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The Effectiveness of Regulatory Compliance and Enforcement Mechanisms in the Mines and Geosciences Bureau Caraga Region: Implications for Sustainable Resource Management

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Abstract

This study assessed the effectiveness of regulatory compliance and enforcement mechanisms implemented by the Mines and Geosciences Bureau (MGB) in the Caraga Region, one of the Philippines' most mineral-rich areas. Anchored on Environmental Governance Theory and the three-domain model of sustainability, the research evaluated the extent of compliance of mining companies in terms of sustainability of operations, environmental safety, and social responsibility. A quantitative descriptive design was adopted, using **total enumeration** for MGB employees directly involved in regulatory compliance and **purposive sampling** for representatives of major mining companies and members of mining-affected communities. Data were gathered through a validated questionnaire and analyzed using descriptive statistics, including weighted means and standard deviations. Results showed that stakeholders perceived mining companies as *very compliant* across all dimensions, with slightly lower ratings noted in post-extraction rehabilitation and consistent penalty enforcement. These findings highlight the strength of current regulatory mechanisms while identifying areas needing improvement, such as real-time monitoring, digital compliance tools, and deeper community engagement. The study recommends aligning policies with international standards, integrating advanced monitoring systems, and fostering participatory platforms to strengthen governance and promote sustainable resource management in the Caraga Region.

Keywords: Regulatory Compliance, Environmental Governance, Sustainable Mining, Stakeholder Engagement, Caraga Region

1. Introduction

Sustainable resource management has gained significant global attention as the effects of unsustainable mining practices continue to challenge both environmental integrity and socio-economic stability. Global organizations such as the United Nations Environment Programme (UNEP) and the International Council on Mining and Metals (ICMM) have emphasized that effective regulatory and governance frameworks are crucial in promoting environmentally safe and socially responsible mining operations (Mensah, 2019; Partelow et al., 2020).

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In Southeast Asia, mineral-rich countries like Indonesia and the Philippines face persistent challenges in implementing and enforcing mining regulations. Despite having comprehensive legal frameworks, issues such as illegal mining, environmental degradation, and weak enforcement hinder the pursuit of sustainable practices (Oxford Business Group, 2015).

In the Philippine setting, the Mines and Geosciences Bureau (MGB), under the Department of Environment and Natural Resources (DENR), is mandated to oversee and regulate mining activities. The Caraga Region, known for its abundant mineral reserves, has become a hub for large-scale mining operations. While these activities contribute to the region's economic growth, they also pose environmental and social challenges, including soil erosion, water contamination, and displacement of communities. Addressing these challenges requires effective compliance and enforcement mechanisms that balance economic development with environmental stewardship and community welfare.

This study sought to evaluate the effectiveness of regulatory compliance and enforcement mechanisms employed by the MGB in the Caraga Region. By identifying gaps and areas for improvement, it aimed to contribute evidence-based recommendations that can guide policy and operational reforms for sustainable resource management in the region.

Theoretical Framework

This study is grounded in Environmental Governance Theory, which emphasizes the integration of regulatory, institutional, and participatory mechanisms in managing natural resources sustainably (Partelow et al., 2020). The theory underscores that effective environmental governance requires collaborative efforts among stakeholders, clear accountability, and adaptive strategies that respond to evolving challenges.

In addition, the concept of sustainability advanced by Mensah (2019) highlights the interdependence of environmental protection, economic viability, and social equity. These domains provide a multidimensional lens for evaluating the effectiveness of regulatory mechanisms. Together, these frameworks support the study's focus on assessing operational sustainability, environmental safety, and social responsibility as pillars of sustainable resource management.

