



Regulatory Fragmentation of Compensation and Recovery for Communities Affected by Mining Blasting: A Critical Normative Study of Cases in Leuwikaret, Lulut, and Hambalang

Saefullah ^{a,*}, Ajrina Rahmah Hira ^b

^a Universitas Krisnadwipayana, Jakarta, Indonesia

^b Toulouse Business School, Toulouse, France

* Email: saefullah1980@gmail.com

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Abstrak

Mining blasting is a technically permissible activity in mining operations; however, it may generate ground vibrations, dust, noise, cracks in buildings, and disturbances to the comfort of surrounding communities. This article examines the regulatory fragmentation of compensation and recovery for communities affected by mining blasting, using limited empirical illustrations from Leuwikaret Village, Lulut Village, and Hambalang Village in Bogor Regency. This study employs a critical normative legal method, incorporating statutory, conceptual, and limited empirical-illustrative approaches. The findings indicate that environmental law regulates community rights, access to information, complaint mechanisms, compensation, recovery, supervision, and administrative sanctions. Mineral and coal mining law regulates good mining practices, reclamation, post-mining activities, guidance, supervision, data management, and community empowerment. Company law governs corporate social and environmental responsibility. However, these three legal regimes have not yet established specific operational mechanisms for verifying losses caused by blasting, disclosing technical blasting data, assessing damage to buildings, distinguishing corporate social responsibility from compensation, and defining the role of local governments in facilitating complaints. This article recommends the adoption of specific guidelines on compensation and recovery for losses arising from mining blasting.

Kata Kunci: Affected Communities; Compensation; Mining Blasting; Recovery; Regulation.

1. INTRODUCTION

The mining of raw materials for cement production makes a significant economic contribution to industrial development while simultaneously posing environmental and social risks. The extraction of limestone, clay, and other mineral resources is not merely associated with production activities but also with the living environment of surrounding communities. In the context of the cement industry, Indocement states that its business activities encompass the production of cement, ready-mix concrete, mortar, coal mining, the quarrying of limestone, clay, trass, stone, sand, and other mineral resources. This information is significant because the areas surrounding cement plants and quarry sites serve not only as industrial spaces but also as the social living environment of rural communities.

Mining blasting is among the most sensitive mining activities from the perspective of surrounding communities. Technically, blasting is employed to fragment rock formations and improve the efficiency of mining operations.



However, the study by Torres, Silveira, Lopes, and Lima demonstrates that mining blasting generates ground vibrations that may cause structural disturbances and human discomfort, particularly where open-pit mines operate in close proximity to local communities (Navarro Torres et al., 2018). Similarly, Nguyen et al. report that blasting in open-pit mines may produce peak particle velocity (PPV), air overpressure, flyrock, dust, and toxic effects, making the measurement and prediction of blast-induced vibrations essential components of impact mitigation (Nguyen et al., 2019). Accordingly, mining blasting is not merely a matter of mining engineering; it also raises important legal, environmental, public health, and community protection concerns.

Within the context of Bogor Regency, Leuwikaret Village and Lulut Village in Klapanunggal District, together with Hambalang Village in Citeureup District, provide relevant limited empirical illustrations. These villages are situated within the landscape of the cement industry and in areas surrounding the extraction of raw materials for cement production. A study by Pambudi et al. on PM10 concentrations in Klapanunggal and Citeureup Districts found that PM10 levels fluctuated between 2002 and 2018 and tended to cluster around cement plants, cement-based industries, and limestone mining areas (Pambudi et al., 2020). Although the study did not specifically examine mining blasting, compensation, or recovery, it provides an important baseline indicating that the environmental conditions in Klapanunggal and Citeureup warrant more focused legal and environmental investigation.

