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Environmental Degradation and Weak Law Enforcement in Illegal Mining Activities: A Juridicial Review

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Abstract:

Illegal Mining (PETI) is a form of legal violation that poses a serious threat to environmental sustainability and the conservation of natural resources in Indonesia. This study aimed to analyze the environmental damage caused by PETI, its impact on ecosystem functions, and the weaknesses in legal enforcement within the mining sector. This study employed a normative juridical approach, focusing on the analysis of statutory regulations and international legal instruments, such as Law No. 32 of 2009 on Environmental Protection and Management and the Minamata Convention on Mercury. The findings indicated that PETI contributes to deforestation, soil degradation, contamination from hazardous heavy metals such as mercury and cyanide, and the destruction of wildlife habitats in conservation areas. Weak law enforcement, the involvement of corrupt officials, and poor institutional coordination exacerbate the situation. Addressing PETI requires a comprehensive legal and environmental strategy, including ecological reclamation, the development of environmentally-based alternative livelihoods, public education, and regulatory reform. These measures are essential to establish a just and sustainable natural resource governance system and to guarantee the constitutional right to a clean and healthy environment.

Keywords: Environmental Degradation; Law Enforcement; Illegal Mining.

INTRODUCTION

Indonesia, a country rich in natural resources, particularly minerals and mining materials such as gold, coal, nickel, and tin, faces serious challenges in terms of governance and supervision of the mining sector. One of the main emerging issues is the rampant spread of illegal mining activities (known as Pertambangan Tanpa Izin or PETI) across various regions, from Sumatra, Kalimantan, and Sulawesi to Papua (Wibawa et al., 2023). These activities are often carried out covertly by community groups or large syndicates that exploit mineral potential illegally, without regard for applicable legal provisions. This phenomenon not only reflects the weakness of the monitoring and law enforcement system but also reveals loopholes in the permitting system, which remains far from transparent and fair (Narulita et al., 2025).

Illegal mining significantly contributes to environmental degradation, especially because it is conducted without regard for the principles of conservation and sustainability (Sukananda & Nugraha, 2020). One of its direct consequences is large-scale deforestation in protected and production forest areas, paving the way for soil degradation, loss of wildlife habitats, and disruption of natural ecosystem chains. Furthermore, PETI operations are rarely, if ever, equipped with Environmental Impact Assessments (AMDAL), which should be a mandatory requirement before any mining activity begins (Karuniani, 2022). Without such assessments, mining activities proceed without any

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consideration of environmental and social risks, making them highly prone to long-term ecological disasters, such as flash floods, groundwater pollution, and heavy metal poisoning (Kristianto, 2016).

Worse still, PETI lacks a proper waste management system. The use of hazardous chemicals, such as mercury and cyanide, in gold mining frequently contaminates rivers and lakes that serve as community water sources. This directly affects the health of surrounding communities, especially vulnerable groups such as children and pregnant women, who are continuously exposed to heavy metals in the environment. Meanwhile, the ecological damage caused by mining waste also disrupts the productivity of agricultural and fisheries land, threatening local food security. Consequently, social conflicts frequently arise between residents or between the community and authorities or companies, as the right to a clean and healthy environment is neglected.

Economically, PETI may appear profitable in the short term for a small group of actors, but on a macro level, its presence harms the state. The government loses potential revenue from taxes and royalties and gains no contribution to its local income. Moreover, PETI hampers legal investment by creating an unhealthy and legally uncertain business climate. This situation is further exacerbated by the involvement of rogue officials, local elites, and community leaders who support PETI operations for personal gain. Therefore, solving the problem of illegal mining cannot rely solely on legal approaches; it must be accompanied by a comprehensive strategy, including regulatory reform, enhanced monitoring capacity, community empowerment, and the provision of sustainable economic alternatives that do not harm the environment (Maulana, 2023).

Illegal mining has become a serious threat to environmental conservation efforts, particularly in protected forests and national parks, which should be safeguarded from excessive exploitation. The immediate impacts of these activities are visible in forest cover loss, disruption of wildlife habitats, and extinction of endemic species due to the uncontrolled destruction of ecosystems. Additionally, PETI interferes with the vital ecological functions of forests, such as absorbing atmospheric carbon dioxide (CO_2), maintaining the hydrological cycle through groundwater absorption, and preserving soil fertility through natural decomposition (Wibawa et al., 2023). Illegal logging and excavation remove essential vegetation layers that stabilize the soil, thus increasing the risks of erosion, river sedimentation, and landslides that endanger nearby communities (Budyanto, 2013).