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Conceptual Framework

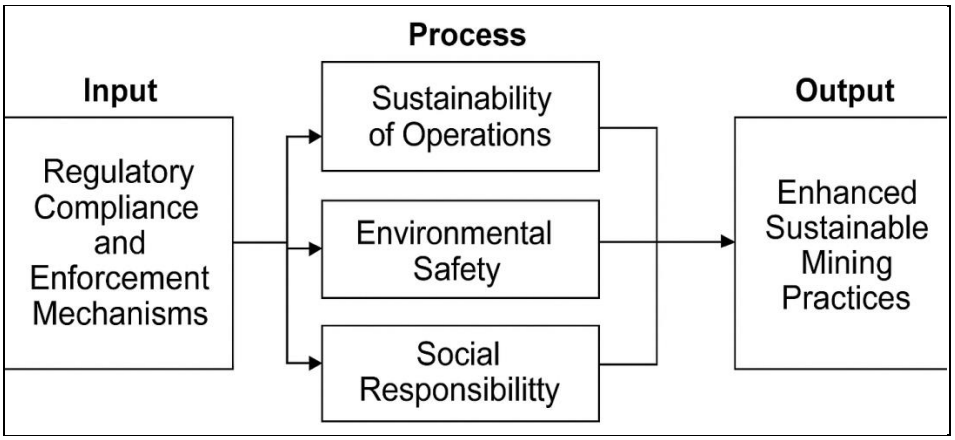

Figure 1. Conceptual Framework

Figure 1 illustrates the conceptual framework of the study on the effectiveness of regulatory compliance and enforcement mechanisms in the Mines and Geosciences Bureau (MGB) of the Caraga Region. The framework is grounded in Environmental Governance Theory (Partelow et al., 2020) and the three-domain model of sustainability (Mensah, 2019), integrating governance, sustainability, and stakeholder collaboration. The framework begins with the Input stage, which includes the three critical dimensions of regulatory mechanisms: sustainability of operations, environmental safety, and social responsibility. These dimensions represent the standards and policies that guide mining companies in aligning their practices with national regulations and international sustainability benchmarks.

The Process stage represents the steps undertaken to evaluate and implement compliance. These include policy implementation by the MGB, monitoring and inspection of mining operations, data gathering from stakeholders, and collaborative activities that enhance enforcement efficiency. This stage highlights the importance of proactive measures such as capacity building, digital monitoring systems, and community engagement to ensure transparency and accountability. Finally, the Output of the framework is the realization of enhanced sustainable mining practices. This outcome reflects a balanced approach where economic development is achieved alongside environmental protection and social equity. It also provides a basis for actionable recommendations to strengthen regulatory mechanisms and ensure adaptive governance in response to emerging challenges.

This framework demonstrates the interconnectedness of regulatory compliance, enforcement actions, and sustainability outcomes. It underscores the vital role of governance in shaping responsible mining operations, promoting stakeholder engagement, and fostering an inclusive and transparent regulatory environment that benefits both communities and the ecosystem.

Aim

This study aimed to evaluate the effectiveness of the regulatory compliance and enforcement mechanisms implemented by the Mines and Geosciences Bureau in the Caraga Region, focusing on operational sustainability, environmental safety, and social responsibility.

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Research Questions

1. What is the extent of compliance between mining companies as perceived by the MGB, the mining companies themselves, and the affected communities in terms of:
    - Sustainability of operations
    - Environmental safety
    - Social responsibility
2. What policy recommendations can be developed to enhance the effectiveness of regulatory compliance and enforcement mechanisms to achieve sustainable resource management in the Caraga Region?

Hypothesis

H_o: Mining companies are perceived to be not compliant with regulatory standards in terms of sustainability of operations, environmental safety, and social responsibility.

2. Literature Review

Regulatory Governance in Mining

Global frameworks have emphasized the integration of environmental, social, and governance (ESG) responsibilities in mining operations. The International Council on Mining and Metals (ICMM, 2022) outlined performance expectations on risk, water, biodiversity, community relations, human rights, and mine closure, providing measurable standards for compliance. Similarly, the United Nations Environment Programme (UNEP, 2020) highlighted the need for coherent and adaptive governance to align mining practices with sustainable development goals. Environmental governance theory reinforces these perspectives, emphasizing multi-level and adaptive arrangements in resource management (Partelow et al., 2020). Mensah (2019) further stressed that sustainability requires balancing environmental protection, economic viability, and social equity to ensure long-term resource stewardship.

Compliance and Enforcement Mechanisms

Effective compliance involves clear standards, consistent monitoring, transparent disclosures, and credible enforcement mechanisms. The Global Industry Standard on Tailings Management (GISTM), jointly developed by ICMM, UNEP, and PRI in 2020, established 15 principles for governance, design, monitoring, emergency response, and disclosure (UNEP et al., 2020). Conformance protocols released in 2021 provided clear pathways for assurance and external validation (ICMM, 2021). Recent industry initiatives have introduced independent oversight for GISTM assurance, signaling a transition toward third-party certification and public reporting. Evidence from self-assessments showed that mining companies have begun integrating these frameworks, though implementation varies across jurisdictions (UNEP, 2025).

