Review Article

A Review of the Effectiveness of the Sierra Leone Mining Policies in Sustainable Environmental Management

Abstract

The mining industry is a key driver of revenue in Sierra Leone and plays a crucial role in the country's economy. However, its environmental impacts have become one of the most significant challenges facing the nation.

This study assesses the effectiveness of mining policies in Sierra Leone in promoting sustainable environmental management. While legal frameworks such as the Mines and Minerals Act of 2009 and the Environmental Protection Act of 2008 have been established, enforcement remains a major challenge, contributing to ongoing environmental degradation and social conflicts. The study identifies key gaps in policy implementation, including limitations in institutional capacity, financial resources, and community engagement. Comparisons are made with mining policies in countries like Ghana, Australia, and South Africa, highlighting the importance of effective environmental regulation and robust enforcement mechanisms.

The study concludes with recommendations for improving the governance framework, enhancing the capacity of regulatory agencies, and fostering greater community participation to support sustainable development in Sierra Leone's mining sector.

Key Word: Mining, Policy, Environment, Regulation, Sierra Leone

1. Introduction

“Despite being a cornerstone of many developing economies, mining operations—regardless of their scale—inevitably disrupt the environment”[1]. It contributes to widespread vegetation loss, degradation of farmland [2], and river sedimentation [3]. The environmental destruction caused by mining operations is primarily the result of inappropriate mining practices. As mineral production expands both regionally and globally, ensuring sustainable resource extraction has become a significant challenge. This underscores the growing need for effective and sustainable environmental management practices in the mining sector [4]. The environmental risks associated with mining, along with the health and safety consequences for workers and nearby communities, stem from a combination of factors, including lack of awareness, financial constraints, inadequate technology, and weak enforcement of environmental regulations [5]. Sustainable mineral production is crucial for the preservation of natural resources and is a key priority in many countries worldwide [6].

Over the past few decades, the "polluter pays" principle has become deeply embedded in the policy framework, and environmental regulations have become increasingly stringent worldwide. Although there is often tension between the goals of attracting investment in mining and protecting the environment, evidence suggests that it is entirely feasible to strike a balance, with both robust environmental regulation and a favorable investment climate coexisting [7].

The international landscape for environmental management in mining is rapidly evolving, shaped by a combination of international guidelines, resolutions, protocols, treaties, and conventions. Additionally, the influence of international lending and aid institutions plays a significant role, as they demand consistent yet continually evolving standards of environmental performance from their clients[8]. A common objective for governments is to establish an effective environmental regulatory system, often within a short timeframe. This system must be equipped with the necessary institutional capacity, comprehensive training and educational programs, mechanisms to fund inspection efforts, and sufficient in-country analytical support [8].

Regionally, environmental management practices vary depending on each country's governance system, particularly in relation to mining policies, land use regulations, and environmental

protection laws, as is the case in many African nations within the subregion. As one scholar aptly noted, "In his pursuit of a higher standard of living, man has allowed all other considerations to take a backseat, accelerating environmental degradation and threatening the delicate ecological balance that sustains life on Earth." Therefore, it is crucial that environmental, economic, and performance considerations become the foundation for sustainable development if life on our planet is to endure [9].

Despite the economic benefits associated with mining, environmental protection must be prioritized. Therefore, careful planning is essential to ensure that the long-term health of the environment is safeguarded while balancing economic development [10]. According to Lein (2008), "Environmental planning is uniquely focused on understanding the relationship between human landscapes and the ecological and physical processes that directly and indirectly sustain our existence." [11] Therefore, there is a pressing need for effective planning that aligns with one of the key findings of the Brundtland Report, which emphasizes the "necessity of striking the right balance between environmental protection on one hand and development needs on the other" [12].

The legal and regulatory framework governing the mining sector in Sierra Leone has developed over time to address the evolving needs of the industry. The initial legislation, the Minerals Act of 1927, was designed to regulate mineral exploration and extraction. Over the years, this framework has been revised several times to respond to changing industry dynamics and to incorporate elements of environmental and social governance. Key legislative milestones include the Mines and Minerals Act of 2009, which serves as the current legal foundation for mining operations, and the Environmental Protection Agency Act of 2008, which establishes the environmental management obligations for mining companies [13].