The impact of PETI is not limited to ecological aspects and entails complex social and economic consequences. These include rising agrarian conflicts among local communities, PETI actors, and the government, especially in areas with unclear land ownership status. The situation is worsened by weak law enforcement and the involvement of officials in protecting such illegal activities. In terms of public health, hazardous chemicals such as mercury and cyanide used in illegal gold mining contaminate water and soil, causing skin diseases, nervous system disorders, and long-term poisoning among local residents. Economic inequality also worsens, as the profits from PETI are enjoyed by only a few individuals, while environmental degradation and social burdens are borne by the wider community (Hamid, 2022).

Furthermore, PETI fosters an underground economy that does not contribute to state revenue via taxes or royalties. This results in significant national revenue loss and hinders sustainable development in resource-rich areas. Without strict regulation and oversight, PETI will continue to thrive as a destructive activity that harms the environment and erodes the values of social justice, economic equity, and human rights that are central to national development. For these reasons, tackling PETI must be prioritized in Indonesia's environmental policy and natural resource governance agendas.

METHODS

This normative juridical study analyzes the legal aspects of illegal mining practices in relation to environmental degradation and the responsibilities of the Indonesian state in fulfilling its national and international legal obligations concerning environmental protection. This study employs two main approaches: the statutory approach, which examines various national legal instruments, such as Law No. 32 of 2009 on Environmental Protection and Management, Law No. 4 of 2009 on Mineral and Coal Mining (along with its amendments under the Job Creation Law), and other relevant

implementing regulations; and the international convention approach, which analyzes Indonesia's commitments within global legal frameworks, including the Basel Convention, the Minamata Convention on Mercury, and the principles outlined in the 1992 Rio de Janeiro Declaration concerning sustainable development and state responsibility for transboundary environmental protection (Setiawan, A. (2020).

Data collection in this study was conducted through library research, which included legal literature, academic journals, scholarly books, and official documents, such as reports from government agencies, international organizations, and environmental NGOs. Additionally, this study analyzed relevant court decisions, particularly legal cases concerning illegal mining and environmental damage, to assess the practical implementation of environmental law. Reports from institutions such as the Ministry of Environment and Forestry (KLHK), the Ministry of Energy and Mineral Resources (ESDM), and the National Disaster Management Agency (BNPB) were also used to observe field realities and policy responses to PETI (Indonesia Ministry of Environment and Forestry (KLHK), 2023).

Data analysis was carried out using a descriptive-qualitative method, systematically and thoroughly describing the collected data to understand the causal relationships between the rise of PETI and violations of environmental functions, as well as to evaluate whether these conditions reflect breaches of international legal obligations ratified by Indonesia. This approach allows the researcher to portray the normative state of national legal systems and assess the effectiveness and alignment of national law with binding and non-binding international norms (soft law). Consequently, this research is expected to contribute to strengthening the national environmental legal system and promoting more integrated policymaking based on the principles of ecological justice, precaution, and common but differentiated responsibilities in natural resource governance.

RESULTS

Deforestation and Habitat Loss

Illegal mining (*PETI*) has become a major driver of large-scale vegetation loss across various biodiverse regions of Indonesia, particularly in Kalimantan, Sulawesi, and Papua. These activities, conducted without proper supervision and regulation, not only degrade the soil surface but also result in massive deforestation that directly disrupts the ecosystem balance. In Kalimantan, for instance, PETI is one of the main contributors to the degradation of dense tropical forests that once served as the lungs of the planet. Illegal logging to access mining sites, the use of heavy equipment that destroys topsoil, and the uncontrolled burning of vegetation for land clearing have drastically reduced forest cover and fragmented the habitats of wildlife such as orangutans, clouded leopards, and sun bears.

In Sulawesi, PETI activities are prevalent in limited-production and protected forests, particularly those containing gold and nickel deposits. The impacts include the destruction of native vegetation that normally absorbs carbon and maintains soil moisture, along with serious pollution of groundwater and rivers due to the indiscriminate dumping of mining waste. Sulawesi's endemic vegetation, often adapted to volcanic or limestone soils, is highly vulnerable to both physical and chemical disturbances from illegal mining. Once vegetation is lost, the soil becomes unstable and highly prone to erosion, accelerating land degradation.