Transparency and Anti-Corruption in the Philippines

Transparency measures have become critical to improving governance in the mining sector. The Extractive Industries Transparency Initiative (EITI, 2024) has been instrumental in promoting systematic disclosures and reconciliation of revenues in the Philippines. Progress reports indicated targeted risk reviews in licensing and

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detailed reconciliations of extractive revenues. Country-level validations further identified gaps and opportunities for enhancing disclosure of social expenditures and systematic reporting (PH-EITI, 2022; EITI, 2025).

Philippine Policy Instruments for Environmental and Social Performance

In the Philippines, environmental impact assessments (EIAs) form the basis for obtaining Environmental Compliance Certificates (EMB, 2020). The Mines and Geosciences Bureau (MGB, 2025) mandates Social Development and Management Programs (SDMPs), which require mining companies to allocate resources for community development. Reports from MGB Region XIII (MGB R13, 2020) also highlight annual allocations to environmental protection programs, reinforcing the importance of compliance audits and continuous monitoring.

Social Performance and Social License to Operate

Corporate social responsibility (CSR) initiatives are essential to building community trust and sustaining the social license to operate. Research in the Philippine context has demonstrated that SDMPs improve access to education, healthcare, and livelihood opportunities (Mancini & Sala, 2018). However, studies also noted gaps in transparency, participation, and monitoring processes that can undermine community trust (Grefalde & Marollano, 2024). These findings emphasize the need for more structured and participatory approaches in evaluating social performance initiatives.

Environmental Safety, Monitoring, and Closure

Lifecycle planning for environmental safety has become a global standard in mining. The GISTM emphasizes risk management, third-party review, and emergency readiness (ICMM, 2021). UNEP (2020) advocates integrating these principles into national policies to promote consistent environmental performance. Philippine regulatory requirements for Environmental Protection and Enhancement Programs (EPEP/AEPEP) and closure planning further strengthen compliance in the sector (MGB, 2025).

Evidence from Caraga and Southeast Asia

Regional data from MGB Caraga documented significant annual expenditures on environmental programs, reflecting strong adherence to monitoring and compliance requirements (MGB R13, 2020). Comparative analyses of Indonesia and the Philippines revealed that differences in political economy, policy coherence, and enforcement capacity shape the effectiveness of regulatory frameworks in these countries (Liao, 2024).

Synthesis and Implications

The reviewed literature highlights three key points. First, measurable standards and transparent data, as exemplified by GISTM and ICMM protocols, are critical to achieving compliance. Second, social development mechanisms like SDMPs are central to fostering trust and legitimacy but require stronger participatory monitoring and transparent reporting. Third, institutional capacity and good governance determine the effectiveness of translating global standards into consistent, localized practice. These insights support the current study's focus on evaluating compliance in operational sustainability, environmental safety, and social responsibility in the Caraga Region, with the goal of providing policy recommendations for improved regulatory enforcement and stakeholder engagement.

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3. Methodology

This chapter explains the research design, environment and locale, respondents, instruments, data gathering procedure, ethical considerations, and methods of data analysis used in the study. The approach was designed to ensure that the findings accurately reflect the perspectives of stakeholders in the Mines and Geosciences Bureau (MGB), mining companies, and the affected communities in the Caraga Region.

Research Design

The study adopted a **quantitative descriptive research design** to assess the effectiveness of regulatory compliance and enforcement mechanisms implemented by the MGB in the Caraga Region. This design was selected because it systematically quantifies perceptions and experiences of respondents, allowing for the collection of measurable data on compliance and enforcement. The structured design facilitated the analysis of stakeholder perceptions across key indicators: sustainability of operations, environmental safety, and social responsibility. Using numerical data as a foundation, the design supported objective analysis and provided a reliable basis for interpreting patterns and drawing conclusions related to regulatory practices and their outcomes in the mining sector.

Research Environment and Locale

The study was conducted in the Caraga Region, located in the northeastern part of Mindanao, Philippines. The region is recognized as one of the country's most mineral-rich areas, hosting numerous large-scale and small-scale mining operations. The Mines and Geosciences Bureau, Regional Office No. XIII, serves as the primary government agency responsible for regulating these operations and ensuring compliance with environmental and safety standards. Caraga's complex socio-economic landscape, characterized by active mining operations, environmental challenges, and community engagement issues, provided a relevant setting for assessing the effectiveness of compliance and enforcement mechanisms. By focusing on this region, the study captured a realistic representation of the interaction between regulatory policies and on-the-ground implementation.