The *das sollen* of Indonesian law has, in fact, established a normative foundation for legal protection. Article 28H(1) of the 1945 Constitution of the Republic of Indonesia guarantees every person's right to a good and healthy environment. Article 33(3) of the Constitution further provides that land, water, and natural resources are controlled by the State and shall be utilized for the greatest prosperity of the people. Law No. 32 of 2009 on Environmental Protection and Management regulates community rights, environmental information systems, public participation, supervision, administrative sanctions, dispute resolution, and evidentiary mechanisms. Government Regulation No. 22 of 2021 further elaborates the framework governing environmental approvals, environmental damage control, data related to guarantees for environmental restoration, guidance, supervision, and administrative sanctions.

From the perspective of mining regulation, Law No. 3 of 2020 introduced significant reforms to the legal framework governing mineral and coal mining, including the allocation of regulatory authority, licensing, the strengthening of environmental policies in mining operations, reclamation, post-mining activities, guidance, supervision, data and information management, and community empowerment. Law No. 2 of 2025, the most recent amendment to the Mining Law, introduced several new provisions; however, its primary focus remains on the governance of mining permit areas, the involvement of designated business entities, and non-tax state revenue. From the corporate law perspective, Law No. 40 of 2007 on Limited Liability Companies recognizes corporate social and environmental responsibility for companies conducting business activities in, or related to, the exploitation of natural resources. This provision is particularly relevant to companies engaged in the extraction of raw materials for cement production, as their operations are directly associated with the utilization of natural resources.

The *das sein*, however, reveals a more complex reality. Communities

experiencing ground vibrations, cracked houses, dust, and disturbances to their daily lives often possess evidence of the impacts but lack access to the technical data relating to blasting operations. Essential information—such as blast locations, blasting distances, explosive quantities, delay timing, peak particle velocity (PPV) values, vibration frequencies, and monitoring reports—is typically controlled by mining companies or regulatory authorities. Consequently, the burden of proof becomes inherently unequal. While affected residents may document structural cracks and provide chronological accounts of their complaints, they face substantial difficulties in establishing a technical causal link without access to blasting data. It is precisely at this point that the regulatory gap becomes evident. Although the law recognizes the rights to information and compensation, it has yet to establish a specific and accessible procedural mechanism for addressing claims arising from damage caused by mining blasting.

Previous studies reveal a significant research gap. Torres et al. examined methods for predicting, assessing, and controlling blast-induced vibrations in open-pit mines located near surrounding communities ([Navarro Torres et al., 2018](#)). Norén-Cosgriff et al. investigated structural damage caused by blasting-induced vibrations and emphasized the importance of vibration limits and frequency in assessing building damage ([Norén-Cosgriff et al., 2020](#)). Khan et al. evaluated blasting-induced vibrations using peak particle velocity (PPV), scaled distance, the United States Bureau of Mines (USBM) criteria, and DIN 4150 standards as benchmarks for assessing risks to structures ([Hossain Khan et al., 2025](#)). Efendi et al. applied the kriging method to map the spatial distribution of blast-induced vibrations, classifying affected areas into safe, cautionary, and hazardous zones ([Efendi et al., 2025](#)). Pambudi et al. examined PM10 concentrations associated with the cement industry in Klapanunggal and Citeureup ([Pambudi et al., 2020](#)). However, none of these studies critically and normatively examines the regulatory fragmentation governing compensation and recovery for communities affected by mining blasting in villages surrounding cement industry operations. Likewise, Wardono et al. investigated community empowerment programs implemented by PT Indocement within the context of environmental accounting and the circular economy but did not address compensation for damages resulting from mining blasting ([Wardono et al., 2023](#)).

The novelty of this article lies in its critique of regulatory fragmentation. Rather than determining the technical liability of any particular company, this study examines why the existing frameworks of environmental law, mineral and coal mining law, and company law remain insufficiently operational to answer practical questions raised by affected communities. These questions include: Who is responsible for verifying damage to residential buildings? How can residents obtain access to blasting data? What standards should be applied in calculating compensation for losses? How should corporate social responsibility (CSR) be distinguished from legal compensation? And what role should local governments play when technical regulatory authority over mining activities rests with the central or provincial governments?

