systemic corruption [5-7]. Previous research has widely acknowledged that governance failures lie at the core of these issues, particularly in the context of decentralization policies that lack adequate oversight mechanisms [8-10]. In particular, Indonesia's regional autonomy law has yet to establish a robust legal foundation for the effective oversight of mining exploration, particularly in preventing environmental

Corresponding author Email: n.suparman69@gmail.com (S. Nanang)

degradation [11]. Discriminatory practices [12–14] include horizontal conflicts between mining entrepreneurs and the surrounding communities [15-18].

Although numerous studies have explored mining in Indonesia since the enactment of regional autonomy, international research has predominantly concentrated on the natural sciences and mining technologies [19-21]. In recent years, the economic and environmental dimensions of mining have garnered increasing scholarly attention. However, studies that integrate public policy analysis with scientific data particularly those examining local government oversight supported by laboratory-based evidence of ecological damage remain scarce. This gap persists despite the enactment of Law Number 32 of 2004, which mandates greater regional responsibility in environmental management.

This study aims to address that gap by analyzing the implications of recent regulatory developments on local government performance in managing bauxite mining on Bintan Island, with a particular focus on Tanjungpinang City. Bintan, the largest of more than 2,400 islands in the Riau Islands Province, spans approximately 11,000 km² and is located between 104°10′–104°40′ E and 0°40′–1°15′ N. According to data from the CORE MAP LIPI team, the island is rich in mineral reserves, including bauxite, iron ore, tin, granite, and andesite. Tanjungpinang City specifically the Senggarang District is recognized as one of Indonesia's most productive bauxite mining regions. Mining activities in this area are conducted through direct extraction methods, categorizing it as a primary industry without recycling processes. As Carelos Andrade et al. [22] note, mining is inherently limited by location, type, quantity, and material quality. Without proper regulation, such extractive activities can result in severe environmental consequences, particularly due to poor waste management [23].

Local government supervision plays a critical role in mitigating environmental damage resulting from mining activities. The authority to issue mining permits is a central aspect of this supervisory function, particularly following the decentralization of governance through Law No. 22 of 1999 and its successor, Law No. 32 of 2004. These reforms granted substantial control over natural resource management to regional governments. However, in practice, this shift has often resulted in unsustainable forest and land use practices that prioritize short-term economic gains over environmental conservation. Mining permits are frequently issued with minimal oversight and excessive discretionary power. In the context of bauxite mining, environmental regulation is governed by Minister of Environment Regulation No. 34 of 2009, which sets wastewater quality standards. The rapid expansion of the bauxite industry in Bintan has placed regional authorities in a challenging position requiring them to balance economic incentives such as employment generation, increased tax revenues, and the growth of small and medium enterprises (SMEs) with escalating environmental costs.

This study builds upon prior research by examining the role of local government-issued mining permits in the governance of bauxite ore mining in Tanjungpinang and its ecological implications. The findings are intended to raise awareness among policymakers and stakeholders within affected communities. Additionally, the study offers a detailed assessment of the regulatory hierarchy governing bauxite exploration in the context of decentralization an aspect that has received limited scholarly attention. It further evaluates whether regional governments, operating under broad autonomy, are capable of effectively supervising bauxite mining in accordance with the principles of good local governance. Ultimately, the study advocates for the urgent formulation of a comprehensive new Minerba Law to address regulatory conflicts between central and regional authorities and to advance a more environmentally sustainable mining sector.

2. Materials and Methods

2.1. Studied Area

This research was conducted in Tanjungpinang City, covering three primary locations: Senggarang Village, Sebauk Village, and Kampung Bugis Village, including the surrounding Madong Village area. The study was carried out from July to December 2022. Sediment samples were collected from the bottom surface and analysed at the Tanjungpinang Environmental Health Engineering Center Laboratory, while metal content analyses were conducted at the Sucofindo Government Laboratory in Tanjungpinang. Figure 1 shows the location of the study area, including the distribution of sampling sites across the selected villages.