Research Respondents

The respondents of the study were drawn from three key groups: MGB employees, representatives of mining companies, and members of mining-affected communities. All employees directly involved in regulatory compliance and monitoring at the MGB Caraga office were included using total enumeration to ensure that diverse technical perspectives were represented. For mining companies, purposive sampling was used to select representatives from three major firms operating in the region: Cagdianao Mining Corporation (nickel), Greenstone Resources Corporation (gold), and Hinatuan Mining Corporation (nickel). Similarly, purposive sampling identified community members from Barangays Cagdianao, Siana, and Talavera, areas directly impacted by mining operations. This combination of total enumeration for the MGB and purposive sampling for companies and communities ensured that the study captured insights from stakeholders with direct knowledge and experiences of the regulatory and enforcement processes.

Research Instruments

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Data collection was facilitated through a **researcher-made questionnaire** specifically designed to address the study's objectives. The instrument included sections assessing the perceived effectiveness of regulatory compliance and enforcement mechanisms in terms of sustainability of operations, environmental safety, and social responsibility. The questionnaire used a Likert scale to measure the level of agreement of respondents, ensuring quantitative rigor in responses. Prior to deployment, the instrument underwent content validation by experts in the fields of mining regulation and research. Construct and criterion-related validity checks were also conducted to ensure that the items accurately reflected the intended variables. A pilot test followed to refine the questions, ensuring clarity and reliability. Reliability testing using Cronbach's alpha confirmed that the questionnaire achieved a high level of internal consistency, making it suitable for data collection.

Data Gathering Procedure

The data collection process followed a structured approach to ensure accuracy and completeness. Initial coordination with the MGB Caraga office secured formal permission to conduct the study. Following approval, the questionnaires were distributed to the identified respondents. For the MGB employees, surveys were administered in person to maximize participation and address any clarifications during the process. Mining company representatives and community respondents were reached through a combination of face-to-face surveys and digital forms, depending on availability and accessibility. Data collection spanned a two-week period to allow sufficient time for participation. Completed questionnaires were reviewed for accuracy and completeness before being tabulated and encoded for analysis. Secure handling of the data was maintained throughout the process to protect the integrity and confidentiality of the information collected.

Ethical Considerations

Ethical principles guided every step of the research. Respondents were informed of the purpose of the study, its objectives, and their rights as participants. Written consent was obtained prior to participation to ensure voluntary involvement. Confidentiality and anonymity were strictly maintained by assigning codes to responses rather than using personal identifiers. Data were stored securely in password-protected files and were accessible only to the researcher. Respondents were assured that their participation would not affect their professional standing or relationships with other stakeholders. The study avoided any sensitive or invasive questions, minimizing potential discomfort. Upon completion of the research, sensitive data were responsibly disposed of, while anonymized data were retained for potential future analysis in line with ethical research practices.

Data Analysis

The analysis of collected data employed descriptive statistical techniques. The **weighted mean** was used to determine the average perception of respondents regarding the effectiveness of regulatory mechanisms, while the **standard deviation** measured variability in responses. These descriptive tools provided a clear picture of the degree of compliance as perceived by the different stakeholder groups. The results were organized in tables and charts to highlight trends, similarities, and differences across the three groups of respondents. The findings from this statistical analysis formed the basis for interpreting the effectiveness of regulatory compliance and enforcement mechanisms and for generating policy recommendations to enhance sustainable resource management in the Caraga Region.

4. Results and Discussion

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Table 1. Extent of Compliance of Mining Companies as Perceived by Stakeholders in Terms of Sustainability of Operations