Based on the foregoing discussion, this article addresses two research questions. First, how are compensation and recovery for communities affected by mining blasting regulated under environmental law, mineral and coal mining law, and company law? Second, what regulatory weaknesses hinder the effective verification of losses, access to information, compensation, recovery, and the role of

local governments in protecting communities affected by mining blasting? Accordingly, this article aims to analyze the normative framework governing compensation and recovery while formulating a regulatory critique that may serve as a basis for strengthening policies on the protection of communities affected by mining blasting.

2. RESEARCH METHODOLOGY

This study employs a critical normative legal research method. Normative legal research is adopted because the primary object of analysis consists of legal norms, legal principles, legal doctrines, and the allocation of legal authority governing compensation and recovery for losses arising from mining blasting. The critical perspective is employed to evaluate the adequacy of the existing regulatory framework rather than merely describing the content of statutory provisions. In legal research, the statutory approach is used to examine the consistency and interrelationship of legal norms, whereas the conceptual approach is employed to construct legal arguments based on relevant legal concepts ([Marzuki, 2019](#)).

The study applies three complementary approaches: the statutory approach, the conceptual approach, and limited empirical illustrations. The statutory approach examines the 1945 Constitution of the Republic of Indonesia, Law No. 32 of 2009 on Environmental Protection and Management, Government Regulation No. 22 of 2021, Law No. 3 of 2020 on Mineral and Coal Mining and its subsequent amendments, Law No. 40 of 2007 on Limited Liability Companies, and legislation governing local government. The conceptual approach explores the legal concepts of compensation, recovery, access to information, corporate social and environmental responsibility, administrative supervision, and regulatory fragmentation. Limited empirical illustrations are incorporated by referring to Leuwikaret Village, Lulut Village, and Hambalang Village as factual contexts that demonstrate the potential gap between legal norms and the protection needs of affected communities.

The empirical data presented in this article are not intended to establish the technical liability of any particular company conclusively. Rather, they are used as illustrative evidence of the impacts of mining blasting and the need for effective verification mechanisms. Relevant empirical materials include chronological accounts of residents' complaints, documentation of structural cracks in buildings, maps showing the distribution of affected houses, complaint letters, responses from village or local government authorities, and publicly available information issued by companies or government agencies, where available. This methodological position enables the study to retain its normative legal character while remaining grounded in the broader social context. The analysis is conducted using a qualitative-prescriptive approach to identify regulatory weaknesses and formulate recommendations for reforming the mechanisms governing compensation and recovery for losses resulting from mining blasting.

3. RESULTS AND DISCUSSION

3.1 Mining Blasting as a Legal Risk, Not Merely a Technical Risk

Mining blasting is commonly understood as a technical activity within mining operations. While this perspective is valid, it is insufficient. From a legal standpoint, a technical activity that causes adverse impacts on residential buildings, public health, the environment, and the sense of security of surrounding communities gives

rise to questions of legal responsibility and accountability. Zhou et al. demonstrate that peak particle velocity (PPV) is a key parameter for estimating blast-induced vibrations and that vibration prediction can help prevent damage to structures surrounding mining sites (Zhou et al., 2021). Accordingly, vibration measurement is not merely an engineering requirement; it also serves as an important legal instrument for determining whether a mining company has taken adequate preventive measures.

Norén-Cosgriff et al. further argue that structural damage resulting from blasting-induced vibrations should be assessed by considering vibration limits, vibration frequency, building type, and structural condition (Norén-Cosgriff et al., 2020). This finding is significant from a legal perspective because residents' claims regarding cracks in their houses should not be dismissed solely on the basis of a company's assertion that blasting operations remained within permissible thresholds. Conversely, such claims must also be subject to objective verification so that every instance of structural damage is not automatically attributed to mining blasting. An effective regulatory framework should therefore provide an independent verification mechanism capable of balancing these competing positions.