In Papua, PETI poses a serious threat to primary rainforests, which store vast carbon reserves and hold significant global conservation value. Although typically conducted in remote, isolated locations, illegal mining in Papua causes extensive damage through forest clearing in mountainous and riverine areas that are difficult to monitor. Both traditional and semi-mechanized illegal gold mining have led to widespread deforestation and heavy metal contamination in previously undisturbed ecosystems. PETI not only removes vegetation but also destroys swamp and peatland ecosystems, which are crucial for global climate regulation.

It is estimated that PETI has contributed to the destruction of approximately 24,000 hectares of conservation forests in the last five years. This level of damage is alarming, given that conservation areas should be strictly protected under Law No. 5 of 1990 on the Conservation of Biological Natural

Resources and Their Ecosystems. The loss of vegetation in conservation zones signifies not only the disappearance of trees and shrubs but also the extinction of rare flora, destruction of microhabitats, and disruption of pollination and food chains that sustain the ecosystems. This damage can become irreversible if not addressed urgently, as the recovery of tropical vegetation is slow and requires complex and costly ecological rehabilitation (Yuliana, 2021).

Therefore, PETI is not merely a legal or economic issue; it represents an urgent environmental crisis. The loss of vegetation due to illegal mining has far-reaching implications for climate change, increased carbon emissions, and the disappearance of critical ecosystem services that support local and global communities. Addressing PETI requires integrated efforts involving legal enforcement, conservation area protection, Indigenous community participation, and the use of spatial data and remote sensing technologies to accurately and sustainably monitor land-cover changes.

Heavy Metal Pollution from Illegal Mining Activities

Illegal mining activities, particularly in the gold mining sector, have become a major source of heavy metal pollution in several Indonesian regions. One of the most significant environmental impacts of PETI is the widespread use of hazardous chemicals such as mercury (Hg) and cyanide (CN) during gold extraction, which is carried out without proper operational standards or environmental oversight. Waste containing mercury and cyanide from these activities is often discharged directly into the environment without undergoing appropriate waste treatment procedures. These toxic substances typically contaminate water bodies, including rivers and lakes, and leach into the surrounding soil in mining areas (Ghozali, Putra, & Sari, 2024).

This type of pollution has systemic and long-term effects. In the short term, water quality deteriorates significantly, both chemically and biologically, rendering it unsafe for consumption by humans and animals. Moreover, mercury entering the aquatic food chain accumulates in the bodies of organisms, including fish, which are commonly consumed by local communities. This significantly increases the risk of heavy metal poisoning in humans, which over the long term can lead to neurological disorders, kidney damage, and even impaired brain development in children (Ghozali, Putra, & Sari, 2024).

From a soil perspective, heavy metal contamination significantly degrades the soil fertility. High concentrations of these metals can disrupt the activity of beneficial soil microorganisms, hinder plant growth, and reduce agricultural productivity in the surrounding communities. Soil contaminated with mercury and cyanide may become unusable for agriculture or human settlement for extended periods without costly and complex remediation efforts (Ghozali, Putra, & Sari, 2024).

This situation is further worsened by the fact that most PETI activities take place in environmentally sensitive areas, such as watersheds, tropical rainforests, and conservation zones. As such, heavy metal pollution from illegal mining not only poses a threat to local environments but also endangers biodiversity and ecosystem resilience on a broader scale. Therefore, strengthening environmental regulations**,** strict enforcement of environmental laws against PETI actors, and active community involvement in monitoring and environmental rehabilitation efforts are urgently needed to mitigate the expanding impact of pollution (Ghozali, Putra, & Sari, 2024).

Ecosystem Function Degradation

Illegal mining (PETI) has significant ecological impacts on the sustainability of natural ecosystems. One major effect is the alteration of soil structure due to uncontrolled excavation and the absence of proper land-use planning. According to Rahman (2022), PETI directly alters the soil surface, destroys the topsoil layer, and creates critical lands that are difficult to recover naturally. The removal of vegetation caused by illegal mining makes the soil highly vulnerable to erosion, particularly during the rainy season. The accumulated damage not only affects soil fertility but also worsens overall land degradation (Rahman, Yusuf, & Latifah, 2022).

Additionally, the disrupted soil structure reduces the ability of the land to absorb and retain water. Former mining areas, often left with open pits and uneven terrain, hinder water infiltration, thereby resulting in increased surface runoff. This leads to a higher flood risk during the rainy season and droughts during dry periods, as the land loses its capacity to store groundwater. This imbalance

disrupts the local hydrological cycle and directly affects water availability for humans, animals, and surrounding vegetation (Rahman, Yusuf, & Latifah, 2022).