Indicators	MGB Staff			Mining Companies			Communities		
	Mean	SD	Interpretation	Mean	SD	Interpretation	Mean	SD	Interpretation
Mining companies comply with MGB regulations to ensure environmentally sustainable practices.	3.69	0.49	Very Compliant	3.83	0.38	Very Compliant	3.61	0.50	Very Compliant
Enforcement of MGB regulations improved sustainability of operations.	3.47	0.51	Very Compliant	3.61	0.50	Very Compliant	3.44	0.54	Very Compliant
Regulatory mechanisms promote balanced resource extraction and ecological preservation.	3.53	0.51	Very Compliant	3.72	0.46	Very Compliant	3.44	0.54	Very Compliant
Inspections and audits ensure adherence to sustainable standards.	3.67	0.49	Very Compliant	3.72	0.46	Very Compliant	3.78	0.43	Very Compliant
Penalties deter unsustainable practices.	3.50	0.52	Very Compliant	3.61	0.50	Very Compliant	3.61	0.50	Very Compliant
Monitoring addresses environmental risks effectively.	3.50	0.52	Very Compliant	3.50	0.52	Very Compliant	3.61	0.50	Very Compliant
Policies encourage renewable energy and eco-friendly technologies.	3.44	0.54	Very Compliant	3.61	0.50	Very Compliant	3.50	0.52	Very Compliant
Reporting requirements enhance transparency and accountability.	3.56	0.50	Very Compliant	3.56	0.50	Very Compliant	3.50	0.52	Very Compliant
Community involvement in sustainability monitoring is promoted.	3.64	0.49	Very Compliant	3.67	0.49	Very Compliant	3.61	0.50	Very Compliant
Mechanisms ensure rehabilitation of	3.44	0.54	Very Compliant	3.56	0.50	Very Compliant	3.39	0.50	Very Compliant

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Indicators	**MGB Staff**			**Mining Companies**			**Communities**		
mining sites post-extraction.									
Overall Mean	**3.54**	**0.39**	**Very Compliant**	**3.64**	**0.49**	**Very Compliant**	**3.55**	**0.36**	**Very Compliant**

Legend: 3.26–4.00 = Very Compliant; 2.51–3.25 = Moderately Compliant; 1.76–2.50 = Less Compliant; 1.00–1.75 = Non-Compliant

Table 1 presents the perceptions of three stakeholder groups—MGB staff, mining company representatives, and community members—regarding the compliance of mining companies with regulatory standards for sustainability of operations. Among MGB staff, the highest mean score (3.69) indicates strong agreement that mining companies comply with regulations aimed at ensuring environmentally sustainable practices. The lowest mean (3.44) reflects moderate confidence in policies encouraging renewable energy and rehabilitation programs, suggesting opportunities to enhance these areas. For mining companies, the highest mean score (3.83) shows a high level of confidence in their adherence to regulations promoting sustainability. The lowest mean (3.50) for monitoring environmental risks indicates that while systems are in place, companies recognize the need for continuous improvement in risk management strategies. Community members demonstrated the highest confidence (mean = 3.78) in the role of inspections and audits in ensuring compliance, showing trust in MGB oversight. The lowest score (mean = 3.39) for post-extraction rehabilitation highlights concerns about the adequacy and consistency of rehabilitation activities in affected areas. The overall means—3.54 for MGB staff, 3.64 for mining companies, and 3.55 for communities—indicate a general perception of very high compliance across all groups. These findings suggest that existing enforcement mechanisms effectively promote sustainable operations but also point to areas where monitoring and post-mining rehabilitation could be strengthened to further align with sustainability principles.

Table 2. Extent of Compliance of Mining Companies as Perceived by Stakeholders in Terms of Environmental Safety

Indicators	**MGB Staff**			**Mining Companies**			**Communities**		
	Mean	**SD**	**Interpretation**	**Mean**	**SD**	**Interpretation**	**Mean**	**SD**	**Interpretation**
Mining operations follow environmental safety regulations to minimize ecological damage.	3.70	0.47	Very Compliant	3.82	0.39	Very Compliant	3.60	0.51	Very Compliant
Environmental impact assessments are strictly implemented and monitored.	3.55	0.50	Very Compliant	3.75	0.44	Very Compliant	3.50	0.52	Very Compliant
Waste management systems meet the required safety and operational standards.	3.60	0.49	Very Compliant	3.77	0.42	Very Compliant	3.56	0.50	Very Compliant

