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The Principle of Sustainable Development in Good Mining Practice: A Legal Review of Equitable and Beneficial Nickel Mining Governance in Indonesia

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Abstract: *In the dynamics of the global political economy, nickel is no longer just a mining commodity but a strategic resource that influences industrialization, energy technology, and the stability of the global supply chain. Indonesia, as the world's largest nickel producer, plays a crucial role in meeting the growing global demand for nickel. Projections from the International Nickel Study Group (INSG) indicate that global nickel consumption is expected to reach 3.824 million tons in 2026, up from 3.601 million tons in 2025, driven primarily by the stainless steel and energy technology industries. Normatively, the management of mineral resources is regulated in Article 33, paragraph (3) of the 1945 Constitution of the Republic of Indonesia, which affirms that natural resources are controlled by the state and utilized to the greatest extent for the prosperity of the people. This provision is reinforced by Law Number 3 of 2020 concerning Mineral and Coal Mining, which mandates sustainable mining management through the implementation of Good Mining Practice principles. However, in fact, nickel mining expansion still gives rise to various problems, including environmental degradation, ecosystem damage, and inequality in the use of natural resources, which ultimately leads to injustice for communities around mining areas. This study aims to analyze the application of Sustainable Development principles within the Good Mining Practice concept to nickel mining governance in Indonesia to achieve equitable and beneficial management. This research employs a normative juridical method with a legislative approach and a conceptual approach through an analysis of mining regulations, including Regulation of the Minister of Energy and Mineral Resources Number 26 of 2018 concerning the Implementation of Good Mining Principles and Supervision of Mineral and Coal Mining. The research results show that the principles of sustainable development have been normatively integrated into the national mining legal framework through the implementation of Good Mining Practices, which encompass occupational safety, environmental protection, post-mining reclamation, and corporate social responsibility. However, its implementation still faces challenges in balancing economic interests, environmental protection, and community welfare. Therefore, strengthening legal governance in the mining sector based on sustainable development principles is essential to ensure that nickel resource management is sustainable, equitable, and beneficial for national development.*

Keywords: *Sustainable Development; Good Mining Practice; Mining Governance; Nickel Mining; Justice.*

Introduction

Nickel has evolved into a strategic commodity in the dynamics of the global political economy, no longer limited to a conventional industrial raw material but rather as a key component in technology supply chains and energy transitions. Global nickel demand

continues to increase, particularly for the stainless steel industry and energy technology development, making it a crucial resource for global industrial stability. Indonesia, as the world's largest nickel producer, holds a central position in meeting this demand. Projections from the International Nickel Study Group (INSG) indicate that global nickel consumption is expected to reach 3.824 million tons in 2026, up from 3.601 million tons in 2025, confirming Indonesia's strategic role in the global supply chain (Ferreira, 2026).

However, increased nickel mining activity also raises various fundamental issues, particularly those related to environmental degradation, climate change, and inequality in the distribution of natural resource benefits. Extractive mining activities may cause significant ecosystem damage if not managed responsibly. This situation demonstrates the tension between economic interests and environmental sustainability, making mining governance an urgent issue requiring study (UNEP 2020).

In a global context, the concept of sustainable development, as formulated in the Sustainable Development Goals (SDGs), serves as a normative framework for guiding development practices, including in the mining sector. Goal 13 on climate change mitigation and Goal 15 on terrestrial ecosystem protection provide important standards for assessing the extent to which mining activities address environmental sustainability and ecosystem balance (UN 2015). Therefore, integrating sustainable development principles into mining governance is an integral requirement.

In the Indonesian legal system, sustainable development principles have been incorporated into various regulations, including Law Number 3 of 2020 concerning Mineral and Coal Mining and Regulation of the Minister of Energy and Mineral Resources Number 26 of 2018 concerning the Implementation of Good Mining Principles and Supervision of Mineral and Coal Mining (Law No. 26/ 2018). The regulation introduces the concept of Good Mining Practice as a guideline for responsible mining activities. However, existing research tends to focus on general normative or policy aspects, while studies specifically linking sustainable development principles to the implementation of Good Mining Practice in nickel mining governance in Indonesia are still limited. It indicates a gap between the existing legal framework and evaluations of its implementation in the field.

However, the study does not clearly distinguish Good Mining Practice (GMP) as a technical-operational standard from sustainable development as a broader transformative paradigm. The manuscript acknowledges that GMP is introduced through mining regulations as a guideline for responsible mining activities and seeks to analyze its relationship with sustainable development principles. However, the provided discussion tends to treat GMP and sustainable development as closely interconnected concepts without explicitly clarifying their different scopes and functions. Sustainable development represents a broader normative framework encompassing long-term environmental protection, social equity, and economic sustainability, whereas GMP primarily functions as a technical and operational standard governing mining practices. A clearer conceptual distinction between these two concepts would strengthen the theoretical foundation of the study and help demonstrate whether GMP merely operationalizes certain aspects of sustainable development or is sufficient to achieve the broader objectives of sustainable resource governance. Based on this, this study aims to analyze the application of sustainable development principles within the Good Mining Practice framework to nickel mining

governance in Indonesia and to assess the extent to which existing regulations are able to realize equitable and beneficial natural resource management.

Conceptual and Legal Framework

The Concept of Sustainable Development in Natural Resource Management

The concept of sustainable development emerged as a response to the conventional development paradigm, which emphasized economic growth without regard for environmental sustainability and social justice. This development model has proven incapable of improving the overall quality of life and has even triggered environmental degradation and widened social inequality (Nurlita Pertiwi., 2017).