Despite the existence of legal frameworks, the mining industry in Sierra Leone continues to face significant challenges, including weak governance, insufficient enforcement of regulations, and limited community involvement in decision-making processes. These issues have often resulted in conflicts between mining companies and local communities, particularly over land rights, environmental degradation, and the equitable distribution of mining benefits. These persistent challenges highlight the need for stronger governance, more effective regulatory enforcement,

and greater community engagement to ensure the sustainability and fairness of the sector [14]. The objective of this study is to critically analyze the framework of mining policies and regulations in Sierra Leone, evaluate their implementation effectiveness, identify key gaps, and offer actionable recommendations to strengthen sustainable environmental practices and management within the mining sector.

2. Materials and Methods

The study employed an integrative review methodology to evaluate the effectiveness of Sierra Leone's mining policies in promoting sustainable environmental management. The objective was to gather both qualitative and quantitative data to assess the impact of mining policies and regulations. Peer-reviewed online resources, including publications on mining policies related to environmental sustainability, were sourced primarily from reputable databases such as Google Scholar, ResearchGate, Web of Science, as well as reports from the Government of Sierra Leone, Ghana, South Africa, Australia, and their respective Environmental Protection Agencies (EPA). For this study, reliable and consistent data were obtained using key search terms such as "Mining," "Policy," "Sustainable," "Environment," "Regulation," "Act," and "EPA." When these terms were entered into Google Scholar, an average of 1,850 results and relevant metadata from academic publications were retrieved for analysis.

2.1 Data Acquisition of Sierra Leone Mining Activities and Environment Policy

Data on Sierra Leone's mining production, industry, and environmental policies were gathered through a thorough review of relevant literature and publicly available government documents. Despite the sector's economic importance, the mining industry in Sierra Leone faces numerous challenges. A critical issue is the inadequacy of the legal and regulatory framework that governs mining activities. Over the years, Sierra Leone has implemented several laws and regulations aimed at mitigating the environmental and social impacts of mining. Key pieces of legislation include the Mines and Minerals Act of 2009, the Environmental Protection Agency Act of 2008, and the National Minerals Agency Act of 2012. However, the effectiveness of these policies in achieving sustainable mining practices remains a significant concern [15].

The first mining legislation in Sierra Leone, the Minerals Act of 1927, was amended in 1960 and became the Revised Minerals Act. This was later replaced by the 1994 Mines and Minerals Decree, which was formalized as law in 1996 (the 1994 Act), with minor amendments made in 1999 and 2004. It was further supplemented by the Mines and Minerals Regulations of 1994. Over the following decades, additional laws and regulations were introduced to address

emerging challenges in the mining sector. Notable among these are the Environmental Protection Agency Act of 2008 (EPA Act), the Mines and Minerals Act of 2009, and the National Minerals Agency Act of 2012. These legislative developments aim to enhance the regulation of the mining industry, with particular focus on environmental protection and sustainable resource management [16].

However, these regulations have faced criticism for their ineffectiveness, particularly regarding enforcement and the lack of clarity in addressing critical issues such as environmental protection, social development, health and safety, and community welfare. Despite the existence of these laws, their practical application has often been hindered by weak institutional capacity, limited resources, and insufficient coordination among stakeholders, leading to gaps in implementation and oversight [17, 18]. In recent years, the government of Sierra Leone has undertaken significant efforts to reform the mining sector to enhance its contribution to sustainable development. Key initiatives, such as the adoption of the Extractive Industries Transparency Initiative (EITI), have been introduced to improve transparency and accountability within the sector. Furthermore, the establishment of the National Minerals Agency (NMA) in 2012 marked a crucial step in strengthening regulatory oversight, ensuring that mining activities adhere to national laws and align with international best practices. These reforms aim to foster a more sustainable, responsible, and transparent mining industry, ultimately supporting the country's long-term economic and environmental goals [19] .

Mining operations in Sierra Leone have been ongoing for over a decade; however, the country continues to rank among the lowest in terms of development and environmental performance. This can largely be attributed to the poor adherence to sustainable mining practices. Over the years, unsustainable mining has caused significant environmental damage, leading to widespread land degradation, loss of biodiversity, and serious health risks. These issues have reached a crisis point, underscoring the urgent need for more effective environmental management and adherence to sustainable mining protocols [20]. The conflict between promoting mining activities to drive economic development and protecting the environment in which these activities occur is a persistent dilemma for mineral-dependent countries like Sierra Leone. To address this challenge, the concept of sustainable development was introduced on the international stage as a means to balance these competing priorities. Sustainable development serves as a mediator,

aiming to reconcile the tension between economic growth and environmental protection by advocating for the integration of both goals, ensuring that development occurs without compromising the environment for future generations [21].