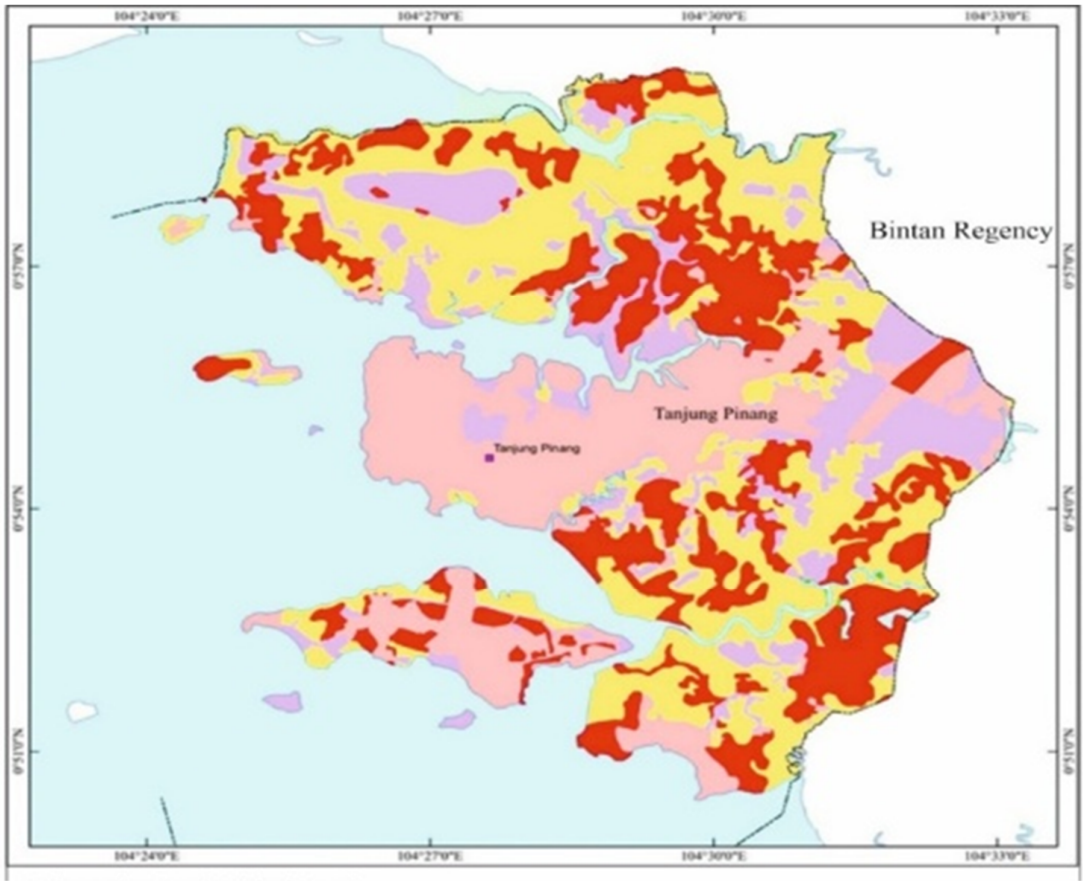

Figure 1. Study area map of Tanjungpinang City

2.2. Sampling Procedure

Bauxite waste samples were collected from mining sites in Tanjungpinang City, Bintan Island, to assess wastewater and soil pollution levels. Core samplers were used to obtain samples from multiple locations, including the Carang River in Kampung Bugis and the Bintan Buyu area, which served as a comparison site. All samples were analyzed at the Class I Environmental Assessment Technical Center (BTKL).

The sampling procedures followed Indonesian National Standards (SNI) for wastewater collection in surface water and seawater, specifically SNI 03-7016-2004 and SNI 6989.59.2008, as well as water quality testing standards (SNI 6989.2.2009). In-situ measurements included temperature, pH, dissolved oxygen (DO), total dissolved solids (TDS), water depth, and brightness. Laboratory analyses encompassed total suspended solids (TSS), biological oxygen demand (BOD), chemical oxygen demand (COD), nitrate (NO_3), phosphate (PO_4), and iron (Fe), in accordance with SNI 6989.2:2009 (12).

2.3. Sampling Tool

The instruments used in this study included a multi-tester for measuring temperature, dissolved oxygen (DO), and pH; a Secchi disk for assessing water brightness; a TDS meter; a cool box for sample preservation; aeration equipment; BOD bottles; incubators for BOD analysis; Millipore filter paper; a vacuum pump; distilled water; an oven; a desiccator; an analytical balance for TSS analysis; a spectrophotometer for nitrate and phosphate measurements; and an atomic absorption spectrophotometer for analyzing iron concentrations.

2.4. Sampling Method

Sampling was carried out in accordance with SNI 03-7016-2004 and SNI 6989.59.2008, which provide standardized procedures for monitoring water quality in river basin areas. Accurate sampling is essential to ensure the reliability of water quality assessments, as it directly affects the validity of the analytical results. The findings are presented in Table 1.

Table 1. Post Bauxite Mine Water Quality

Parameter	Unit	Measurement results	Quality Book *
Physics			
Temperature	°C	31,38 ±0,2	3 Standard Deviations
Brightness	M	2,24 ±0,45	
Depth	M	2,95 ±0,44	
TSS	mg/L	012 ±0,04	50
TDS	mg/L	60,2 ±2,66	1000
Chemistry			
pH		3,65±0,20(n=3, SD=0.20)	6-9
DO	mg/L	6,77 ±0,21	4
BOD	mg/L	4,007 ±0,67	3
COD	mg/L	5,41 ±3,06	25
Nitrate	mg/L	0,00 ±0,00	10
Phosphate	mg/L	0,061 ±0,05	0,2

***Quality standards are based on Indonesian Government Regulation No. 82 of 2001.**

Source: Data compiled by the author (2025)

2.5. Regulatory Hierarchy and Mining Law Reform

This study critically examines the regulatory hierarchy within Indonesia's bauxite mining sector, with particular emphasis on the evolving governance dynamics resulting from recent legal and institutional reforms. The decentralization era, inaugurated by Law No. 22 of 1999, initially conferred broad authority upon regional governments to manage natural resources. However, subsequent legislative changes most notably Law No. 3 of 2020 and Law No. 11 of 2020 on Job Creation have significantly re-centralized mining governance by transferring key licensing and oversight functions back to the central government.

This research employs a normative-legal approach to assess the implications of this shift, focusing on the juridical misalignment between centralized authority and regional autonomy in enforcing environmental accountability. Although these legal reforms were designed to streamline mineral resource governance and reduce local regulatory fragmentation, they have unintentionally exacerbated institutional ambiguities and diminished the capacity of regional governments to exercise ecological oversight. Key scholarly contributions, such as Pujiastuti ([24], highlight the erosion of decentralized control under the current legal framework, while Natsir et al. [25] propose cooperative governance models to bridge regulatory dissonance between national and local actors.

These findings underscore the urgent need for a coherent regulatory framework that integrates legal clarity, robust environmental safeguards, and principles of equitable resource governance. While the current top-down reconfiguration of authority may improve administrative efficiency, it also risks marginalizing local stakeholders and undermining community-based environmental monitoring efforts.