Global awareness of the negative impacts of this development gave rise to the concept of sustainable development, formally introduced in the 1987 report "Our Common Future" by the World Commission on Environment and Development (WCED). This concept emphasizes that development must meet the needs of the present generation without compromising the ability of future generations to meet their own needs (WCED, 1987).

Over time, the concept of sustainable development has been institutionalized through various international forums, including the United Nations Conference on Sustainable Development, which produced the Sustainable Development Goals (SDGs). The SDGs consist of 17 integrated goals that serve as global guidelines for achieving inclusive and sustainable development (UN 2015). In the context of natural resource management, particularly in the mining sector, Goal 13 on climate change mitigation and Goal 15 on terrestrial ecosystem protection hold significant relevance.

The concept of sustainable development extends beyond the normative realm to an operational approach through the integration of economic, environmental, and social aspects. This approach has even been expanded through the "4Ps" concept: profit (economic), planet (environment), people (social), and partnership (collaboration). This approach emphasizes that development aims not only to generate economic profit but also to preserve the environment, ensure community well-being, and collaboratively involve various stakeholders (Ista et al., 2026). In the context of natural resource management, a sustainable development approach is crucial because uncontrolled exploitation can lead to various negative impacts, such as environmental pollution, ecosystem damage, and social conflict. Studies show that unsustainable natural resource management can reduce the quality of human life and hinder long-term development (Ista et al., 2026).

In Indonesia, the principles of sustainable development also have a strong legal basis. Law No. 4 of 2009 concerning Mineral and Coal Mining emphasizes that mining management must be carried out based on the principles of benefit, justice, sustainability, and environmental awareness(Law No. 4/2009). It shows that the concept of sustainable development has become an integral part of the national legal system, especially in the management of the mining sector. Thus, sustainable development is not only a global concept, but also a legal principle that must be implemented in every policy and practice of natural resource management in Indonesia, including in the governance of nickel mining.

The Concept of Good Mining Practice from a Legal and SDGs Perspective

Good Mining Practice (GMP) is a concept developed as a guideline for the implementation of responsible, efficient, and sustainable mining activities. This concept aims to ensure that mining activities are not solely oriented towards resource exploitation but also consider environmental, social, and good governance aspects.

In the Indonesian legal system, the implementation of Good Mining Practice is strictly regulated in the Minister of Energy and Mineral Resources Regulation No. 26 of 2018 concerning the Implementation of Good Mining Principles and Supervision of Mineral and Coal Mining. This regulation requires every mining business permit holder to implement good mining principles in every stage of their mining business activities (Minister of Energy and Mineral Resources Regulation No. 26/2018).

Substantively, GMP in this regulation encompasses two main dimensions: good mining engineering principles and mining business governance. Good mining engineering principles encompass technical aspects of mining, mineral and coal conservation, occupational safety and health, operational safety, environmental management, including reclamation and post-mining, and the use of mining technology (Article 3(2), Minister of Energy and Mineral Resources Regulation No. 26/2018). Meanwhile, aspects of mining business governance encompass financial management, marketing, workforce development, and community empowerment (Article 3(4), Minister of Energy and Mineral Resources Regulation No. 26/2018).

Furthermore, in policy practice, the government, through the Minister of Energy and Mineral Resources, emphasizes that the implementation of Good Mining Practice encompasses five main aspects: environmental management, reclamation and post-mining, mining technical management, mineral conservation, mining safety, and the use of technology. The statement demonstrates the government's efforts to promote mining practices that are oriented not only toward production but also toward sustainability.

Normatively, the concept of Good Mining Practice aligns with the principles of sustainable development, as reflected in the mining principles that emphasize sustainability and environmental awareness (Article 2, Law No. 4/2009). However, when further analyzed from the perspective of the Sustainable Development Goals (SDGs), several issues indicate that the implementation of GMP in Indonesia has not fully embraced the principles of sustainable development comprehensively.

First, the GMP approach in Indonesia still tends to be oriented toward impact control (mitigation), such as reclamation and post-mining environmental management, making it reactive in nature. Meanwhile, the SDGs demand a more transformative approach, such as changes to production models, resource efficiency, and carbon emission reduction. Second, GMP regulations have not explicitly integrated climate change aspects as a central component of mining policy. It indicates that SDG 13 (climate action) has not yet become a primary focus of mining governance in Indonesia. Third, although regulations regarding community empowerment exist, their implementation tends to be administrative in nature and does not fully guarantee substantive social justice as mandated by the SDGs. Fourth, the GMP concept in Indonesia has not yet been fully integrated with global approaches such

as Environmental, Social, and Governance (ESG), which are currently the international standard for managing extractive industries.

The Relationship between Sustainable Development and Good Mining Practice

The concepts of Sustainable Development and Good Mining Practice (GMP) are closely related in the context of natural resource management, particularly in the mining sector. Sustainable development serves as a normative framework that provides direction and objectives for development, while Good Mining Practice is an operational instrument that translates these principles into practical mining activities. Thus, GMP can be understood as a concrete manifestation of the application of sustainable development principles in the mining sector.

From a theoretical perspective, sustainable development emphasizes the integration of economic, environmental, and social aspects in every development activity. This principle is then translated into the mining sector through the implementation of good mining principles, which encompass environmental management, occupational safety, efficient resource utilization, and community empowerment. It aligns with the view that natural resource management is not only aimed at generating economic profit but must also ensure environmental sustainability and long-term community welfare (Ista et al., 2026).