Rahman, Yusuf, & Latifah also note that one vital ecosystem function is its capacity to absorb carbon from the atmosphere as part of climate change mitigation. However, PETI activities that drive deforestation and vegetation loss significantly reduce the ability of forests and vegetated land to sequester carbon. This not only contributes to global warming but also accelerates local and regional climate changes. The loss of vegetation also means the loss of habitat for various flora and fauna species, leading to a decline in biodiversity and disruption of food chains within these ecosystems (Rahman, Yusuf, & Latifah, 2022).

With the disruption of various ecosystem functions ranging from hydrological regulation, soil fertility, carbon absorption, and natural habitats, PETI places enormous pressure on ecological balance. The resulting damage is complex and long-term and may take decades to recover, even with intensive restoration efforts. Therefore, it is crucial to prevent and terminate illegal mining activities immediately and develop ecosystem rehabilitation strategies based on ecological and participatory approaches to sustainably restore environmental functions (Rahman, Yusuf, & Latifah, 2022).

Weak Law Enforcement

One of the main reasons illegal mining (*PETI*) continues to flourish across various regions of Indonesia is the persistent weakness in law enforcement. Although mining-related regulations are adequately covered in numerous statutory instruments, such as Law No. 3 of 2020, which amends Law No. 4 of 2009 on Mineral and Coal Mining, in practice, enforcement remains far from effective. Fitriani (2023) notes several contributing factors, including a lack of inter-agency coordination, limited supervision capacity, and lenient application of sanctions.

The lack of coordination between the central and local authorities has led to overlapping jurisdictions and slow responses to PETI cases. Law enforcement agencies, such as the police, the Ministry of Energy and Mineral Resources (ESDM), and local governments, often lack an integrated mechanism to combat illegal mining. Moreover, long and complex bureaucratic procedures frequently delay enforcement actions, even in areas where PETI is well-known. These gaps are exploited by PETI actors who continue to operate with impunity.

However, limited supervisory capacity is another serious issue. There are far too few mining inspectors (Waspam) relative to the vast areas that require supervision. Illegal mining sites are often in remote and difficult-to-access locations, with limited infrastructure and resources for monitoring. Consequently, PETI operations often continue openly, without fear of legal consequences.

Furthermore, Fitriani (2023) highlights the weaknesses of legal sanctions against PETI offenders. In many cases, the penalties are too lenient to serve as deterrents. Many perpetrators resume illegal activities after prosecution. The absence of strict administrative sanctions, such as confiscation of heavy equipment, revocation of business licenses, or maximum criminal charges, renders enforcement more symbolic than substantive.

More worryingly, there have been indications of involvement by rogue officials or law enforcement personnel who directly or indirectly support PETI activities. This undermines justice and erodes public trust in the government and legal institutions. Fitriani (2023) emphasizes the need for structural reforms in law enforcement systems, including stronger coordination, improved oversight capacity, and consistent enforcement of strict penalties.

DISCUSSION

PETI as Destructive Exploitation and a Complex Legal Challenge

Illegal Mining (PETI) is a form of natural resource exploitation that not only violates the law but also significantly damages the environment because it is carried out without standard procedures, environmental impact assessments, or oversight from authorized authorities. PETI ignores the basic principles of sustainability, which emphasize the balance between resource exploration, ecological

protection, and the interests of future generations. According to Hamid (2022), PETI activities cause multidimensional and cumulative environmental damage. Physically, the damage is evident in the massive deforestation in protected and production forest areas, soil degradation, and water pollution due to toxic waste, such as mercury and cyanide, which are dumped directly into rivers and other water bodies without treatment. (Hamid, 2022)

Moreover, the biological impacts of illegal mining are extremely serious. The loss of natural habitats due to the brutal clearing of mining land has led to a sharp decline in biodiversity, including threats to endemic and endangered species that depend on specific ecosystems. In the long term, this ecological destruction could accelerate the biodiversity crisis in Indonesia, which is considered one of the world's mega-biodiverse nations. Furthermore, illegal mining has widespread social impacts, such as public health problems due to exposure to heavy metals, increased rates of skin and respiratory diseases, and the emergence of land conflicts between indigenous communities, companies, and illegal mining operators.