Sierra Leone is endowed with rich natural resources, yet it remains vulnerable to environmental degradation as results of mining activities. Mining communities often experience social tensions stemming from the trade-off between the anticipated employment benefits and the environmental costs of mining operations. Over the past decades, while the mining sector has contributed to the country's economic growth, its positive impact has been overshadowed by the significant environmental damage caused. This damage is largely attributed to the country's weak environmental policies and the failure of mining oversight institutions to effectively monitor and regulate mining operations, leaving communities and ecosystems vulnerable to the adverse effects of unchecked industrial activity [22].

In addition to the inconsistencies within the Mines and Minerals Act (MMA) of 2009 and the Environmental Protection Act (EPA) of 2008, political influence and personal ties have significantly impacted the enforcement of these laws in Sierra Leone's mining sector. This has often hindered the ability of artisanal mining to effectively contribute to the achievement of the Sustainable Development Goals (SDGs). Regarding environmental regulations, the lack of clarity in the EPA Act 2008 on how environmental assessment license fees should be determined has led to disputes between the National Minerals Agency (NMA), the EPA, and mining companies. The relevant provision in the law states, "The Minister may, by statutory instrument, prescribe fees for licences issued under this Act," but it fails to provide a clear formula or methodology for calculating these fees, resulting in ongoing confusion and contestation among stakeholders [23].

The Role of Government in the Mining Industry Environmental Protection in Sierra Leone

The government plays a role in environmental protection through regulation, management, and funding. The government regulates environmental protection through laws and regulations, manages environmental resources through agencies such as the National Park Services, the Forest Service, and the Fish and Wildlife Service, and provides funding for environmental

protection initiatives through taxes, grants, and loans[24]. By engaging in these activities, the government takes a proactive stance in safeguarding the environment and addressing environmental challenges. The Government of Sierra Leone enacte**d** the Mines and Mineral Act, 2009[25], the amendment of the EPA Act, 2008 in July 2010 and also made a provision in the National Constitution of 1991 to protect and regulate the environment. The National Constitution of 1991[25] Chapter II: 7 (1) deals with the Economic objectives and Chapter II: 7 (1)a) affirms the country's commitment to "harness all the natural resources of the nation to promote national prosperity and an efficient, dynamic and self-reliant economy" and Chapter III: 18(3) states that" Nothing contained in or done under the authority of any law shall be held to be inconsistent with or in contravention of this section to the extent that the law in question and makes provision" Chapter III 18 (3)a) "which is reasonably required in the interest of defense, public, safety, public order, public morality, public health or the conservation of the natural resources, such as mineral, marine, forest and other resources of Sierra Leone, except in so far as that provision or, as the case may be the thing done under the authority thereof is shown not to be reasonably justifiable in a democratic society". Based on the foregoing provisions, the National Constitution of 1991 provides a clean bill of health for the Sierra Leone Mines and Mineral Act, 2009, and the Environment Protection Agency Act 2010 enactment.

"The Environment Protection Agency (EPA) Act, 2008 as amended in 2010, provides the overarching legislative framework for the implementation of the constitutional provision on environmental protection and natural resource management (EPA Strategic Plan, 2017-2021). The Environment Protection Agency (EPA) Act, 2008, as amended in 2010, plays a crucial role in providing the legislative framework for environmental protection and natural resource management in Sierra Leone. The establishment of the Environment Protection Agency, Sierra Leone (EPA-SL), as the focal institution responsible for environmental protection and management demonstrates the government's commitment to addressing environmental issues comprehensively"[25].

Environment Protection Agency Sierra Leone and Its Core Function

"Before 1986, several Government Departments, Non-Governmental organizations (NGOs), and other Agencies carried out development activities without due consideration for sound