In the Indonesian context, the link between sustainable development and Good Mining Practice can be seen in the provisions of Law No. 4 of 2009 concerning Mineral and Coal Mining, which emphasizes that mining activities must be carried out based on the principles of sustainability and environmental awareness (Article 2, Law No. 4/2009). This principle was then operationalized through Minister of Energy and Mineral Resources Regulation No. 26 of 2018, which details the obligations of mining business actors to implement good mining engineering principles, including aspects of environmental management, reclamation, occupational safety, and technology utilization (Minister of Energy and Mineral Resources Regulation No. 26/2018).

Furthermore, in practice, the implementation of Good Mining Practice also reflects the integration of sustainable development principles, as explained in the literature: sustainable development-based natural resource management must prioritize a balance between economic efficiency, environmental sustainability, social justice, and collaboration among stakeholders (Minister of Energy and Mineral Resources Regulation No. 26/2018). This approach is known as the 4Ps concept (product, planet, people, and partnership), which is a key indicator in assessing the success of sustainable development implementation.

However, the relationship between sustainable development and Good Mining Practice is not always linear. Normatively, mining regulations in Indonesia have accommodated various principles of sustainable development. However, in their implementation, there may be differences between the ideal concept and actual practice. It is due to the differing orientations between the transformative goals of sustainable development and the Good Mining Practice approach, which, in some aspects, still focuses on compliance with technical and administrative standards.

Within this framework, it is important to understand that Good Mining Practice does not automatically reflect the full implementation of Sustainable Development principles.

While both share common ground in environmental, social, and economic aspects, there are differences in the level of depth and policy orientation. Sustainable development demands a comprehensive change in development paradigms, while Good Mining Practice serves more as a minimum standard for implementing mining activities.

Therefore, the relationship between Sustainable Development and Good Mining Practice requires a more in-depth analysis, particularly in the context of nickel mining in Indonesia. This analysis is important to assess the extent to which the concept of Good Mining Practice regulated in national regulations is able to represent the principles of sustainable development substantively, as well as to identify gaps that may occur between the normative framework and implementation in the field.

Result and Dicussion

Governance and Strategic Position of Indonesian Nickel

1. Nickel's Position in the Global Economy

Nickel, in global economic development, is no longer viewed as a mere mining commodity but rather as a strategic resource that plays a crucial role in determining the direction of global industrialization and energy transition. This shift aligns with the increasing demand for nickel as a primary raw material in the stainless steel industry and as a crucial component in the development of battery technology for electric vehicles. Thus, nickel not only has economic value but also strategic value in the context of global energy geopolitics.

Based on projections from the International Nickel Study Group (INSG), global nickel consumption is estimated to reach 3.824 million tons in 2026, up from 3.601 million tons in 2025. This increase indicates that global nickel demand remains on a positive trend, despite experiencing quite complex dynamics. Traditionally, nickel consumption has been dominated by the stainless-steel industry, which remains the main global nickel absorber. However, in recent years, the electric vehicle (EV) sector has also begun to become a driving factor in nickel demand, albeit at a volatile pace.

Interestingly, developments in battery technology indicate that nickel demand from the electric vehicle sector does not always increase linearly. The dominance of nickel-free Lithium Iron Phosphate (LFP) batteries, along with the increasing use of Plug-in Hybrid Electric Vehicles (PHEVs), has slowed nickel demand growth in this sector. This situation suggests that the narrative of nickel as "green gold" in the energy transition is not entirely consistent, but is instead influenced by technological dynamics and global market preferences.

On the other hand, despite changes in the demand structure, global demand for nickel remains high, primarily due to the stainless-steel industry's continued dominance in consumption. This demonstrates that nickel remains a highly demanded commodity in various industrial sectors, both conventional and modern. In this context, the stability of nickel supply is crucial for the sustainability of the global industry.

Furthermore, global supply dynamics also indicate pressures in various nickel-producing countries. Several countries, such as Australia, the Philippines, and New Caledonia, are facing serious challenges related to mine profitability, rising production costs, and increasingly stringent environmental regulations. These conditions have led some mines to reduce production and even cease operations. Amidst these conditions, INSG notes that global primary nickel production is projected to increase to 4.085 million tons in 2026, with production from Indonesia largely driven by this increase (Ferreira, 2026).

This development demonstrates that the global nickel market is influenced not only by economic factors but also by policy, technological, and geopolitical dynamics. The global industry's dependence on nickel supplies creates a complex relationship between producing and consuming countries, where supply stability becomes a strategic issue with broad implications for the energy, manufacturing, and technology industries.

Nickel's position in the current global economy is inseparable from its role as a strategic commodity at the intersection of economic, technological, and geopolitical interests. This position positions nickel as a resource that plays a crucial role in determining the direction of future global industrial development.

2. Indonesia's Position in the Global Nickel Industry

Indonesia occupies a highly strategic position in the global nickel industry, both in terms of reserves, production, and its role in the global industrial supply chain. In recent years, Indonesia has not only become a major producer but has also developed into a key actor influencing nickel supply stability. Globally.

In terms of resources, Indonesia has the largest nickel reserves in the world. Data shows that global nickel reserves reach approximately 139.4 million tons, of which Indonesia controls approximately 72 million tons, or approximately 52% of the world's total reserves (Ministry of Energy and Mineral Resources No.3, 2020 p.12). This position places Indonesia as the country with the most dominant resource base compared to other producing countries such as Australia, Brazil, and Russia.