2.6. Regional Autonomy and its implications for Mining Governance

This study also interrogates the operationalization of regional autonomy in the governance of bauxite mining, with particular focus on its implementation in Tanjungpinang City. Utilizing a case study methodology, the research explores the institutional role of local governments in regulating extractive activities and evaluates their effectiveness in balancing economic interests with environmental protection.

Data collection methods included document analysis, field-based observations, and semi-structured interviews with regional policymakers and regulatory officers. The study draws upon the insights of Wang and Liang [26], who argue that while decentralization has opened avenues for region-specific resource management, it has also created opportunities for regulatory capture, administrative discretion, and rent-seeking behaviour. Additionally, Hayati [27] underscores a legal paradox in which regional autonomy though constitutionally guaranteed often conflicts with the state's overarching control over natural resources, resulting in fragmented governance and diminished accountability.

The findings reveal that regional governments frequently encounter structural and institutional constraints in enforcing sustainable mining practices, especially when subjected to political and economic pressures to issue extractive permits. These dynamics raise critical questions about the balance between local discretion and national oversight in the pursuit of environmentally

responsible and socially equitable mineral governance.

2.7. Data analysis: Integrating Kagan's Model in an Interdisciplinary Framework

This study adopts an interdisciplinary approach, integrating environmental science with public policy and legal analysis to evaluate the issuance of mining permits and the effectiveness of oversight mechanisms [28]. In doing so, it draws on Kagan's [29] model of adversarial legalism, which offers a useful lens for analyzing how formal legal complexity and institutional conflicts influence policy implementation.

Adversarial legalism refers to a legal culture characterized by rigid regulations, procedural formality, and contentious enforcement processes, often resulting in delays, fragmented governance, and diminished administrative efficiency. Within the Indonesian context, this model helps to explain the persistent tensions between the aspirations of decentralized governance and the realities of centralized regulatory control, particularly in the environmental and mining sectors.

By applying this framework, the study illustrates how inconsistencies within the legal hierarchy combined with inadequate coordination between central and regional actors undermine the enforcement of environmental standards and the broader goals of sustainable development. Moreover, recent advancements in sustainable mining practices advocate for the use of multi-criteria decision-making frameworks, which facilitate more comprehensive and context-sensitive assessments of mining impacts [23]. Building on these insights, this study seeks to explore how mining regulations might be realigned with sustainability objectives and principles of local governance.

3. Results

3.1. Current conditions of bauxite mining in Indonesia

The mining sector remains a critical pillar of economic development in many developing countries, including Indonesia. Revenues generated from mining exploration contribute significantly to national income and support employment across various sectors [30]. However, mining activities are also closely associated with severe ecological consequences, including deforestation, land degradation, and the contamination of natural resources [31].

Moreover, local communities frequently suffer substantial adverse effects, as environmental degradation such as water, air, and soil contamination disrupts traditional livelihoods and contributes to the erosion of cultural heritage. These impacts are often the result of development-induced displacement [32–34]. Growing public concern over these issues has manifested in increased media attention, community protests, and appeals directed at both central and regional authorities [35].

Indonesia holds substantial bauxite reserves, estimated at approximately 1.26 billion tons of ore and 3.61 billion tons of mineral resources. These reserves are primarily concentrated in the Riau Islands Province, particularly on Bintan and Tanjungpinang Islands, where bauxite extraction is extensive and largely oriented toward export. Despite its economic potential, bauxite mining in this region is increasingly pursued with a profit-centric approach, often at the expense of environmental and social safeguards. Field observations in villages such as Senggarang, Sebauk, and Madong located within the administrative boundaries of Tanjungpinang City reveal a troubling pattern of unregulated and poorly supervised mining operations.

Bauxite, composed of hydrated aluminium and iron oxides, is a critical raw material in the production of alumina and, ultimately, aluminium metal through the Bayer process [36]. While the mineral itself is vital to global industry, the predominant extraction method used in Indonesia open-pit mining raises significant environmental concerns. The process typically begins with land clearing using bulldozers to remove vegetation, followed by overburden stripping and ore excavation with shovel loaders [37]. The mined ore is then transported via dump trucks, often along public roads that pass directly through densely populated areas.

Residents of villages situated along these transport routes particularly Senggarang, Sebauk, and Madong have reported widespread dust pollution affecting homes and agricultural lands. The constant movement of uncovered trucks carrying raw bauxite results in the dispersal of fine particulates, contributing to respiratory illnesses and skin irritations among local populations. Additionally, soil spillage from overloaded vehicles frequently clogs drainage systems, exacerbating flood risks during the rainy season [38-40].

Environmental degradation resulting from bauxite mining is not limited to terrestrial areas.

Ongoing deforestation to access bauxite-rich layers reduces natural water retention, increases surface runoff, and contributes to the contamination of coastal waters [41]. Fishermen along the Tanjungpinang coastline report a sharp decline up to 50% in fish catch volume, attributing this to bauxite sedimentation that drives fish populations away from nearshore habitats. In areas such as Sei Enam, fruit trees and crops have withered due to exposure to bauxite tailings. Despite these escalating impacts, local government responses have been largely ineffective.

Rehabilitation efforts such as reforestation programs initiated by the Tanjungpinang municipal government have thus far failed to restore ecological balance. These initiatives lack scientific rigor, particularly in areas such as soil biology, nutrient cycling, and the re-establishment of native vegetation [41]. Globally, the rehabilitation of tropical forest ecosystems affected by bauxite mining has become an urgent priority [42]. However, Indonesia's current rehabilitation strategies remain misaligned with international best practices and show limited adoption of science-based and innovative restoration techniques [43].