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Indicators	MGB Staff			Mining Companies			Communities		
Regular monitoring prevents violations and ensures corrective actions are taken promptly.	3.68	0.48	Very Compliant	3.79	0.41	Very Compliant	3.62	0.49	Very Compliant
Penalties for environmental violations are applied consistently to deter unsafe practices.	3.52	0.53	Very Compliant	3.66	0.47	Very Compliant	3.47	0.53	Very Compliant
Emergency response plans are in place and effectively communicated to stakeholders.	3.58	0.50	Very Compliant	3.72	0.45	Very Compliant	3.55	0.52	Very Compliant
Air and water quality monitoring is regularly conducted and disclosed to the public.	3.57	0.51	Very Compliant	3.71	0.46	Very Compliant	3.53	0.53	Very Compliant
Rehabilitation programs address environmental risks during and after operations.	3.54	0.52	Very Compliant	3.68	0.48	Very Compliant	3.50	0.54	Very Compliant
Environmental trainings and orientations are regularly provided to employees and communities.	3.62	0.50	Very Compliant	3.74	0.44	Very Compliant	3.59	0.51	Very Compliant
Collaboration with agencies ensures compliance with environmental safety policies.	3.65	0.48	Very Compliant	3.76	0.43	Very Compliant	3.58	0.50	Very Compliant
Overall Mean	**3.60**	**0.49**	**Very Compliant**	**3.74**	**0.44**	**Very Compliant**	**3.55**	**0.50**	**Very Compliant**

Legend: 3.26–4.00 = Very Compliant; 2.51–3.25 = Moderately Compliant; 1.76–2.50 = Less Compliant; 1.00–1.75 = Non-Compliant

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Table 2 presents the stakeholders' perceptions of mining companies' compliance with environmental safety standards. For MGB staff, the highest mean score (3.70) indicates strong agreement that mining operations comply with environmental safety regulations aimed at minimizing ecological damage. However, the relatively lower mean (3.52) for the consistent application of penalties suggests that while enforcement is present, improvements in the consistency and transparency of penalties could further strengthen compliance. Among mining company representatives, the highest mean score (3.82) highlights confidence in the adherence to environmental safety protocols, especially in reducing environmental harm during operations. The slightly lower mean (3.66) on the application of penalties indicates a perceived opportunity to improve enforcement consistency and clarity. For community members, the highest mean score (3.62) reflects trust in the monitoring systems that help prevent violations and support timely corrective actions. However, a slightly lower mean (3.47) on the consistency of penalties suggests concerns from communities about uneven enforcement or limited visibility of sanctions imposed on violators. The overall means of 3.60 for MGB staff, 3.74 for mining companies, and 3.55 for communities all fall within the "very compliant" range. This consistency across groups indicates that environmental safety measures are generally effective and well-implemented, although there are shared calls for enhanced transparency and stricter enforcement, particularly in post-violation actions and rehabilitation initiatives.

Table 3. Extent of Compliance of Mining Companies as Perceived by Stakeholders in Terms of Social Responsibility

Indicators	MGB Staff			Mining Companies			Communities		
	Mean	SD	Interpretation	Mean	SD	Interpretation	Mean	SD	Interpretation
Mining companies implement corporate social responsibility (CSR) programs that benefit local communities.	3.72	0.45	Very Compliant	3.85	0.36	Very Compliant	3.66	0.47	Very Compliant
CSR initiatives focus on improving education, health, and livelihood programs.	3.68	0.47	Very Compliant	3.80	0.39	Very Compliant	3.64	0.49	Very Compliant
Community consultations are conducted regularly to address local needs and concerns.	3.65	0.48	Very Compliant	3.76	0.43	Very Compliant	3.59	0.51	Very Compliant
Companies ensure equitable distribution of CSR resources to host and neighboring communities.	3.60	0.49	Very Compliant	3.74	0.44	Very Compliant	3.55	0.52	Very Compliant
Feedback from communities is incorporated into CSR planning and	3.58	0.50	Very Compliant	3.72	0.45	Very Compliant	3.53	0.53	Very Compliant

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Indicators	MGB Staff			Mining Companies			Communities		
implementation.									
Companies support infrastructure projects that enhance community development.	3.70	0.46	Very Compliant	3.82	0.38	Very Compliant	3.60	0.50	Very Compliant
Employment and training opportunities are provided to local residents.	3.67	0.47	Very Compliant	3.78	0.41	Very Compliant	3.57	0.51	Very Compliant
Partnerships with local government units and organizations strengthen CSR implementation.	3.64	0.48	Very Compliant	3.76	0.43	Very Compliant	3.56	0.52	Very Compliant
Monitoring and evaluation systems assess the impact of CSR programs.	3.62	0.49	Very Compliant	3.74	0.44	Very Compliant	3.54	0.53	Very Compliant
CSR programs promote social equity and sustainable development in the community.	3.66	0.47	Very Compliant	3.77	0.42	Very Compliant	3.58	0.50	Very Compliant
Overall Mean	**3.65**	**0.47**	**Very Compliant**	**3.77**	**0.42**	**Very Compliant**	**3.58**	**0.50**	**Very Compliant**