In villages located near mining operations, evidence submitted by residents generally consists of photographs of structural cracks, testimonies regarding ground vibrations, complaints concerning dust, and chronological accounts of the incidents. Although such evidence may be insufficient to establish technical liability conclusively, it is sufficient to trigger a legal obligation to conduct verification. The law should not require affected residents to prove technical parameters that are accessible only to mining companies. Where data relating to PPV, blast locations, and blasting records remain exclusively under the control of the company, the burden of proof should not be imposed disproportionately upon affected communities.

Regulatory fragmentation becomes evident at this stage. Environmental law provides the legal basis for community rights and environmental dispute resolution. Mineral and coal mining law imposes technical obligations and environmental management responsibilities upon mining companies. Company law requires corporations engaged in activities involving natural resources to implement corporate social and environmental responsibility. However, none of these legal regimes establishes an integrated mechanism specifically governing claims for losses arising from mining blasting. As a consequence, affected residents may be directed to environmental law procedures, mining regulatory mechanisms, corporate social responsibility (CSR) programs, or village-level deliberation processes, without any clear procedural certainty regarding the appropriate avenue for seeking compensation and recovery.

3.2 Environmental Law: A Strong Foundation of Rights, but a General Framework for Mining Blasting

Environmental law provides the primary legal foundation for protecting communities affected by mining blasting. Law No. 32 of 2009 on Environmental Protection and Management recognizes the right to a good and healthy environment, the right to obtain environmental information, the right to participate in environmental decision-making, the right to submit proposals or objections, and the right of access to justice (Purwendah et al., 2022). These provisions provide the

legal basis for residents of Leuwikaret, Lulut, and Hambalang Villages to request information concerning the environmental risks associated with mining activities in their surrounding areas. The right of access to information is particularly important because claims relating to the impacts of mining blasting cannot be meaningfully assessed without access to relevant technical data.

Government Regulation No. 22 of 2021 further strengthens the regulatory framework governing environmental supervision and administrative sanctions. The regulation establishes provisions concerning environmental approvals, pollution control, environmental damage control, environmental information systems, governmental guidance, regulatory supervision, and the imposition of administrative sanctions (Effendi et al., 2022). Nevertheless, its principal weakness lies at the operational level. Government Regulation No. 22 of 2021 does not establish specific procedures for addressing claims involving structural cracks in buildings or disturbances to community well-being resulting from mining blasting. The regulatory framework governing environmental damage control remains largely general in nature, despite the distinctive characteristics of blasting activities, which involve technical parameters such as ground vibration, vibration frequency, blasting distance, geological conditions, structural characteristics of buildings, and blasting intensity.

Under environmental law, compensation and environmental restoration are distinct legal concepts. Compensation is directed toward victims or parties who have suffered losses, whereas environmental restoration is intended to restore impaired environmental functions. This distinction is particularly significant in cases involving mining blasting. Where residential buildings have sustained structural cracks, individual damage assessments and compensation are required. By contrast, where recurring dust, noise, or ground vibrations adversely affect environmental quality, environmental restoration measures and operational controls become necessary. A regulatory framework that emphasizes compensation without requiring environmental restoration is unlikely to prevent recurring conflicts.

The principal criticism of the environmental law framework is its failure to establish evidentiary procedures that adequately address the unequal distribution of access to information. Technical blasting data remain under the control of mining companies, while evidence of the resulting impacts is held by affected residents. Meanwhile, regulatory oversight is exercised by government authorities. However, neither Law No. 32 of 2009 on Environmental Protection and Management nor Government Regulation No. 22 of 2021 explicitly requires the establishment of an independent verification team to investigate claims of damage arising from mining blasting. The existing regulatory framework likewise fails to prescribe mandatory time limits for investigations, minimum categories of technical data that must be disclosed, or procedural mechanisms enabling residents to challenge the findings of damage assessments.