These impacts are not isolated but are interconnected and cumulative, accelerating the rate of systemic environmental degradation. This leads to a broader ecological crisis, which not only threatens environmental sustainability but also directly reduces the environment's capacity to support human life, particularly in terms of the availability of clean water, fertile land and healthy air (Hamid, 2022)

From a legal perspective, illegal mining (PETI) clearly violates the provisions of Law Number 32 of 2009 concerning Environmental Protection and Management, as well as other sectoral regulations such as Law Number 3 of 2020 concerning Mineral and Coal Mining. However, in practice, law enforcement against illegal mining remains weak. Several key obstacles include weak oversight by authorized officials, overlapping authority among government agencies, and a lack of consistency in the application of legal sanctions. The remoteness of illegal mining areas, coupled with the practice of "tolerance" or even the involvement of certain local officials, further complicates the comprehensive eradication of illegal mining (Hamid, 2022).

Furthermore, socio-economic issues surrounding mining areas are crucial factors complicating the handling of illegal mining (PETI). Most people in these areas are economically disadvantaged and lack alternative sources of livelihood. PETI activities are not merely illegal for them but have become their primary source of livelihood. This dependence renders efforts to regulate PETI solely through legal approaches ineffective and potentially triggers social unrest. In this context, a more comprehensive and multidisciplinary approach to PETI management is crucial, one that emphasizes not only law enforcement but also social and ecological dimensions (Hamid, 2022).

Steps that need to be taken include strengthening community empowerment through the development of sustainable alternative economies, environmental education, and the active involvement of local communities in environmental monitoring. Furthermore, cross-sectoral policy reform and strengthened coordination between state institutions are essential for building a fair, transparent, and sustainable mining governance system. Only through an inclusive and integrative approach can efforts to combat illegal mining (PETI) be effective without compromising the community's right to life and the future sustainability of the environment (Hamid, 2022).

Forms of Reparation

Land Reclamation and Rehabilitation

Efforts to address the negative impacts of illegal mining (PETI) and restore damaged environmental conservation and functions require a comprehensive, planned, and sustainable reparative approach. One of the most fundamental and crucial forms of environmental reparation is land reclamation and rehabilitation programs. Land reclamation is the process of managing ex-mining land to restore the physical and biological conditions of the soil to approximate its original state or to allow it to be reused for other suitable purposes. In contrast, rehabilitation emphasizes the restoration of ecological functions and the increase of long-term land productivity through revegetation, soil restoration, and hydrological system improvements.

Reclamation and rehabilitation in illegal mining areas require a contextual approach, considering the extent of land damage, type of mining materials used, and characteristics of the local ecosystem. In practice, reclamation involves various stages, such as backfilling, slope stabilization, topsoil addition, and local vegetation replanting. Meanwhile, the rehabilitation of land severely damaged by toxic chemicals such as mercury and cyanide must be accompanied by a chemical or bioremediation program using microorganisms that break down toxins to restore the soil (Hamid, 2022).

Furthermore, the reparative approach must be synergized with sustainable development policies and regional spatial planning. Former illegal mining areas that are no longer suitable for returning to forest use can be converted into productive and ecologically viable uses, such as community forests, community conservation areas, or even organic agricultural land with integrated management. This process must involve the active participation of local communities, not only as beneficiaries but also as key actors in planning, implementing, and supervising the reclamation and rehabilitation processes. Empowering communities in the reparation process not only helps restore the environment but also creates alternative, legal, and sustainable economic sources, thereby reducing their dependence on illegal mining (Hamid, 2022).

Meutia stated that PETI (illegal mining) practices in small-scale gold mining areas result in serious ecological damage and increased public health risks due to exposure to heavy metals such as mercury. Meutia et al. (2023)

Motion et al. (2023) corroborated these findings by stating that weak environmental monitoring systems in mining areas, particularly coal mining, exacerbate environmental damage, such as soil degradation, water pollution, and loss of vegetation cover.

Furthermore, environmental reparations for PETI must be complemented by social reparations, which include restoring the health of affected communities, providing access to clean water, and resolving land conflicts arising from illegal exploitation. This is crucial because the impacts of PETI are not only ecological but also deeply social in nature. Therefore, reparative policies cannot be sectoral in nature but must be cross-sectoral and based on collaboration between the central and regional governments, civil society, academics, and the private sector committed to environmental sustainability (Hamid, 2022).

The success of environmental reparations for former illegal mining operations is largely determined by consistent policies, budget availability, transparent management, and legal enforcement to prevent the recurrence of illegal mining activities in the same area. If these reparations can be implemented systematically, there is still a chance of reversing the damage that has occurred and restoring environmental functions for the well-being of current and future generations (Hamid, 2022).