Figure 2. Extent of environmental degradation resulting from bauxite mining on Bintan Island.

As shown in the mining zoning map, 31 bauxite operations run by both large and small corporations are distributed across 13 inland and 18 island locations. Without immediate intervention, the continued exploitation of these fragile island ecosystems could lead to their eventual collapse or disappearance [44]. The land used for mining consists of both government-concessioned zones and parcels leased directly from local residents. Economic pressures have compelled many residents to rent out their land to mining companies. Unfortunately, some of the most severe environmental degradation has occurred on community-owned lands, where mining activities began prior to the issuance of a government moratorium. Many of these excavation sites remain abandoned, leaving behind barren landscapes and destroyed agricultural plots [45].

During the height of the so-called "bauxite boom" in early 2014, a surge in economic activity was observed. Residents engaged in various support roles, from providing catering services to driving mining trucks and operating vehicle wash stations. It was reported that some workers earned over IDR 20 million (approximately USD 1,800) per month. Bauxite-related employment generated

income opportunities for a large segment of the local population, including positions in operations, surveying, administration, and field supervision.

While the economic benefits of bauxite mining are evident, the associated environmental and social costs demand urgent policy attention. Without rigorous regulation, the adoption of sustainable practices, and the implementation of a robust framework for ecological rehabilitation, the long-term viability of bauxite mining in Indonesia remains critically at risk.

3.2. Water Condition Analysis

Ensuring water quality for public consumption is paramount, particularly in regions impacted by mining activities [46]. In Tanjungpinang, bauxite mining has significantly affected key water sources, notably the Carang and Sei Timun rivers, raising serious ecological concerns. Field observations and laboratory analyses indicate elevated sedimentation levels in these rivers, primarily due to soil erosion resulting from mining operations. Increased sedimentation raises turbidity, reducing light penetration and negatively impacting aquatic ecosystems. These effects are further exacerbated during the rainy season, leading to shallower riverbeds and an increased risk of flooding. Sediment particles can obstruct fish gills and hinder photosynthesis in aquatic plants, ultimately disrupting ecological balance.

To assess water quality in mining-affected areas, the Canadian Water Quality Index (CWQI) was applied. The CWQI offers a comprehensive evaluation by aggregating multiple water quality parameters into a single numerical index. The calculation method, as outlined by the Canadian Council of Ministers of the Environment (CCME), involves three key factors:

1. Scope (F1): the percentage of water quality variables that fail to meet objectives;
2. Frequency (F2): the percentage of individual tests that do not meet water quality standards; and
3. Amplitude (F3): the extent to which failed test values deviate from the objectives.

The CWQI is then calculated using the formula:

$$\text{CWQI} = 100 - \left(\frac{\sqrt{F1^2 + F2^2 + F3^2}}{1.732}\right)$$

The CWQI generates a score ranging from 0 to 100, which is then classified into five qualitative categories. A score of 95–100 reflects "Excellent" water quality with virtually no ecological risk, while 80–94 indicates a "Good" condition with only minor threats. Scores between 65–79 are considered "Fair," suggesting occasional impairment, whereas scores between 45–64 fall under "Marginal," where water is frequently threatened. Any value below 45 is categorized as "Poor," indicating significant and persistent ecological degradation.

The CWQI method used in this study aggregates multiple environmental parameters using structured scoring to produce a single index score. This type of parameter weighting is consistent with other semi-quantitative approaches in environmental impact assessments, such as those developed by Ataei et al. [47], which apply mathematical models to evaluate sustainability in mining, and the Fuzzy Delphi Folchi Method proposed by Saffari et al. [48], which integrates expert judgment with fuzzy logic. The consistency lies in the shared use of a structured evaluation framework that (1) quantifies multiple environmental variables, (2) applies weighted or expert-driven scoring schemes, (3) synthesizes results into a single, interpretable index, and (4) ultimately classifies outcomes to support decision-making processes. These structured methodologies provide greater transparency and reliability in determining ecological risks and reinforce the need for more robust, data-driven EIAs in mining governance.

In this study, parameters such as pH, dissolved oxygen, turbidity, total suspended solids (TSS), and heavy metal concentrations were measured. The CWQI scores for water samples taken from areas near bauxite mining sites ranged from 40 to 55, classifying the water quality as “Poor” to “Marginal.” These findings indicate frequent impairment and potential health risks for communities that rely on these water sources [49].

Heavy metals such as aluminium, arsenic, and mercury commonly associated with bauxite mining pose additional environmental and public health risks. Rainfall can transport these metals into rivers, contaminating surface water. Dust from mining activities may settle on exposed surfaces and be washed into water bodies, further contributing to pollution. Moreover, the bauxite washing process produces waste containing heavy metals, which can infiltrate nearby waterways. Laboratory tests revealed aluminium concentrations of 0.31 mg/L and 0.27 mg/L in samples collected from residential areas near mining sites, exceeding the 0.20 mg/L limit set by Indonesia’s Ministry of Health [50]. This contamination poses significant health risks,

especially when drinking water sources are not adequately protected.

The bauxite washing process involves crushing the ore to remove impurities and sorting it by particle size. This process releases heavy metals that can be absorbed by aquatic organisms and enter the human food chain. Fish sampled from rivers near mining areas have shown arsenic levels ranging from 72.6 to 105.8 µg/kg, exceeding both national and international safety thresholds [51]. Furthermore, the disposal of bauxite waste into marine environments threatens coastal ecosystems, including mangroves and coral reefs, thereby impacting the socio-economic well-being of local communities. Contaminated soils can also affect agricultural production, as heavy metals such as arsenic and lead accumulate in crops and pose long-term health hazards.