3.3 Mineral and Coal Mining Law: Strong in Mining Governance, Weak in Addressing Community Claims

The Mineral and Coal Mining Law positions mining as a state-controlled economic activity conducted through a licensing regime. The amendments introduced by Law No. 3 of 2020 strengthened the regulatory framework governing governmental authority, licensing, environmental management, reclamation, post-

mining obligations, guidance, supervision, data and information management, and community empowerment (Farhan Tigor Lubis & Lubis, 2024). From a normative perspective, these provisions demonstrate that mining is not viewed merely as the exploitation of natural resources but is also subject to risk management and environmental restoration obligations.

However, when examined from the perspective of communities affected by mining blasting, the mining law framework continues to exhibit significant shortcomings. Although the requirement to comply with good mining practices is an important regulatory principle, affected residents are unable to rely effectively on this standard without access to the underlying technical documentation. They generally lack information regarding peak particle velocity (PPV), the quantity of explosives used, blast locations, and the results of vibration monitoring. Efendi et al. demonstrate that mapping the spatial distribution of blast-induced vibrations can classify mining areas into safe, cautionary, and hazardous zones (Saptono & Lestari, 2024). If such technical assessments are feasible, then, as a matter of legal obligation, mining companies and government authorities should provide surrounding communities with information on blasting risk zoning.

A further regulatory weakness lies in the disconnect between reclamation and post-mining obligations, on the one hand, and recovery measures required during the operational phase of mining activities, on the other. Reclamation and post-mining measures are generally understood as obligations to be fulfilled after land disturbance has occurred or mining operations have ceased. In the context of mining blasting, however, damage may occur while mining operations are still underway. Where residential buildings develop structural cracks or communities experience recurring disturbances, recovery measures cannot reasonably be deferred until the post-mining stage. The regulatory framework should therefore distinguish between environmental restoration following mine closure and recovery measures addressing operational impacts as they occur during the active life of the mine.

Law No. 2 of 2025 represents the most recent reform of Indonesia's mineral and coal mining regime. However, the matters emphasized in its official explanatory summary primarily concern the implementation of decisions of the Constitutional Court, the priority allocation of Mining Business Permit Areas (*Wilayah Izin Usaha Pertambangan* or WIUPs), the participation of cooperatives, small and medium-sized enterprises, religious social organizations, and higher education institutions, as well as the administration of non-tax state revenue (*Penerimaan Negara Bukan Pajak* or PNBP) by the Minister (Widyaningrum & Hamidi, 2024). Although these reforms are significant for the governance of the mining sector, they do not address the need for specific standards governing compensation and recovery for communities affected by mining blasting.

From a normative perspective, the principal criticism is that the mining law framework fails to establish a direct connection between the technical obligations imposed on mining companies and the legal claims of affected communities. The regulatory framework does not prescribe standardized procedures requiring every complaint concerning structural cracks allegedly caused by mining blasting to be assessed using vibration data, blast-radius mapping, structural assessments of affected buildings, and relevant environmental documentation. Nor does it require mining companies to disclose summaries of blasting data to affected residents through government authorities or an independent verification team. In the absence

of such procedural mechanisms, the principle of good mining practices cannot effectively function as an instrument for protecting affected communities.

3.4 Company Law: Corporate Social Responsibility Is Not Equivalent to Legal Compensation

Companies engaged in the extraction of raw materials for cement production are generally incorporated as limited liability companies. Consequently, their legal responsibilities must be assessed not only through mining licenses and environmental documentation but also in light of their corporate obligations. Law No. 40 of 2007 on Limited Liability Companies requires companies conducting business activities in, or related to, the exploitation of natural resources to undertake corporate social and environmental responsibility ([Herman & Badrunsyah, 2024](#)). This provision is directly relevant because the extraction of raw materials for cement production is intrinsically linked to the utilization of natural resources.