environmental management (Strategic Plan, 2017-2021) . The establishment of the Environment Protection Agency Sierra Leone (EPA-SL) in 2008 marks a significant step in the country's efforts to address environmental management and sustainability"[26]. The main functions of the Agency as described in Section 12 of Part Three of the EPA Act of 2008 as amended in July 2010 (Functions Of EPA-SL - EPA-SL)) are mentioned as follows: **a)**Environmental Impact Licensing: The Agency reviews and approves environmental impact assessments and environmental impact statements submitted following the EPA Act of 2008 or any other sector law; b)Enforcement and Compliance: The Agency ensures compliance with laid down environmental impact assessment procedures in the planning and execution of development projects, including compliance in respect of existing projects; c)Education and Awareness Raising on the Environment: The Agency is responsible for the creation of public awareness of the environment and its importance to the economic and social life of Sierra Leoneans; d) Environmental policy-making and Legislation: The Agency prescribes standards and guidelines relating to ambient air, water, and soil quality, the pollution of air, water, land, and other forms of environmental pollution including the discharge of wastes and the control of toxic substances. e) Mobilize, expedite, and monitor resources for environmental management: The Agency develops plans and programs with environment management issues that can be funded from multiple funding sources. f)Strengthen private sector involvement in Environmental Management: Liaise with the private sector, non-governmental agencies, and Community-Based Organizations on issues relating to the environment; g) Mobilize, expedite, and monitor resources for environmental management: The Agency develops plans and programs with environment management issues that can be funded from multiple funding sources; h) Strengthen private sector involvement in Environmental Management: Liaise with the private sector, non-governmental agencies, and Community-Based Organizations on issues relating to the environment; g) Climate Changes and Environmental Protection: Climate change and environmental protection are pressing global challenges, and their impacts are being felt across the world. Years of environmental degradation, overexploitation of natural resources, and the burning of fossil fuels have contributed to the intensification of climate change[27].

2.2 Data Acquisition of Ghana Mining Activities and Environment Policy

Data acquisition for this study was carried out through a comprehensive review of existing literature and publicly available government documents. The Minerals and Mining Law of 1986 serves as the foundational legislative framework for the mining sector in Ghana. This law established the royalty and corporate tax rates applicable to the industry but was subsequently amended in 1994 and 2005 as Ghana transitioned to a constitutional system of governance. These amendments focused on revising corporate tax rates, royalty fees, and imposing limits on the duration of mining leases.

In addition, following the legalization of small-scale mining, three new mining laws were introduced: The Small-Scale Gold Mining Law, the Mercury Law, and the Precious Minerals Marketing Corporation Law. The Small-Scale Gold Mining Law addresses the registration, licensing, and establishment of support centers for small-scale mining activities. The Mercury Law permits the legal purchase of mercury for mining purposes, while the Precious Minerals Marketing Corporation Law facilitates official marketing services for small-scale gold and diamond miners, promoting trade in precious metals, diamonds, and jewelry both within Ghana and internationally.

"Ghana's long-standing tradition in the extractive sector has allowed the country to build a robust institutional framework to support the mining industry. Key organizations involved in the mining sector include the Ministry of Mines and Energy, the Minerals Commission, the Geological Survey Department, the Chamber of Mines, the Mines Department, the Environmental Protection Agency (EPA), the Lands Commission, the Land Valuation Board, and the Forestry Commission. These institutions work collaboratively to ensure the optimal exploitation of Ghana's natural resources while promoting sustainable mining practices"[28].

The Minerals and Mining Policy outlines a comprehensive framework of principles and strategies that guide the Government of Ghana in managing the mining and minerals sector. This Policy has been developed in alignment with the provisions of the 1992 Constitution of the Republic of Ghana (as amended in 1996) and aims to complement broader national initiatives such as the Ghana Growth and Poverty Reduction Strategy (GPRSII), the Draft Medium-Term Development Plan, and the Better Ghana Agenda. These documents collectively aim to foster economic growth and improve the standard of living for all Ghanaians.

Additionally, the Policy considers relevant guidelines and frameworks developed under the Natural Resources and Environmental Governance (NREG) Programme. This includes addressing social and environmental issues, as well as ensuring the sustainability of mining communities, particularly in terms of their resilience and well-being following the closure of mining operations. By integrating these comprehensive plans, the Minerals and Mining Policy seeks to ensure that Ghana's mining sector contributes positively to sustainable development while minimizing its negative impacts on both the environment and local communities [29].

"Despite all these policies and institutions, environmental degradation in most of mining communities in Ghana is still of a major threat and concern. The extent of environmental devastation caused by mineral mining in Ghana is well documented" [30].

"There are increasing levels of gold mining activity in these locations, which are persistent and growing exponentially, and have negative effects on water quality"[31]. "The government's decision to ban all galamsey (illegal mining) activities in the country was prompted by the widespread environmental damage caused by these activities in various localities across Sierra Leone. The uncontrolled nature of illegal mining has led to significant degradation of land, water sources, and ecosystems, prompting the government to take decisive action in a bid to protect the environment and promote sustainable mining practices" [31].