In addressing such complex environmental consequences, previous studies have demonstrated the value of structured assessment frameworks in Environmental Impact Assessments (EIAs), such as the case study by Ilkhani et al. [(52], which applied multi-parameter analysis in open-pit mining to support more systematic and evidence-based implementation.

Table 2 shows the percentage distribution of environmental impacts from 66 mining operations, highlighting the prevalence of water and soil pollution as well as their potential consequences for human health and ecosystems. These empirical findings, reported by the U.S. Environmental Protection Agency (1995), reinforce the urgency of adopting robust and comprehensive EIA methodologies to address the multidimensional nature of mining-related risks.

Table 2. Environmental impact distribution across 66 mining activities

Impact Type	Per cent of Incidence
Surface Water Pollution	70
Groundwater Pollution	65
Soil Pollution	50
Human Health	35
Damage to Flora and Fauna	25
Air pollution	20

Source: US EPA (1995)

Mining operations not only impose significant environmental pressures but also generate complex social ramifications. As a result, Environmental Impact Assessments (EIAs) in the mining sector must fulfil two critical objectives [53]:

1. To ensure that environmental, social, and health-related costs are thoroughly considered in assessing the economic viability of mining projects and in selecting among alternative development options; and
2. To guarantee that control, management, monitoring, and mitigation measures are effectively integrated into the project's design, implementation, and mine closure strategies.

The consequences of inadequate environmental impact assessments and the absence of effective monitoring mechanisms are often reflected in visible ecological degradation. This condition is clearly illustrated in the spatial distribution of degraded land shown in the Tanjungpinang deforestation map (Figure 3), where large areas appear barren and desiccated. The cream-colored zones on the map indicate non-forest areas, highlighting regions that have undergone significant land cover change.

Additional field observations further corroborate these findings, particularly within both active and abandoned bauxite mining zones. These areas exhibit severe dryness and a notable absence of vegetative cover, suggesting ongoing or residual environmental disturbance (Figure 4).

3.3. Mining Regulation Analysis

The enactment of Law No. 22 of 1999 on Regional Government marked a pivotal shift in Indonesia's decentralization policy, replacing Law No. 5 of 1974 on the Principles of Governance in the Regions [54]. Unlike its predecessor, which emphasized deconcentration, Law No. 22/1999 introduced broad autonomy for districts and municipalities, granting them the authority to independently plan and manage government affairs within their jurisdictions.

This wave of decentralization had a significant impact on mining sector governance. The transition continued with the replacement of Law No. 22/1999 by Law No. 32/2004, followed by the enactment of Law No. 4 of 2009 on Mineral and Coal Mining (commonly referred to as the Minerba Law), which restructured the concession licensing system. However, these legal transitions have not been without challenges. Conflicting interpretations of licensing authority, overlapping

and inconsistent regulations, and weak institutional coordination have led to widespread confusion and inefficiencies in mining governance [53].

Table 3 presents the division of responsibilities between central and regional governments under the 2009 Minerba Law, within the broader framework of state control over natural resources.

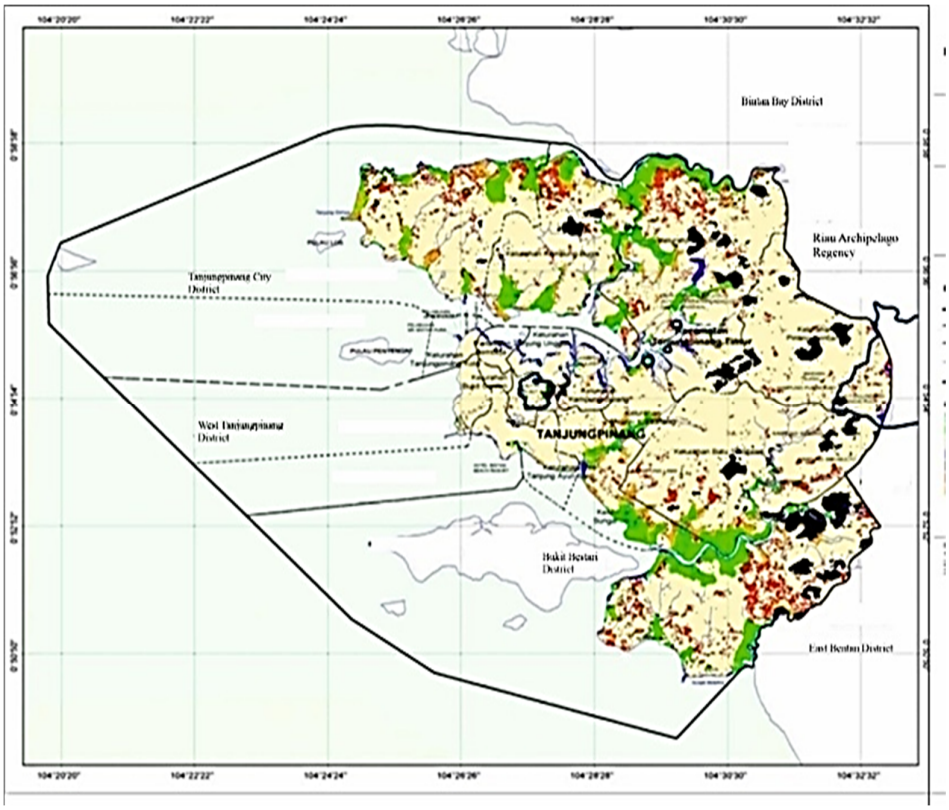

Figure 3. Spatial distribution of deforested and non-forested land in Tanjungpinang

Figure 4. Environmental impacts of bauxite washing waste on local hydrology and vegetation conditions

Table 3. Division of authority between central and regional governments under the 2009 Mineral and Coal Law, within the framework of state control.