Beyond reserves, Indonesia's dominance is also evident in its production. In 2019, Indonesia was recorded as the world's largest nickel ore producer, with production reaching approximately 800,000 tons, far surpassing other countries such as the Philippines (420,000 tons) and Russia (270,000 tons) . It demonstrates that Indonesia possesses not only resource potential but also significant production capacity to meet global demand.

The distribution of Indonesia's nickel reserves also demonstrates its strategic geographic advantage. National nickel reserves are estimated at 4.5 billion tons, with resources reaching approximately 11.7 billion tons, mostly distributed in Sulawesi and Maluku (Ministry of Energy and Mineral Resources No.3, 2020 p.15). This geographic concentration provides advantages for the development of nickel-based industrial areas, particularly in supporting downstream programs.

Furthermore, Indonesia's advantage lies not only in reserves and production but also in its competitive cost structure. The production costs of Indonesian nickel ore are relatively low compared to other countries, a key factor in attracting global investment in the nickel mining and processing sector (Ministry of Energy and Mineral Resources No.3, 2020 p.19).

Furthermore, the availability of a workforce and government policy support strengthen Indonesia's position as a global hub for nickel industry development.

In the industrial context, Indonesia has also experienced significant progress in the construction of processing and refining facilities (smelters). Data shows that by 2020, hundreds of mining business permits (IUP) and several smelters were operating in various regions, particularly in Sulawesi and Maluku (Ministry of Energy and Mineral Resources No.3, 2020 p.17). The development of these smelters is part of a downstreaming policy aimed at increasing the added value of domestic mineral resources.

Furthermore, Indonesia has begun integrating the nickel industry into the broader global supply chain, particularly in the electric vehicle industry. The development of nickel-based battery industries, such as Nickel Cobalt Manganese (NCM) and Nickel Cobalt Aluminum (NCA), demonstrates that Indonesia is no longer merely a raw material supplier but is moving toward value-added industrialization (Ministry of Energy and Mineral Resources No.3, 2020 p.30).

From a global perspective, Indonesia's dominance in nickel reserves and production provides significant bargaining power in the international market. The dependence of industrialized countries on Indonesian nickel supplies makes Indonesia a key player in maintaining the stability of the global supply chain, particularly in the steel and energy industries.

However, this strategic position also carries its own consequences, particularly in terms of governance and sustainability. Dominance in resources and production does not automatically guarantee optimal economic benefits or environmental sustainability. Therefore, it is important to further examine how Indonesia's strong position in the global nickel industry is managed through national policies, and the extent to which such governance can address the challenges of sustainable development.

3. Nickel Governance Policy in Indonesia

Nickel governance policy in Indonesia in recent years has demonstrated a paradigm shift from resource exploitation to value-added management and industrialization. This change is reflected in the downstreaming policy, which gradually bans the export of raw materials to encourage domestic processing and refining. This policy aims not only to increase state revenue but also to strengthen Indonesia's position in the global supply chain for strategic minerals.

In terms of resources, Indonesia has enormous potential in the nickel sector. Data from 2023 indicates that Indonesia's nickel resources reached approximately 18.55 billion tons of ore, with reserves of 5.32 billion tons (Ministry of Energy and Mineral Resources Drafting Team, 2024). This substantial potential makes Indonesia a key player in the global supply of industrial raw materials, while also reinforcing the urgency of optimal and sustainable management.

In line with this, the downstreaming policy continues to be promoted through the construction of processing and refining facilities (smelters). There are approximately 147 smelters in various stages of development, including those already operational, under construction, and in the planning stage (Ministry of Energy and Mineral Resources No.

617.Pers/04/SJI/2024). This increase in the number of smelters demonstrates the government's commitment to transforming the mining industry from one based on raw material exports to one based on added value.

Mining governance is not only related to downstreaming but also concerns production control and market stability. In this regard, the government is making policy adjustments through the Work Plan and Budget (RKAB) mechanism. In 2025, the Ministry of Energy and Mineral Resources approved a House of Representatives (DPR) proposal to change the RKAB validity period from three years to one year. This policy was implemented in response to market conditions that indicated an imbalance between production and demand, which resulted in declining commodity prices.

This policy change reflected problems in the previous governance system, where the three-year RKAB approval period was deemed too lax and unadaptive to market dynamics. The situation even led to an oversupply, impacting commodity prices and decreasing state revenues. Thus, adjusting the Work Plan and Budget (RKAB) is a crucial instrument for controlling production and maintaining market stability (Ministry of Energy and Mineral Resources Decree No. 065.Pers/KM.01.03/SJI/2025).

On the other hand, nickel governance policy also faces challenges in maintaining resource sustainability. Increasing exploitation has the potential to reduce reserves if not balanced by sustainable exploration and management. Therefore, the government continues to identify and develop new areas to ensure the continued availability of mineral resources (Ministry of Energy and Mineral Resources Drafting Team, 2024).

Strengthening oversight of mining activities is also a crucial part of nickel governance. This includes compliance with environmental aspects, reclamation, and licensing, aiming to ensure that mining activities are conducted in accordance with applicable regulations. Nickel governance policy in Indonesia demonstrates efforts to balance economic interests, market stability, and resource sustainability. However, policy dynamics, such as changes to the RKAB, demonstrate that mining governance still faces various challenges in achieving this balance, requiring further analysis from a sustainable development perspective.