In response to the pressing environmental challenges, successive governments have implemented a range of interventions and policy instruments to address these issues. These include Environmental Impact Assessments (EIAs), parliamentary acts and legislation, environmental guidelines, reclamation bonds, and emission permits. These measures aim to mitigate the environmental damage caused by mining activities and promote sustainable practices across industries. Such policies reflect a growing commitment to improving environmental governance and ensuring long-term ecological balance [32].

Table 1: Selected Economic Indicators of the Solid Minerals Sub-Sector in Ghana

Parameter	2022	2021	%Change
Gross Value Added (GHC Billion)	12.630	10.105	24.99
Contribution to GDP (%)	7.6	4.5	68.99
Growth Rate (%)	24.99	-11.74	-312.60%

Source: Data from World Gold Council and Metals Focus (2023)[33]

2.3 Data Acquisition of Australia Mining Activities and Environment Policy

Data acquisition for this study was conducted through an extensive review of literature and published government documents. Government policy in Australia is primarily focused on creating a conducive framework for the growth of the mining sector, recognizing its crucial role in driving the country's economic development. Australia is home to some of the world's largest reserves of gold, iron ore, lithium, nickel, uranium, and zinc, which further underscores the importance of this sector. In terms of mineral ownership, the legal position in Australia is that all mineral titles are vested in the state or territory where they are located. Consequently, the development of mining projects is largely governed by the mining laws of the respective states and territories. However, the commissioning of a mining project requires adherence to various Commonwealth laws, including those pertaining to environmental regulations, employment, foreign ownership, and native title, as well as certain state and territory-specific laws, such as resource royalty obligations and stamp duty [30]. In early 2015, Adani was granted environmental approval for its mine project under Australia's Environmental Protection and Biodiversity Conservation Act (EPBC Act 1999). This approval marked a significant milestone in the development of the project, allowing it to proceed with compliance to environmental regulations set forth by the Act [30].

Pollution from mining operations has long been a significant concern for governments, local communities, environmentalists, and mining companies alike. In response, a variety of strategies have been implemented to minimize the production and emission of pollutants and reduce their dispersion from mining sites. These strategies encompass a range of measures, including the adoption of company-specific environmental, community, and safety policies; the use of

advanced equipment and technologies designed to capture and remove pollutants from site emissions; the strategic redesign and siting of operations to minimize leaching, runoff, and noise pollution; efforts to mitigate broader environmental impacts through the controlled release of substances; and comprehensive onsite rehabilitation programs to restore ecosystems [30].

The definition of "sustainable mining" varies significantly depending on the perspective—whether from industry, government, or civil society groups. Despite these differences, a common thread across all viewpoints is the emphasis on ensuring the continued availability of resources, maintaining a productive environment, and fostering healthy communities at both active and post-mining sites. This shared understanding underscores the need for mining practices that not only meet present needs but also contribute to long-term environmental and social well-being [34, 35]. Understanding and predicting the environmental sustainability challenges linked to mining requires a thorough knowledge of historical production trends, as well as an analysis of the relationship between production levels and resource intensity. By examining past trends and their environmental impacts, we can better anticipate future challenges and identify strategies to mitigate negative effects, ensuring that mining practices become more resource-efficient and sustainable over time [36]. The ongoing debate surrounding the integration of sustainable development into the mining industry, however, often lacks systematic, long-term data on mining practices. Essential data, such as economic resources, ore grades, solid waste burdens (including tailings and waste rock), and material inputs and outputs, are critical for assessing and quantifying the environmental sustainability of mining activities. These historical trends, which are vital for comprehensive sustainability assessments, have recently been compiled for the Australian mining industry, providing a valuable reference for future research and policy development [37].