Maulana also emphasized that the success of a reclamation program goes beyond simply planting trees or filling in mining pits. It must also be measured by the extent to which the land's ecological functions are restored, such as increased soil fertility, the re-emergence of insect and bird populations, and the land's ability to maintain water and air cycles. Therefore, a long-term monitoring system is necessary, both by government agencies such as the Ministry of Environment and Forestry (KLHK) and by actively involving local communities through a community-based approach (Maulana, 2023).

Thus, the government's obligation to ensure the reclamation of former PETI areas is not only a matter of administrative law enforcement but also part of the state's commitment to restoring the community's right to a healthy and sustainable environment, as mandated in Article 28H paragraph (1) of the 1945 Constitution and Law Number 32 of 2009 concerning Environmental Protection and Management. This effort is also an important strategy for dealing with the ecological crisis resulting from irresponsible natural resource exploitation activities. Post-mining reclamation shows that if not carried out properly, it causes long-term environmental impacts that are difficult to recover. They proposed a sustainable rehabilitation approach as a solution that can be implemented to restore illegal mining areas (Jamin, 2023).

Environment-Based Economic Alternatives

A major root cause of widespread illegal mining (PETI) in remote and rural Indonesia is the lack of alternative livelihoods. Many communities depend on PETI because of the absence of legal and economically viable alternatives. Therefore, the development of environmentally based alternative economies is a key strategy for breaking this dependency (Rahman, Yusuf, & Latifah 2022).

These alternatives aim not only for economic growth but also for environmental sustainability and social inclusion. One promising model is eco-friendly agriculture, which emphasizes organic farming techniques, soil and water conservation, and local crop diversification. This form of agriculture is safer for the environment and provides stable income and food security. Such programs require training, technical support, and access to capital to enable communities to shift from illegal mining to productive and sustainable farming practices.

Another promising model is community-based ecotourism, particularly in areas of natural beauty, biodiversity, and cultural richness. If managed creatively, reclaimed mining land can be transformed into educational ecotourism sites that showcase environmental recovery. Ecotourism creates jobs in guiding, lodging, crafts, and traditional food, benefiting the wider community and raising ecological awareness (Rahman, Yusuf, & Latifah 2022).

The third strategy is social forestry, which grants communities legal access to sustainably manage state forest areas. This includes schemes such as community, village, and plantation forests. Social forestry encourages forest protection while enabling communities to benefit economically from non-timber forest products, such as honey, rattan, forest coffee, and medicinal plants. It also reduces the pressure on conservation forests and prevents forest conversion into illegal mining areas. Rahman note that social forestry has proven effective in several regions in reducing illegal activities and improving community welfare.

However, the success of these alternatives depends heavily on government support in terms of policies, regulations, funding, and technical assistance. Collaboration between central and local governments, NGOs, businesses, and academic institutions is also required to create a fair and sustainable economic ecosystem. Hence, the development of environment-based economic alternatives is a strategic and transformative step. It addresses PETI-related problems while promoting inclusive, equitable, and environmentally conscious development in line with sustainable development principles.

Law Enforcement and Regulatory Strengthening

Handling Illegal Mining (PETI) activities will not be effective without strong law enforcement and clear and operational regulations. PETI constitutes a serious violation of various applicable legal provisions, including Law Number 3 of 2020 concerning Mineral and Coal Mining and Law Number 32 of 2009 concerning Environmental Protection and Management (Natsir & Rachmad, 2019). However, in practice, weak enforcement and a lack of policy synchronization between the central and regional governments make it difficult to eradicate PETI comprehensively. Therefore, efforts are needed to strengthen the synergy between the central and regional governments in law enforcement and regulatory reform as a primary foundation (Rahman et al. 2022).

First, synergy between law enforcement agencies, such as the police, prosecutor's office, Ministry of Energy and Mineral Resources, Environmental Agency, and regional governments, must be built through a structured and data-driven coordination system (Durahman et al., 2021). Disharmony between the central and regional governments, as well as overlapping authorities, often hampers the enforcement process against PETI. Many regions lack the full authority to conduct enforcement operations, while central agencies are limited in their ability to reach remote and difficult-to-access illegal mining locations. By strengthening cross-sectoral collaboration and unifying the national illegal mining database, the government can respond more quickly and effectively to public reports and field-monitoring results (Dekiawati, 2022).