Indocement states that its community development programs are designed to promote community empowerment and generate long-term benefits for communities surrounding its operational areas. The company also reports that it engages local communities and village governments through the Bilikom forum across all partner villages ([Afnan et al., 2024](#)). In the environmental context, Indocement further states that it has adopted policies governing environmental impact management, dust emission control, the use of alternative fuels, and mine reclamation in accordance with Environmental Impact Assessment (*Analisis Mengenai Dampak Lingkungan* or AMDAL) requirements, Environmental Management and Monitoring Plans (*Rencana Pengelolaan Lingkungan/Rencana Pemantauan Lingkungan* or RKL/RPL), the Mining Work Plan and Budget (*Rencana Kerja dan Anggaran Biaya* or RKAB), and regulations issued by the Ministry of Energy and Mineral Resources (MEMR). These disclosures indicate the company's stated commitment to environmental protection and community welfare.

From a legal perspective, however, corporate social responsibility (CSR) must not be treated as a substitute for legal compensation. CSR constitutes a social development program, whereas compensation serves to restore the rights of individuals who have suffered legally recognizable losses. Where residential buildings have sustained structural damage as a result of mining activities, the appropriate legal response is not merely the provision of community development programs or social assistance. Rather, it requires the verification of damage, the assessment of repair costs, the restoration of damaged property, the payment of legal compensation, and the implementation of measures to control the source of the impacts. Wardono et al. demonstrate that Indocement's community empowerment programs in waste management and alternative energy have generated positive economic and environmental outcomes for local communities ([Wardono et al., 2023](#)). Nevertheless, the success of such community development initiatives does not resolve the legal issues arising from specific losses caused by mining blasting.

Regulatory fragmentation becomes apparent when CSR is used as the principal mechanism for addressing concrete losses suffered by affected communities. In practice, mining companies may provide assistance for house repairs, construction materials, or monetary payments through social responsibility programs. While such assistance may alleviate the immediate burden on affected residents, it risks

obscuring their legal rights if it is not based on a transparent and objective assessment of the damage. Residents may be deemed to have accepted compensation even though no independent evaluation of their losses has ever been conducted. Accordingly, the regulatory framework should draw a clear legal distinction between CSR, community empowerment programs, social assistance or ex gratia compensation, and legally enforceable compensation for damages.

The board of directors also bears important responsibilities in this regard. Under company law, directors are required to manage the company with due care and in compliance with applicable legal obligations. Accordingly, recurring complaints concerning ground vibrations, structural cracks in residential buildings, or dust generated by mining operations should form part of the company's risk management framework. Compensation and recovery should not be treated as external costs to be borne by affected communities. Companies that derive economic benefits from mining activities should also bear the costs of risk mitigation and the recovery of impacts resulting from their operations.

3.5 The Ambiguity of the Role of Local Government

The role of local government in addressing issues arising from mining blasting must be understood with due regard to the current legal framework. Following the amendments to the Mineral and Coal Mining Law, regulatory authority over the technical governance of mineral and coal mining has largely been centralized within the national government, although certain functions may be delegated. Law No. 3 of 2020 reorganizes the allocation of authority over mineral and coal mining governance, including regulatory oversight, supervision, data and information management, and community empowerment ([Wardono et al., 2023](#)). As a result, district governments no longer necessarily possess full regulatory authority over mining permits. Nevertheless, the absence of comprehensive licensing authority does not mean that local governments may remain passive in responding to the impacts experienced by their communities.

Local governments continue to perform important functions in the protection of communities, public health, environmental protection, public order, the facilitation of public complaints, and inter-agency coordination. Village and subdistrict administrations may receive and document residents' complaints, prepare official records of reported incidents, map affected residential areas, facilitate meetings between relevant stakeholders, and forward reports to the competent authorities. Regional environmental agencies may also undertake preliminary investigations where there are indications of pollution, excessive dust, noise, or violations of environmental obligations. Where the issues concern the technical aspects of mining operations, local governments may request further investigation by the provincial government or the relevant national ministry.