Actor	Function	Legal Basis
Provincial Government	Regulation (regelendaad)	Art. 7(1)(a)
	AdministrativeAction (bestuursdaad)	Art. 7(1)(b, c, d, j)
	Management (beheersdaad)	Art. 38; Art. 6(2) Gov. Reg. No. 23/2010
	Supervision (toezichthoudensdaad)	Art. 7(1)(b, c, d, n)
District/City Government	Regulation (regelendaad)	Art. 8(1)(a)
	AdministrativeAction (bestuursdaad)	Art. 8(1)(b, c)
	Management (beheersdaad)	Art. 38; Art. 6(2) Gov. Reg. No. 23/2010
	Supervision (toezichthoudensdaad)	Art. 8(1)(b, c, k)

Source: Processed by the author (2025).

The enactment of Law No. 22 of 1999 marked a pivotal transition in Indonesia's decentralization policy, granting districts and municipalities the authority to manage governmental affairs independently. This transformation had significant implications for the governance of natural resources, including the mining sector. The subsequent adoption of Law No. 4 of 2009 on Mineral and Coal Mining (Minerba Law) introduced major changes to the licensing regime. However, the law's structure shows that both provincial and district/city governments are tasked with four out of five core governmental functions related to mining governance.

A closer reading of the Minerba Law and its explanatory notes reveals that the terminology used particularly the term "management" does not fully reflect the extent of authority envisioned by the legislation. Articles 6, 7, and 8 of the law encompass not only administrative and technical functions but also significant policy-making powers, which are essential for effective governance. In light of the Constitutional Court's interpretation of "the state's right to control," it would be conceptually more accurate for future revisions of the law to replace the term *management* with *mastery*, to minimize misinterpretation and reduce fragmentation in authority.

In practice, the management of bauxite mining in Indonesia continues to face persistent challenges. The transition from Law No. 11 of 1967 to the 2009 Minerba Law failed to generate a paradigm shift sufficient to address structural weaknesses in governance. Although the 2009 law introduced mandates for value-added processing—such as the construction of smelters it did not adequately consider short mine-life deposits or regional disparities in mining infrastructure. As a non-renewable and finite resource, bauxite requires management guided by justice, prudence, and a long-term sustainability perspective that goes beyond investment metrics and foreign exchange gains.

Critically, the Minerba Law falls short in incorporating the three fundamental pillars of good governance: transparency, participation, and accountability. It inadequately integrates community rights into the mining governance framework and offers minimal recognition of regional ecological carrying capacities. The law's extractive orientation is apparent in its treatment of all mineral-bearing areas as exploitable "deposits," with insufficient consideration for environmental thresholds, coastal and marine ecosystems, or the socio-cultural contexts of affected communities.

Additionally, the absence of standardized criteria for assessing soil and ecosystem degradation has led to inconsistent reclamation practices across regions. There is currently no unified regulatory framework for land stripping, topsoil handling, or post-mining rehabilitation. While the law assigns the responsibility for environmental restoration to the Environmental Permit system, this mechanism alone is insufficient to ensure sustainable outcomes. A site-specific, science-based regulatory approach is urgently needed.

Although the law sets spatial limits on concession areas, it does not cap the number of permits that can be issued, thereby enabling administrative inflation. Prior to the full implementation of the law, over 8,000 mining permits had already been granted. This trend reflects the legislation's bias toward facilitating short-term investment rather than ensuring long-term environmental stewardship. While decentralization initially empowered regional governments to issue mining permits, the absence of effective oversight has contributed to weakened environmental governance.

3.4. The Urgency of New Mining Regulations

Law No. 4 of 2009 on Mineral and Coal Mining is increasingly regarded as outdated and insufficient for addressing the legal, institutional, environmental, and socio-economic challenges of contemporary mineral-resource governance. Although the 2020 amendment introduced several progressive elements, it still lacks the breadth and depth needed to meet present-day realities and future demands. Drawing on an extensive body of academic research and critical policy analysis, the following key considerations are proposed to guide the formulation of a reformed, forward-looking mining law. Table 4 shows a concise summary of the legal, environmental, and governance considerations that should inform Indonesia's revised mining regulatory framework.

Table 4. Summary of legal, environmental, and governance considerations for the reform of Indonesia's mining regulatory framework.

No	Policy Focus Area	Recommended Reform Measures
1	Enhancing Value Addition	Harmonize IUP-OP duration with downstream obligations; support functional independence and BUMN involvement.
2	Clarifying Inter-Sectoral Permitting	Define legal boundaries between IUP-OP and IUI; standardize regulations to boost legal certainty and investor trust.
3	Strengthening Mining Area Concepts	Clarify zones under sovereign territory vs. sovereign rights to reinforce national jurisdiction over strategic minerals.
4	Transitioning KK/PKP2B to IUPK	Convert expired contracts to IUPK under state ownership to ensure national control.
5	Area Limitations for Equity	Impose area caps to prevent monopolization and ensure fair resource access.
6	Balanced Licensing Periods	Align permit durations with fair business practices and constitutional BUMN mandates.
7	Empowering State-Owned Enterprises (BUMN)	Prioritize BUMN in expiring contracts and manage resources via fully state-owned entities.
8	Implementing Constitutional Court Decisions	Centralize oversight per Law No. 23/2014, ensuring transparency and legal supervision.
9	Central-Provincial Supervision	Clearly assign IUP/IUPK/IPR responsibilities to ensure effective governance coordination.
10	National Mining Management Plan	Reinforce DMO obligations and integrate renewable energy into the national resource framework.
11	Data and Information Transparency	Ensure public access to mining data in accordance with information disclosure laws.
12	Bauxite Exploration Incentives	Promote private exploration with legal and investment protections.
13	Small-Scale Mining Permits	Develop tailored licensing schemes for small-scale mining operations.
14	Rock Tenure Permits	Allow longer and broader permits for rocks to meet increased demand.