Second, the government must clarify and strengthen spatial planning policies, particularly regarding the designation of mining-free areas or areas protected from mining activities. In this context, revising

the Regional Spatial Plan (RTRW) at the provincial and district/city levels is crucial to provide legal certainty regarding which areas are and are not permitted for mining activities. Many PETI cases occur in protected forest areas, customary forests, and water catchment areas where mineral exploration is prohibited. The lack of clarity and weak oversight of spatial use opens up opportunities for land misuse in illegal mining activities (Rahman et al. 2022).

Third, strengthened regulations must be accompanied by strict legal sanctions and deterrent effects. PETI perpetrators proven to have committed environmental damage should be subject to the maximum criminal and civil sanctions, including environmental restoration as part of the punishment. Furthermore, law enforcement officers must be trained in environmental and mining laws to equip them with the technical capacity to handle complex cases. Transparency in the legal process, community involvement as supervisors, and the elimination of corrupt practices in the field are crucial elements in building a fair and effective law enforcement system.

Furthermore, the government needs to strengthen mining licensing mechanisms to prevent permit abuse or legal loopholes exploited by certain parties to legalize illegal activities. Integrating an online single-submission licensing system with technology-based monitoring, such as drones and satellite imagery, can strengthen mining oversight, particularly in areas prone to illegal mining (PETI).

From an administrative perspective, Zahroh and Najicha (2022) highlight the weak implementation of the Environmental Impact Assessment (EIA) as one of the root causes of the problem, where environmental permit processes are often ignored or reduced to formalities. This creates loopholes that allow illegal mining activities to flourish.

In the context of environmental management, administrative aspects play a crucial role in ensuring that all business activities, including mining, comply with the principles of sustainable and environmentally friendly laws (Yani & Din, 2021). One key instrument in this administrative aspect is the Environmental Impact Analysis (EIA), which is mandatory before an environmental permit is issued to a mining business. However, in practice, the EIA is often merely a formal administrative requirement and is not substantively implemented.

Zahroh and Najicha (2022) critically revealed that the implementation of AMDAL (Environmental Impact Assessment) in Indonesia suffers from numerous weaknesses, both in substance, the preparation process, and post-approval oversight. Licensing procedures are often rushed without adequate community involvement, creating opportunities for environmental violations. This gap is further exacerbated by weak oversight from local government institutions, allowing various mining activities, both legal and illegal (PETI), to proceed without effective regulation.

This situation demonstrates a dysfunctional administrative law, where environmental regulations, which should act as a control tool, fail to perform their function due to weak implementation. In the context of PETI, this is particularly significant because the absence of an AMDAL process in illegal mining activities results in environmental impacts not being identified early, leading to greater and more systematic damage to the environment.

Furthermore, weak institutional capacity to verify environmental documents and monitor their implementation contributes to a culture of impunity in the mining sector. Many mining companies, including those with large capital, operate without fully complying with environmental regulations. This situation creates a legal gray area, where the line between legal and illegal activities becomes blurred in the public's eyes. Meanwhile, Situmeang and Redi (2024) highlight that violations of reclamation obligations by mining business permit holders often go unpunished, demonstrating weak administrative enforcement.

Therefore, to curb illegal mining (PETI) and encourage compliance with environmental norms, fundamental administrative reforms are required. Reforming the AMDAL (Environmental Impact Assessment) governance system, increasing the capacity of environmental supervisory officials, and digitizing the licensing system are strategic steps that must be taken to address this issue. Furthermore, strengthening transparency and public participation in the licensing process can encourage greater accountability in any mining project that has the potential to harm the environment.

Law enforcement and strengthening regulations are two key elements that cannot be separated from the national strategy to eradicate illegal mining (PETI). Without strong commitment from all levels of government and comprehensive policy reform, illegal mining activities will continue, causing environmental damage and deepening social inequality. The success of environmental conservation programs and sustainable natural resource management depends heavily on the robustness and fairness of a country's legal system and policies (Rahman et al. 2022).

Community Education and Involvement

One crucial strategy for eradicating illegal mining (PETI) and achieving sustainable environmental restoration is the active involvement of local communities through educational and participatory programs. According to Rahman, successful monitoring of illegal mining practices cannot be solely the responsibility of law enforcement officials or government agencies but rather requires the involvement of the community as the primary actor who lives directly adjacent to the affected areas. This community-based approach is considered more effective because it prioritizes the principles of ecological justice and builds collective awareness to preserve the environment for long-term interests (Rahman et al. 2022).