Implementation of Good Mining Practice from a Sustainable Development Perspective

1. Analysis of Good Mining Practice with Sustainable Development Principles in Nickel Mining

The implementation of Good Mining Practice (GMP) in nickel mining in Indonesia has a fairly comprehensive legal basis. It is reflected in Law Number 3 of 2020 concerning Mineral and Coal Mining and Minister of Energy and Mineral Resources Regulation Number 26 of 2018, which stipulates that mining activities must be carried out with due regard for occupational safety, resource conservation, environmental management, and reclamation and post-mining obligations (Law No. 3/2020, Articles 2 & 96). Within this framework, GMP is positioned as the minimum standard to ensure that mining activities are conducted effectively, efficiently, and in an environmentally friendly manner (Minister of Energy and Mineral Resources Regulation No. 26/2018, Articles 2 & 3).

However, in a global context, the implementation of GMP cannot be separated from the demands of sustainable development as formulated in the Sustainable Development

Goals (SDGs). In this regard, the mining sector is directly linked to several key SDG objectives, including access to clean and affordable energy (SDG 7), addressing climate change (SDG 13), and protecting terrestrial ecosystems (SDG 15) (UNDP, 2015). The ever-increasing demand for energy, including technology-based energy such as electric vehicles, has driven increased exploitation of strategic minerals such as nickel. Data shows that global electricity access increased from 78% to 90% between 2000 and 2018, indicating a significant increase in global energy demand (UNDP, 2015).

This increase in energy-based economic activity also carries serious environmental consequences. Greenhouse gas emissions have increased by more than 50% compared to 1990, a major contributing factor to global climate change.[3] Furthermore, pressure on terrestrial ecosystems is also increasing, as evidenced by the loss of approximately 13 million hectares of forest annually and large-scale land degradation, which has a direct impact on the global environmental balance (UNDP, 2015). This situation emphasizes that mining activities, including nickel, must not only focus on production but also on environmental sustainability.

In the Indonesian context, the implementation of Good Manufacturing Practices (GMP) should be an instrument to bridge economic needs and environmental protection. However, regulatory developments demonstrate dynamics that require careful attention. Environmental law studies indicate that regulatory changes through the Job Creation Law have implications for environmental protection mechanisms, particularly regarding Environmental Impact Assessments (AMDAL), public participation, and oversight systems. These changes have the potential to pose challenges in ensuring effective oversight of mining activities.

Furthermore, in practice, the implementation of GMP in Indonesia still tends to be understood as fulfilling administrative and technical obligations. This approach is evident in the focus on reclamation, occupational safety, and permit compliance, which, while important, do not fully reflect a comprehensive approach to sustainable development. From an academic perspective, sustainable development-based natural resource management should encompass a balanced integration of economic, environmental, and social aspects and involve various stakeholders in the decision-making process (Ista, 2026).

Furthermore, in global developments, the mining sector also faces new demands through the implementation of Environmental, Social, and Governance (ESG) principles. These standards place sustainability as an integral part of business practices, requiring companies not only to comply with regulations but also to demonstrate responsibility towards the environment and society. It demonstrates that global standards in mining management have evolved beyond the concept of Good Mining Practice in the traditional sense (Wibisana, 2025).

The implementation of Good Mining Practice in nickel mining in Indonesia demonstrates a tension between the normative framework stipulated in regulations and the increasingly complex demands of global sustainability. Although legally mandated to implement good mining principles, in practice, further evaluation is needed to assess the

extent to which such implementation substantively accommodates sustainable development principles.

2. Alignment of Good Mining Practice with Sustainable Development Principles

The alignment of Good Mining Practice (GMP) with Sustainable Development principles is a crucial aspect in assessing the quality of nickel mining governance in Indonesia. Normatively, GMP, as stipulated in Minister of Energy and Mineral Resources Regulation No. 26 of 2018, covers various technical and environmental aspects, including environmental management, reclamation, occupational safety, and mineral resource conservation (Law No. 3/2020, Articles 2 & 96; Minister of Energy and Mineral Resources Regulation No. 26/2018, Articles 2–3). These provisions demonstrate that formally, the GMP framework accommodates several basic principles of sustainable development.

However, when compared to the broader concept of Sustainable Development, there are differences in scope and approach. Sustainable Development, as formulated within the United Nations Development Programme framework, not only emphasizes environmental impact management but also encourages the transformation of production systems, energy efficiency, and the balanced integration of social and economic aspects (UNDP, 2015). In this context, GMP tends to focus on controlling the impacts of mining activities, while the SDGs demand more fundamental changes in the way natural resources are managed.

This alignment can be partially seen in several aspects. In relation to SDG 7, the nickel mining sector plays a crucial role in supporting the energy transition, particularly as a raw material for electric vehicle batteries. The increase in global energy access, which has reached 90%, indicates a growing need for energy resources, including strategic minerals like nickel. This demonstrates that mining activities can contribute to achieving sustainable development goals in the energy sector.

This contribution is also accompanied by significant environmental challenges. In relation to SDG 13, increased industrial activity, including mining, has contributed to an increase in greenhouse gas emissions, which have reached more than 50% compared to 1990 (UNDP, 2015). This indicates that mining activities are not only part of the solution but also have the potential to become part of the problem in the context of global climate change.