The principal regulatory weakness lies in the absence of a clearly defined mandatory coordination mechanism. Residents naturally submit complaints to village or district authorities because the impacts occur within their communities. However, the technical investigation of mining operations may fall outside the jurisdiction of district governments. As a consequence, community complaints risk being resolved only through facilitated deliberation without any accompanying technical verification. This situation creates an administrative disconnect between the location where the impacts occur and the authorities responsible for technical regulatory oversight.

This ambiguity has the potential to undermine access to justice. If local governments maintain that mining activities fall exclusively within the jurisdiction of the provincial or central government, affected residents may lose access to the most immediate and accessible complaint mechanism. Conversely, if the provincial or central authorities do not conduct timely investigations, the harmful impacts may continue unabated. Accordingly, a clear coordination model is required. Under such a model, village authorities should formally record community complaints; subdistrict authorities should undertake preliminary validation; district governments, through their Environmental Agency (*Dinas Lingkungan Hidup* or DLH) and other relevant institutions, should prepare impact assessment reports; and provincial or national mining authorities should conduct technical investigations in collaboration with an independent verification team.

In the context of Leuwikaret, Lulut, and Hambalang Villages, the role of local government is particularly significant as an institutional bridge between affected communities and the competent mining authorities. Local governments need not assume technical regulatory authority over mining operations. They do, however, have an obligation to ensure that community complaints are not overlooked. Local governments may also facilitate access to public information, coordinate health assessments, prepare impact maps, and ensure that village-level deliberation forums do not become informal mechanisms that effectively extinguish residents' legal rights to compensation.

3.6 Reformulating the Regulatory Framework for Compensation and Recovery Arising from Mining Blasting

Regulatory fragmentation may be addressed through the adoption of specific guidelines governing compensation and recovery for losses arising from mining blasting. Such guidelines need not take the form of a new statute. Instead, they may be issued as a ministerial regulation, a ministerial decree, or an intersectoral guideline jointly developed by the Ministry of Environment and Forestry (MoEF), the Ministry of Energy and Mineral Resources (MEMR), and local governments. Their primary objective should be to integrate the regulatory frameworks of environmental law, mineral and coal mining law, and company law.

First, the guidelines should establish mandatory requirements for the recording and disclosure of blasting data relevant to affected communities. Such information should include the date and time of each blast, blast locations, the distance from nearby settlements, peak particle velocity (PPV), vibration frequency, airblast levels, and monitoring results. Although commercially or operationally sensitive technical information may be presented in summarized form, it should not be withheld in its entirety. Khan et al. demonstrate that PPV, vibration frequency, and standards developed by the United States Bureau of Mines (USBM) and DIN 4150 provide reliable benchmarks for assessing the risk of structural damage resulting from mining blasting ([Hossain Khan et al., 2025](#)). Within the Indonesian context, nationally adopted technical standards should serve as the principal basis for such assessments.

Second, the guidelines should establish an independent verification mechanism. The verification team should include representatives from the mining, environmental, construction, and public health sectors, together with local government officials, village authorities, and representatives of affected communities. Its responsibilities should include conducting site inspections,

documenting structural damage, reviewing blasting data, assessing temporal and spatial correlations between blasting activities and reported impacts, and preparing recommendations concerning compensation or recovery measures. The risk-zoning model proposed by Efendi et al. may provide a useful framework for classifying areas surrounding blasting sites into safe, cautionary, and high-risk zones ([Efendi et al., 2025](#)).