Source: Processed by the author (2025).

The summarized key points in the table above underscore the urgent need for a comprehensive overhaul of Indonesia's mining legal framework. While Law No. 4 of 2009 and its 2020 amendment have established foundational structures, they remain insufficient in addressing the evolving challenges of governance, environmental sustainability, and social equity. The proposed considerations highlight the importance of regulatory clarity, strengthened state control, equitable access to resources, and strategic alignment with constitutional mandates.

In addition, reinforcing the role of state-owned enterprises (BUMN), improving transparency, and embedding sustainability principles into national development planning are essential steps toward responsible and future-oriented mineral resource governance particularly in the context of the global energy transition.

4. Discussion

The regulatory history of mining governance in Indonesia has undergone a long and complex evolution. Under Law No. 11 of 1967, mining activities were administered through Mining Authorizations (*Kuasa Pertambangan* or KP), which granted rights based on the classification of minerals into Groups A, B, and C. Prior to the decentralization framework introduced by Law No. 22 of 1999, the authority to issue mining concessions was largely centralized within national government agencies, with the exception of Group C minerals, which were delegated to local governments under Government Regulation No. 32 of 1969.

With the enactment of Law No. 22 of 1999 and the issuance of Government Regulation No. 75 of 2001, mining governance was formally decentralized to regional governments. However, Law No. 11 of 1967 remained unchanged between 1999 and 2008, creating a regulatory vacuum that gave rise to legal ambiguities particularly in the form of overlapping mining permits. The ratification of Law No. 4 of 2009 on Mineral and Coal Mining (commonly referred to as the Minerba Law) was viewed as a corrective measure, introducing a new licensing regime through Mining Business Permits (IUP).

Despite these efforts, ambiguities surrounding the nature of permits whether they are merely administrative tools or confer substantive concession rights persist. Moreover, widespread environmental degradation resulting from poorly regulated mining activities highlights the urgent need for comprehensive regulatory reform. Such reform is essential to align Indonesia's mining governance with principles of environmental sustainability, legal clarity, and social responsibility.

As noted by Al Janabi et al. [55], transforming into a learning-oriented organization including within government institutions is essential for adapting to rapid changes and complex challenges such as those posed by natural resource governance. In this context, bauxite, as a key mineral commodity, plays a central role in Indonesia's economic structure and is directly governed by the Mineral and Coal Mining Law (Minerba Law) [56]. In 2020, the Indonesian House of Representatives initiated amendments to this law, introducing substantial reforms aimed at addressing longstanding regulatory deficiencies and harmonizing the law with the Job Creation Law (Omnibus Law).

The amended Minerba Law introduces several notable regulatory advancements, including:

1. Formalizing the concept of Mining Legal Areas;
2. Restructuring the division of authority for mineral and coal management;
3. Mandating the preparation of a national Mineral and Coal Management Plan;
4. Assigning investigatory responsibilities to state research institutions, state-owned enterprises (SOEs), regional enterprises, and private entities for the designation of Mining Business Permit Areas (WIUP);
5. Revising the permit framework to include special-purpose permits and formal recognition of community mining; and
6. Strengthening environmental protection requirements, particularly concerning post-mining reclamation and land restoration.

One of the most pressing challenges facing the current administration under President Joko Widodo is the issue of licensing. Although presidential directives have prioritized reducing investment barriers, the mining permit system continues to suffer from overlapping jurisdictions, legal inconsistencies, bureaucratic inefficiencies, and corruption risks [57]. These constraints not only impede investment but also undermine Indonesia's competitiveness in the global mining sector. The Fraser Institute has ranked Indonesia among countries with relatively low investment attractiveness in mining, further underscoring the urgency of systemic reform.

The upstream mining sector in Indonesia continues to face multiple bottlenecks, including unclear licensing procedures, slow permit processing, and high compliance costs [58]. To enhance the country's attractiveness as a mining investment destination, the government must establish an efficient and transparent licensing system characterized by simplified procedures, predictable timelines, and reduced administrative burdens—while simultaneously enforcing environmental, social, and governance (ESG) standards in alignment with international expectations [59, 60].

Beyond upstream reform, the downstream strategy has become a central pillar of Indonesia's mineral development agenda. The President has repeatedly urged mining operators to pursue downstream processing transforming raw minerals into semi-finished or finished products. This industrialization strategy aims to increase the added value of mineral resources, generate employment, and improve national income and welfare. The revised Minerba Law mandates downstream development in line with the priorities articulated in the 2020-2024 National Medium-Term Development Plan (RPJMN), which explicitly seeks to improve the quality of economic growth by fostering value-added mining activities [61].

Furthermore, the 2020 Government Work Plan identifies mineral downstream processing as a strategic development priority. Key supporting policies include:

1. Restricting the export of raw minerals including bauxite and reinforcing domestic market obligations to ensure national supply;
2. Providing targeted incentives to support investment in mineral processing and refining facilities;
3. Enhancing legal certainty for domestic mineral refining operations; and
4. Establishing formal mechanisms to address unlicensed mining activities, including capacity-building programs for small-scale miners, enforcement of environmental remediation, and the strengthening of provincial mining inspectorates following the 2014 decentralization law reforms [62].