Furthermore, from the perspective of SDG 15, mining activities have a direct impact on terrestrial ecosystems, including deforestation and land degradation. Data shows that approximately 13 million hectares of forest are lost annually due to human activities, including the exploitation of natural resources (UNDP, 2015). In this context, the reclamation obligation in the GMP is indeed an important instrument, but its effectiveness in restoring intact ecosystems remains an issue that requires further study.

From a regulatory perspective, Indonesia's legal framework has adopted sustainability principles as stipulated in Law No. 3 of 2020 concerning Mineral and Coal Mining, which emphasizes sustainability and environmental awareness in mining activities (Law No. 3/2020, Articles 2 and 96; Regulation of the Minister of Energy and Mineral Resources No. 26/2018, Articles 2–3). However, in practice, the implementation of these principles still faces various challenges, particularly in terms of oversight and consistent implementation in the field.

Furthermore, global developments indicate that sustainability standards in the mining sector have evolved through the implementation of Environmental, Social, and Governance (ESG) principles. These standards not only emphasize regulatory compliance but also require companies to comprehensively integrate environmental, social, and governance aspects into their operations. This indicates a paradigm shift from simply Good Mining Practice to more sustainable and responsible mining practices.

The alignment between Good Mining Practice and Sustainable Development principles in the context of nickel mining in Indonesia can be said to be still partial. While there is common ground in environmental and resource management aspects, differences remain in scope and approach, particularly regarding the integration of social aspects, changes in production systems, and comprehensive climate change mitigation. This situation highlights the need for further analysis to identify gaps between the normative framework and the demands of global sustainable development.

3. Critical Analysis: Implementation of Good Mining Practice in Indonesian Nickel Mining

An analysis of the implementation of Good Mining Practice (GMP) in nickel mining in Indonesia shows that, although normatively, a fairly comprehensive legal framework exists, in practice, there is still a gap between the objectives of nickel resource management and the principles of sustainable development. This is crucial considering that nickel is a strategic commodity that plays a role not only in conventional industries but also as a key component in the global energy supply chain, particularly in the development of electric vehicle batteries.

Within the context of national policy, nickel management in Indonesia is heavily influenced by the downstreaming program, which aims to increase added value through the development of smelters and derivative industries. This policy has successfully increased production capacity and strengthened Indonesia's position in the global supply chain. However, the increased activity in the nickel industry also brings environmental pressures, particularly in nickel-producing regions such as Sulawesi and Maluku. Open-pit mining, the dominant activity in the nickel industry, has the potential to cause deforestation, land degradation, and water pollution due to mining waste if not managed optimally.

Within the Good Manufacturing Practices (GMP) framework, as stipulated in Minister of Energy and Mineral Resources Regulation No. 26 of 2018, environmental management, reclamation, and post-mining obligations have become part of the operational standards for mining activities (Ministerial Regulation No. 26/2018, Articles 2–3). However, this approach is essentially mitigative, focusing on controlling and remediating impacts after mining activities have taken place. In the context of large-scale and intensive nickel mining, this approach raises questions about its effectiveness in maintaining long-term ecosystem sustainability.

When compared with the principles of Sustainable Development, particularly SDGs 13 and 15, nickel mining activities should not only focus on impact management but also on preventing and mitigating environmental risks from the planning stage. Global data shows that greenhouse gas emissions have increased by more than 50% since 1990, while forest

loss reaches approximately 13 million hectares per year (UNDP, 2015). This situation indicates that natural resource-based economic activities, including nickel mining, significantly contribute to the global environmental crisis if not managed sustainably.

Furthermore, in the context of the energy transition, nickel is often positioned as an "enabler" in the development of clean energy, particularly through the electric vehicle battery industry. However, there is a paradox in this regard: efforts to support clean energy actually have the potential to cause significant environmental impacts in nickel production areas. This demonstrates that nickel's contribution to SDG 7 cannot be separated from the challenges in achieving SDGs 13 and 15. Thus, the sustainability of the nickel sector is determined not only by industrial output but also by how the production process is managed.

From a governance perspective, policy dynamics such as the change in the RKAB mechanism from three years to one year demonstrate the government's efforts to control production and maintain market stability. However, this policy also indicates that the management of the mining sector, including nickel, still faces challenges in achieving a balance between production and sustainability.

Furthermore, environmental law studies indicate that changes to the environmental licensing system through the Job Creation Law have the potential to impact the quality of oversight of mining activities. In the context of nickel mining, which has significant environmental impacts, effective oversight is a key factor in ensuring that Good Mining Practice principles are truly implemented substantively, not merely as an administrative formality.

Globally, the nickel mining industry is increasingly facing demands for the implementation of Environmental, Social, and Governance (ESG) principles. These standards require companies not only to fulfill legal obligations but also to ensure that their operations have a positive impact on the environment and society. However, in the Indonesian context, the integration of ESG principles in the nickel sector has not yet been fully institutionalized within the existing GMP regulatory framework (Ista, 2026).

Furthermore, the social aspects of nickel mining are also a crucial issue that often receives insufficient attention. Although regulations stipulate community empowerment obligations, their implementation on the ground remains variable and often does not reflect the principles of social justice as mandated by sustainable development. It indicates that the social dimension of GMP still needs to be strengthened so that it is not merely administrative but also substantive (Wibisana, 2025).

Therefore, it can be concluded that the implementation of Good Mining Practice in nickel mining in Indonesia still faces various challenges in comprehensively accommodating sustainable development principles. Although an adequate legal framework exists normatively, in practice, there remains a gap between the mitigative approach and the demands of transformation towards sustainable resource management. Therefore, policy strengthening and more integrative implementation are needed, particularly in linking nickel management with the principles of the Sustainable Development Goals in a more substantive manner.