Third, the guidelines should clearly distinguish between individual compensation and environmental restoration. Individual compensation should cover the repair of damaged houses, repair costs, medical expenses, temporary relocation, and proven economic losses. Environmental restoration, by contrast, should encompass dust control measures, reductions in blasting intensity, modifications to blasting methods, improvements to drainage systems, revegetation, and other measures designed to mitigate environmental impacts. If the response is limited to monetary compensation without addressing the underlying source of the impacts, conflicts are likely to recur.

Fourth, the guidelines should expressly provide that corporate social responsibility (CSR) cannot substitute for legal compensation. While CSR may serve as a complementary instrument for supporting social recovery, it must not be used to discharge a company's legal obligations to compensate affected residents for their losses. This distinction is particularly important because communities participating in company-sponsored community development programs frequently receive various forms of social assistance. Their status as beneficiary communities should not diminish or prejudice their legal right to pursue compensation claims ([Habert et al., 2020](#)).

Fifth, the guidelines should define the role of local government as a mandatory facilitator within the compensation and recovery process. Village authorities should receive and document community complaints. Subdistrict authorities should undertake preliminary administrative verification. District governments, through their environmental and public health agencies, should conduct initial assessments of the reported impacts. Provincial governments or the relevant ministry should then be responsible for the technical assessment of mining operations. Such a coordination model would reduce jurisdictional disputes among government institutions and shorten the institutional distance between affected communities and the State.

Sixth, the guidelines should establish administrative sanctions for companies that fail to disclose relevant technical data, neglect to respond to community complaints, or fail to implement the required recovery measures. Government Regulation No. 22 of 2021 already provides a framework for administrative sanctions within the broader system of environmental protection ([Efendi et al., 2025](#)). These enforcement mechanisms should be operationalized specifically in the context of mining blasting rather than remaining as general regulatory provisions.

With these reforms, the legal framework would not merely recognize the rights of affected communities but would also provide practical mechanisms for the effective realization of those rights. A sound regulatory framework is not satisfied by simply declaring that individuals are entitled to a good and healthy environment. It must also specify the applicable procedures, the responsible institutions, the required data, applicable timelines, technical standards, the forms of compensation and recovery available, and the sanctions to be imposed where legal obligations are not fulfilled.

4. CONCLUSION

The legal framework governing compensation and recovery for communities affected by mining blasting remains fragmented across environmental law, mineral and coal mining law, and company law. Environmental law establishes the legal foundations for the rights to information, public participation, complaint mechanisms, compensation, environmental restoration, regulatory oversight, and administrative sanctions. Mineral and coal mining law regulates technical obligations, environmental management, reclamation, post-mining responsibilities, supervision, data and information management, and community empowerment. Company law recognizes corporate social and environmental responsibility. Nevertheless, these three legal regimes have yet to establish specific operational mechanisms for addressing claims arising from losses caused by mining blasting.

The principal regulatory shortcomings lie in the absence of standardized procedures governing the disclosure of blasting data, the verification of structural damage to buildings, the assessment of the causal relationship between blast-induced vibrations and alleged losses, the distinction between corporate social responsibility (CSR) and legal compensation, and mandatory coordination among village, subdistrict, district, provincial, and national government authorities. In the illustrative cases of Leuwikaret, Lulut, and Hambalang Villages, evidence of impacts submitted by residents should be regarded as preliminary evidence warranting verification rather than conclusive proof of corporate fault. Accordingly, there is a need for specific guidelines governing compensation and recovery for losses arising from mining blasting, including provisions on the disclosure of technical data, independent verification mechanisms, standards for assessing structural damage, individual compensation, environmental restoration, the role of local governments, and administrative sanctions.

The principal limitation of this article lies in its reliance on a critical normative legal approach supported by limited empirical illustrations. Future research should undertake field investigations in the three villages, including the collection of data concerning the chronology of blasting operations, documentation of structural damage, mapping of affected houses, complaint records, company responses, and government inspection and oversight reports. Such empirical evidence would provide a stronger basis for evaluating the effectiveness of the existing regulatory framework and for developing a more evidence-based model of compensation and recovery.

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