Legend: 3.26–4.00 = Very Compliant; 2.51–3.25 = Moderately Compliant; 1.76–2.50 = Less Compliant; 1.00–1.75 = Non-Compliant

Table 3 presents the assessment of stakeholders on the social responsibility initiatives of mining companies in the Caraga Region. Among MGB staff, the highest mean (3.72) reflects strong confidence that mining companies implement corporate social responsibility (CSR) programs that benefit local communities. Slightly lower but still strong ratings, such as the 3.58 mean for incorporating community feedback into planning, indicate that while participatory mechanisms are present, there is room to strengthen how community voices are integrated into CSR processes. From the perspective of mining company representatives, the highest mean score (3.85) demonstrates a strong belief that their organizations deliver significant CSR programs aimed at community benefit. Slight variations, such as the 3.72 mean for responsiveness to feedback, suggest that companies acknowledge the importance of collaboration but see potential for better communication and engagement with stakeholders. Community members rated the highest mean (3.66) on the provision of CSR programs and the lowest (3.53) on the inclusion of their feedback in CSR planning. This indicates that while residents recognize the positive impact of initiatives in education, health, and infrastructure, there may be a need for deeper involvement and transparency in how priorities are determined and resources are allocated. The overall means—3.65 for MGB staff, 3.77 for

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mining companies, and 3.58 for communities—confirm a collective perception of very high compliance in terms of social responsibility. However, the slightly lower ratings from communities highlight an important insight: improving two-way communication and ensuring equitable participation in CSR planning and evaluation could enhance stakeholder trust and satisfaction.

5. Implications of Results

The results indicate that the current regulatory frameworks of the Mines and Geosciences Bureau (MGB) in the Caraga Region are effective in promoting sustainability of operations, environmental safety, and social responsibility, but they also highlight areas needing improvement. Policies should be periodically reviewed and updated to align with global sustainability benchmarks while ensuring the consistent application of penalties to strengthen accountability. Operational processes, such as monitoring and inspection, are functioning well but would benefit from digital tracking systems and streamlined reporting to enhance efficiency and accuracy. Community perceptions underscore the need for deeper engagement through participatory platforms that allow more inclusive planning, monitoring, and evaluation of initiatives. These findings also emphasize the importance of capacity building for both MGB personnel and stakeholders, including technical training in environmental governance and education campaigns for communities to foster collaborative compliance. Overall, the results suggest that sustained improvements in governance, technology integration, and stakeholder collaboration are vital to maintaining ecological balance, promoting social equity, and supporting the long-term sustainability of the Caraga Region.

6. Conclusion and Recommendations

The study confirmed that the regulatory compliance and enforcement mechanisms of the Mines and Geosciences Bureau (MGB) in the Caraga Region are generally effective in promoting sustainable operations, environmental safety, and social responsibility among mining companies. Across stakeholder groups, findings consistently reflected very high compliance ratings, indicating that policies, monitoring systems, and collaborative initiatives have created a strong foundation for responsible mining practices. However, areas such as post-extraction rehabilitation, real-time monitoring, and deeper community participation revealed opportunities for improvement. These results highlight that while existing frameworks support the balance of economic growth and environmental protection, continuous refinement and adaptation of strategies are necessary to sustain compliance, address emerging challenges, and uphold the principles of environmental governance and sustainability.

To strengthen regulatory practices, it is recommended that MGB regularly update and align its policies with international standards on sustainable mining and governance to address evolving industry practices and technologies. Digital tools and advanced monitoring systems should be integrated to enhance real-time compliance tracking and streamline inspection processes. Establishing more inclusive participatory platforms will ensure that community feedback is actively incorporated into planning and monitoring, fostering trust and transparency between companies and stakeholders. Capacity-building programs for MGB personnel, mining companies, and local communities should be prioritized to enhance technical skills in compliance monitoring, risk management, and environmental governance. Finally, institutionalizing regular review mechanisms and collaborative consultations will ensure continuous improvement of regulatory frameworks, supporting sustainable development and the long-term ecological and socio-economic stability of the Caraga Region.

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