4. Challenges and Gaps in GMP Implementation in Nickel Mining in Indonesia

The implementation of Good Mining Practice (GMP) principles in the nickel mining sector in Indonesia has a strong normative foundation, established by Law Number 3 of 2020 concerning Mineral and Coal Mining and Minister of Energy and Mineral Resources Regulation Number 26 of 2018. Both regulations explicitly stipulate environmental management, reclamation and post-mining, occupational safety, resource conservation, and technology utilization (Law No. 3/2020, Articles 2 & 96; Minister of Energy and Mineral Resources Regulation No. 26/2018, Articles 2–3). However, in practice, the implementation of these principles in the nickel sector demonstrates several gaps between legal norms and realities on the ground.

One of the main challenges is the increasing social conflict between nickel mining companies and affected communities. In recent years, various reports have indicated that nickel mining activities in several regions—particularly in Sulawesi and Maluku—have sparked public protests due to the resulting environmental and social impacts. Media reports indicate that protests from residents affected by nickel mining continue to reverberate amidst the increasingly massive downstreaming policy push (Yunus, 2026). This phenomenon demonstrates an imbalance between economic orientation and socio-environmental protection in the implementation of Good Manufacturing Practices (GMP).

In addition to social conflict, other challenges have emerged in the form of environmental degradation due to massive nickel exploitation. Open-pit mining, commonly used in nickel exploitation, has the potential to cause deforestation, sedimentation, and water and soil pollution. This contradicts the principles of environmental management, one of the main pillars of GMP. From a sustainable development perspective, this situation also has the potential to hinder the achievement of global development goals, particularly those related to terrestrial ecosystem protection and climate change (UNDP, 2015).

There are indications that the implementation of GMP in the nickel sector still tends to be administrative in nature and not yet fully substantive. This means that company compliance with regulations often extends only to the completion of permit documents, such as AMDAL (Environmental Impact Assessment), RKAB (Work Plan and Budget), and reclamation reports, without being followed by optimal implementation on the ground. This situation aligns with criticisms in environmental law literature stating that environmental management policies in Indonesia still face weak oversight and law enforcement (Wibisana, 2025).

The push for downstream nickel industry development as part of the national strategy to increase economic added value also influences the implementation of GMP. Policies for smelter construction and increased nickel production are often implemented within the framework of accelerated investment, which, in some cases, potentially neglects environmental and social sustainability aspects. It creates a dilemma between national economic interests and the principles of sustainable development, where GMP should be an instrument to balance both interests.

Thus, it can be seen that the implementation of GMP in nickel mining in Indonesia still faces various structural challenges, ranging from social conflict, environmental degradation,

weak oversight, and pressures from downstreaming policies. This gap between legal norms and practice indicates that GMP implementation has not fully met the demands of sustainable development as envisioned in the SDGs framework. Therefore, strengthening policies and implementing more integrated policies is necessary so that nickel management in Indonesia is oriented not only towards economic growth but also towards environmental sustainability and community welfare.

However, the manuscript does not critically assess whether nickel downstream industrialization genuinely advances sustainability or merely transfers environmental burdens from the extraction stage to processing and smelting activities. While the discussion acknowledges that downstreaming policies can create tensions between economic growth objectives and sustainable development principles, the analysis remains largely focused on the risks of accelerated investment and increased production. It does not examine in detail the environmental and social impacts associated with downstream processing, such as increased energy consumption, industrial emissions, waste generation, or the potential displacement of environmental burdens along the nickel value chain. Consequently, the manuscript identifies the dilemma between economic and sustainability goals but stops short of providing a comprehensive evaluation of whether downstream industrialization contributes to overall sustainability or simply relocates environmental pressures to other sectors of the industry.

5. Directions for Strengthening the Implementation of Good Mining Practices in Nickel Mining Based on Sustainable Development

Indonesia's role in the global nickel industry presents a strategic opportunity to not only play a major role as a supplier but also as a country capable of setting sustainable mining governance standards. In this context, strengthening the implementation of Good Mining Practices (GMP) is crucial so that nickel management not only generates economic value but also aligns with the principles of Sustainable Development. Therefore, transformative strategic steps are needed to integrate sustainability principles into nickel mining practices more comprehensively.

First, strengthening the implementation of GMP needs to be directed towards a preventative approach to environmental management. This can be achieved by integrating sustainability aspects from the mine planning stage, including determining exploitation limits, protecting areas of high ecological value, and implementing more environmentally friendly mining technologies. This approach aligns with the principles of sustainable development, which emphasize preventing environmental damage as a top priority over restoring it after damage has occurred (UNDP, 2025).

Second, integrating climate change aspects into nickel mining policies is a crucial step in strengthening the alignment of GMP with the principles of the SDGs. In this regard, policies are needed that encourage the use of low-carbon energy in nickel mining and processing operations, including at smelter facilities. Furthermore, measuring and reporting carbon emissions from mining activities should be part of a company's obligations, so that the nickel sector's contribution to climate change mitigation can be measured more transparently (UNDP, 2025).

Third, strengthening the social dimension of GMP implementation needs to be done by increasing community participation and protecting the rights of local communities. This includes community involvement in decision-making processes, transparency of information regarding mining impacts, and strengthening dispute resolution mechanisms. Thus, nickel mining activities will gain not only legal legitimacy but also sustainable social legitimacy.