One concrete form of community involvement is the establishment of the Environmental Alert Village program, which involves villages with independent and participatory environmental monitoring and mitigation systems. Under this scheme, villagers are encouraged to form environmental task forces (satgas), which routinely conduct patrols, collect data, and report illegal mining activities and other potential environmental damage. These task forces can collaborate with local governments, environmental NGOs, and security forces to ensure prompt action based on field information. Environmental Alert Villages also serve as educational and information dissemination platforms for environmental regulations, the dangers of heavy metals, and the importance of reclamation and rehabilitation of former mining areas.

In addition to supervision, school-based ecological education is crucial for building environmental awareness from an early age. Rahman stated that students in mining-prone areas need to be provided with supplementary curriculum or local content that includes material on forest conservation, the dangers of illegal mining, waste recycling, and biodiversity conservation. This program can be developed through collaboration between the Department of Education, Department of Environment, and higher education institutions. Activities such as tree planting, composting, or regular river water quality monitoring can be part of hands-on, applicable, and contextual learning. Furthermore, strengthening community capacity through technical training and mentoring is also necessary, intensive, and sustainable.

Communities must be equipped with skills in environmentally friendly agriculture, land rehabilitation techniques, green economic enterprises, and the use of simple technologies for environmental monitoring. In this way, they will not only become passive observers but also active actors in social and ecological transformation. These training programs will be far more effective if tailored to local socio-cultural conditions and needs and implemented collaboratively with traditional leaders, youth, women, and other community groups (Rahman et al., 2022).

Equally important, this participatory approach must be based on the principles of inclusivity and social justice. Community involvement is not merely a formality; it must guarantee the right to determine the direction of development in their own areas. Therefore, participatory mechanisms are needed in policy formulation, spatial planning, and granting mining permits to prevent communities from becoming victims of destructive and unfair resource exploitation practices. He added that the socioeconomic structure in illegal mining areas demonstrates the existence of strong informal networks between perpetrators, local elites, and officials, which indirectly hinders the effectiveness of law enforcement (Hasibuan et al., 2022).

Therefore, community education and involvement are essential foundations for creating sustainable and equitable environmental management systems. Without conscious, organized, and empowered community participation, efforts to regulate illegal mining (PETI) and restore the environment will be short-term and lack depth. Therefore, inclusive environmental development strategies must be

continuously expanded through meaningful education and concrete empowerment (Rahman et al., 2022).

CONCLUSION

Illegal Mining (PETI) is a complex, multidimensional phenomenon that has become a serious threatens environmental sustainability, social justice, and legal certainty in Indonesia. Illegal mining activities, carried out without official permits, environmental impact assessments, and adequate oversight, have been proven to cause massive ecological damage, ranging from deforestation and soil degradation to water pollution by heavy metals such as mercury and cyanide, disruption of biodiversity, and loss of ecosystem function.

Beyond environmental impacts, illegal mining has serious social consequences, such as public health problems, agrarian conflicts, and economic inequality due to the exploitation of resources by a limited group. Furthermore, weak law enforcement, overlapping authority between agencies, and the involvement of certain officials have reinforced the prevalence of illegal mining and hampered effective eradication.

Therefore, resolving the illegal mining (PETI) problem cannot be done in a piecemeal manner but rather through a comprehensive and collaborative approach. Environmental reparations must be implemented through land reclamation and rehabilitation using reforestation techniques, phytoremediation, and other biotechnologies, along with restoring the socio-ecological functions of the affected areas. Furthermore, the development of environmentally based economic alternatives, such as organic farming, ecotourism, and social forestry, is necessary to transition communities from dependence on illegal mining to a sustainable development model.

Strengthening the synergy between the central and regional governments in law enforcement, clear spatial planning, and reforming mining licensing policies are essential prerequisites for creating equitable and environmentally sound natural resource governance. Furthermore, education and active community involvement in environmental monitoring and restoration must be key foundations, ensuring that communities are not merely victims but also agents of change in preserving nature. Thus, eradicating illegal mining (PETI) is not only a matter of law enforcement but also of upholding the principles of ecological justice and intergenerational sustainability. Addressing illegal mining (PETI) must be part of a broader agenda for environmental governance transformation in Indonesia~~,~~ to ensure the right to a healthy environment, as guaranteed by the Constitution.

Conflict of Interest

All the authors declare that there are no conflicts of interest.

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