Nevertheless, as Hidayah et al. [63] caution, many companies continue to disregard the environmental consequences of their operations. This highlights the need for more stringent regulatory oversight and the integration of environmental governance into broader corporate accountability frameworks [64].

To address inefficiencies in licensing, the Job Creation Law (Omnibus Law) introduced a centralized licensing regime, consolidating most permitting authority under the national government except for specific cases such as quarrying and

community-based mining, which may still be delegated to subnational entities. However, the effective implementation of these reforms requires close supervision. Issues related to oversight mechanisms, equitable resource governance, and the balance of power between central and local governments remain unresolved. Without greater regulatory clarity, the risk of fragmented governance and inconsistent policy execution persists.

5. Conclusions

This study reveals that mining governance in Indonesia remains heavily procedural, with limited attention to environmental sustainability and public accountability. Within the framework of regional autonomy, local governments often prioritize investor interests over ecological protection and community welfare. The findings highlight institutional weaknesses in monitoring, licensing, and enforcement particularly regarding bauxite mining alongside poor implementation of smelter mandates, inadequate post-mining recovery, and inconsistent environmental oversight.

Empirical field and laboratory data confirm critical environmental impacts, including acidification of water bodies, metal bioaccumulation in vegetation, and pollutant accumulation in soil. While some water quality parameters fall within acceptable thresholds, CWQI scores of 40–55 indicate degraded conditions with potential health risks to surrounding communities.

The research underscores a misalignment between decentralization policy and its implementation capacity in environmentally sensitive sectors. It contributes a novel interdisciplinary approach by integrating environmental science with regulatory analysis, demonstrating the importance of evidence-based governance reforms.

To improve mining governance, the study recommends: (1) harmonizing legal frameworks to reduce regulatory conflicts; (2) strengthening local monitoring capacity; (3) linking downstream mandates with clear incentives and benchmarks; (4) enhancing transparency and public participation in permit processes; (5) institutionalizing scientific monitoring tools like CWQI; and (6) clarifying central-regional authority through cooperative supervision.

Sustainable bauxite mining in Indonesia will ultimately require not only legal and institutional reform but also a shift toward inclusive, transparent, and science-driven policymaking that balances economic development with ecological integrity.

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تضادهای سلسله مراتبی نظارتی و رژیم خودمختاری منطقه ای در مدیریت معدن بوکسیت در اندونزی

نانانگ سوپارمن[1*]، محمد اندی سپتیادی[1]، یوفلیح ریزکیا تیموتی[2]، و فیضل پیکری[1]

۱ .گروه مدیریت دولتی، دانشکده علوم اجتماعی و سیاسی، دانشگاه اسلام نگری سونان گونونگ جاتی، باندونگ، اندونزی
۲. گروه تجارت دیجیتال دانشکده اقتصاد و بازرگانی، دانشگاه پندیدیکان اندونزی، باندونگ، اندونزی

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کلمات کلیدی

سلسله مراتب نظارتی
رژیم خودمختاری منطقه‌ای
حکمرانی زیست‌محیطی
اندونزی

چکیده

این مطالعه با هدف تحلیل سلسله مراتب نظارتی و پیامدهای آن در رژیم خودمختاری منطقه‌ای در زمینه مدیریت معادن بوکسیت در اندونزی، با تمرکز بر شهر تانجونگ‌پینانگ، انجام شده است. اگرچه تمرکززدایی به دولت‌های محلی اختیار مدیریت منابع طبیعی را می‌دهد، اما همپوشانی مقررات بین مقامات مرکزی و منطقه‌ای منجر به درگیری‌های مدیریتی، اجرای ضعیف و تخریب قابل توجه محیط زیست شده است. این تحقیق با استفاده از یک رویکرد ترکیبی مبتنی بر مدل نظارتی کاگان، ارزیابی‌های زیست‌محیطی مبتنی بر میدان، از جمله نمونه‌برداری از رسوبات بوکسیت و تجزیه و تحلیل کیفیت آب پس از استخراج را با تجزیه و تحلیل هنجاری مقررات معدنی و شیوه‌های مدیریتی ادغام می‌کند. یافته‌ها نشان‌دهنده تسلط چارچوب‌های قانونی رویه‌ای بر پاسخگویی زیست‌محیطی ماهوی است. قوانین خودمختاری منطقه‌ای تمایل دارند منافع سرمایه‌گذاران را در اولویت قرار دهند، که اغلب به قیمت رفاه جامعه و احیای محیط زیست تمام می‌شود. علاوه بر این، نظارت ناکافی محلی امکان صادرات مداوم بوکسیت فرآوری نشده را فراهم کرده و آسیب‌های زیست‌محیطی را تشدید می‌کند. این مطالعه با افشای ناهماهنگی ساختاری بین اختیارات نظارتی و مسئولیت زیست‌محیطی در رژیم خودمختاری فعلی اندونزی، بینش‌های جدیدی ارائه می‌دهد. این امر بر نیاز فوری به اصلاحات نظارتی تأکید می‌کند که خطوط اختیارات را روشن کند، فرآوری بوکسیت در داخل کشور را قبل از صادرات الزامی کند و تعهدات مربوط به احیای پس از استخراج را در سطح منطقه‌ای اجرا کند. هدف این توصیه‌ها حمایت از سیاست‌گذاران در طراحی اصلاحات قابل اجرا و حساس به شرایط برای مدیریت پایدار معادن بوکسیت است.

نویسنده مسئول مکاتبات: n.suparman69@gmail.com (س. نانانگ)