Fourth, strengthening governance is a key factor in ensuring the effectiveness of GMP implementation. In this regard, increased supervisory capacity is needed through the use of digital technology, integration of mining data systems, and transparency in reporting production and environmental activities. Furthermore, consistent law enforcement against violations of environmental and occupational safety regulations must be implemented to create a deterrent effect and increase business compliance (Minister of Energy and Mineral Resources Regulation No. 26/2018).

Fifth, in the context of downstreaming, strengthening the implementation of Good Manufacturing Practices (GMP) must be linked to the development of a sustainable nickel industry. The development of smelters and derivative industries must not only focus on increasing added value but also on energy efficiency, waste management, and the use of cleaner technologies. It is crucial to ensure that the downstreaming process does not create new environmental impacts that conflict with the principles of sustainable development.

Sixth, Indonesia has the opportunity to play a strategic role in promoting global standardization regarding sustainable nickel mining practices. As a major producer, Indonesia can initiate the development of national standards that integrate GMP principles with the SDGs and encourage international recognition of these standards. This step will not only strengthen Indonesia's bargaining position but also enhance the competitiveness of the national nickel industry in the global market.

Therefore, strengthening the implementation of GMP in nickel mining in Indonesia must be directed towards a more comprehensive governance transformation, focusing not only on regulatory compliance but also on the substantive integration of sustainable development principles. This approach is expected to make the nickel sector a key driver of sustainable economic development, while maintaining a balance between economic, environmental, and social interests.

Conclusion

Based on an analysis of the implementation of Good Mining Practice (GMP) in nickel mining governance in Indonesia, it can be concluded that, normatively, Indonesia already has a comprehensive legal framework for regulating mining activities. These regulations are reflected in Law Number 3 of 2020 concerning Mineral and Coal Mining and Minister of Energy and Mineral Resources Regulation Number 26 of 2018, which regulates environmental management obligations, occupational safety, resource conservation, and reclamation and post-mining activities. Normatively, these provisions reflect the basic principles of sustainable development.

However, in practice, the implementation of GMP in the nickel mining sector demonstrates that the application of sustainability principles remains partial and not fully substantive. The approach used tends to be oriented toward administrative compliance and impact control, rather than toward transforming the sustainable resource management system. This is evident in the persistent gap between legal norms and realities on the ground, characterized by social conflicts between mining companies and communities, the potential for environmental degradation due to mining activities, and weak oversight and law enforcement.

Analysis shows a fundamental difference between the concept of Good Manufacturing Practices (GMP) in national regulations and the principles of the Sustainable Development Goals (SDGs). GMP places greater emphasis on minimum operational standards in mining activities, while the SDGs demand the comprehensive integration of economic, environmental, and social aspects and a shift towards a more sustainable development paradigm. In the context of nickel mining, this situation also demonstrates a paradox: nickel, as a strategic commodity in the global energy transition, may put pressure on the environment and ecosystems if not managed optimally.

Downstream policies that encourage the development of the domestic nickel industry have strengthened Indonesia's strategic position in the global supply chain. However, these policies also require strengthened governance to ensure that it focuses not only on increasing economic added value but also on environmental sustainability and community well-being. Therefore, GMP implementation needs to be directed towards a more comprehensive approach, encompassing strengthening preventive aspects of environmental management, integrating climate change mitigation policies, increasing community participation, and strengthening oversight and law enforcement systems.

Furthermore, in a global context, Indonesia's strategic position as the world's largest nickel producer places a greater responsibility on ensuring the sustainable management of this resource. Dominance in the global supply chain is measured not only by production capacity but also by the ability to implement governance standards aligned with sustainability principles. Therefore, Indonesia's success in sustainably managing the nickel sector will be a crucial indicator of its credibility internationally, particularly in supporting the global energy transition agenda.

Transforming nickel mining governance toward a more sustainable direction requires synergy between policymakers, industry players, and the community. A more integrative approach, which balances economic, environmental, and social aspects, is key to achieving equitable and beneficial resource management. Therefore, the future implementation of Good Mining Practices (GMPs) requires not only compliance with applicable legal standards but also the ability to adapt to global dynamics and comprehensively address sustainability challenges.

Therefore, it can be concluded that the implementation of GMPs in nickel mining in Indonesia is still in the transition phase toward sustainable resource management. Although an adequate legal framework is in place, policy strengthening and more integrated implementation are needed to effectively realize the principles of sustainable development. In this context, Indonesia has a strategic opportunity to become not only a major global

nickel producer but also a pioneer in the implementation of sustainable and equitable mining practices.

The study's contribution to Environmental Law and sustainable mining governance theory is only partially articulated and remains somewhat implicit. Beyond identifying implementation gaps, the manuscript contributes by demonstrating that compliance with Good Mining Practice (GMP) standards does not necessarily equate to the achievement of sustainable development objectives. The study highlights a conceptual distinction between GMP as an operational compliance framework and sustainable development as a broader governance paradigm that integrates economic, environmental, and social dimensions. This finding contributes to environmental law scholarship by showing the limitations of regulation that focuses primarily on technical and administrative compliance without addressing broader sustainability outcomes. However, the manuscript does not fully develop this insight into a clear theoretical framework or governance model. As a result, its contribution is more diagnostic than theoretical, identifying deficiencies in the current governance approach rather than proposing a novel conceptual advancement or a distinct theory of sustainable mining governance.

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