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is the Australian Government's primary environmental legislation. It establishes a comprehensive legal framework to protect and manage nationally and internationally significant flora, fauna, ecological communities, and heritage places—collectively referred to as matters of national environmental significance. The EPBC Act facilitates collaboration between the Australian Government, states, and territories, creating a cohesive national approach to environmental protection, heritage conservation, and biodiversity preservation [38]. However, due to their deep

historical and cultural connections to the land, monetary compensation often fails to fully address the loss of land for many Indigenous groups. For communities such as the Iroquois and Huron Indians, who have inhabited certain regions of North America for over 20,000 years, and the Aboriginal peoples of Australia, who are among the earliest human inhabitants of Oceania, it is unrealistic to assume that any amount of financial compensation could adequately replace the profound disruptions to their way of life caused by local mining activities. Their primary concerns regarding land use policies can be summarized as follows:

- Self-determination, including demands for property rights over land and natural resources;
- Prior informed consent in protecting traditional knowledge and plant medicines;
- Cultural rights, encompassing the right to preserve and express cultural identities, language, religion, and access to sacred sites and religious practices;
- Rights to communal property, including land and territories;
- Control over traditional knowledge, ensuring that intellectual property related to cultural practices and natural resources is protected and respected.

For these communities, the issues surrounding land use extend beyond economics and touch on fundamental human rights, identity, and the preservation of their cultural heritage [39].

A survey of Australian companies (Tilt, 1997) found that 46% of companies made their Corporate Environmental Policy (CEP) publicly available, and over 60% claimed to prepare reports assessing performance against the policy. While these reports are predominantly shared with management rather than made publicly available, it is reasonable to expect some form of reporting related to the policy from companies that have a CEP in place. Given that most companies include a statement of objectives in their CEP (Tilt, 1997), there should be a clear link between these policy objectives and the standards set by the company, which would provide the foundation for reporting in line with CWS (Corporate Social Responsibility) guidelines [40].

2.4 Data Acquisition of South Africa Mining Activities and Environment Policy

Data acquisition for this study involved reviewing literature and published government documents. South African mining law is primarily governed by the Mineral and Petroleum

Resources Development Act (MPRDA), which regulates the right to conduct activities such as reconnaissance, prospecting, and mining operations. The MPRDA asserts that all mineral and petroleum resources in South Africa are vested in the state, making the government the custodian of these resources. The state is therefore responsible for allocating mining rights and authorizations under the MPRDA. As outlined in Section 3 of the MPRDA, mineral and petroleum resources are considered the common heritage of all South African people, and the state holds them in trust for the benefit of the nation [41]. The MPRDA stipulates that holders of mining rights, prospecting rights, or mining permits are prohibited from commencing mining activities without first obtaining environmental authorization. Additionally, they must provide the landowner or lawful occupier of the land with at least 21 days' written notice of their intention to exercise the allocated rights. It is important to note that while the MPRDA does not mandate the acquisition of a water use license before initiating mining or prospecting operations, the National Water Act makes it a criminal offense to commence any water use that requires licensing without the appropriate water use license. Since the implementation of the One Environmental System (OES) in 2014, the MPRDA has emphasized that any person seeking a mining right, prospecting right, or mining permit must apply for environmental authorization concurrently. This application must be lodged with the office of the Regional Manager, ensuring that both mining and environmental approvals are considered together [42].

Since the implementation of the One Environmental System, applications for environmental authorization are processed in accordance with the National Environmental Management Act (NEMA) of 1998, along with the Environmental Impact Assessment (EIA) regulations and relevant listing notices. NEMA outlines key environmental management principles that should guide decision-making throughout the entire mining life cycle, from exploration and prospecting to mine closure. These principles are designed to ensure that environmental protection and sustainable development are prioritized at every stage of mining operations [42]. The activities that require Environmental Authorizations (EAs) are outlined in the listing notices published under section 24(2)(a) of the National Environmental Management Act (NEMA). For activities listed in Listing Notice 1, EA applications must be accompanied by a basic assessment report, while activities listed in Listing Notice 2 necessitate a more detailed scoping and Environmental Impact Assessment (EIA) report. The scoping and EIA report is generally more comprehensive

and complex than a basic assessment report. In addition to these reports, applicants must also submit specialist studies, such as assessments from geo-hydrologists, wetland specialists, biodiversity experts, and heritage consultants. Furthermore, the application must include a draft environmental management program, mine closure plans, and a financial provision to ensure that funds are available for the rehabilitation of the site after mining operations have ceased. These requirements aim to ensure that all potential environmental impacts are thoroughly assessed and managed throughout the mining process [42].

Environmental law is an evolving and increasingly significant area of law, both locally and globally. The growing prominence of environmental law in South Africa, and worldwide, is largely due to the escalating impacts of human activities on the environment. These environmental consequences have heightened the urgency to conserve and protect natural resources. In South Africa, Section 24 of the Bill of Rights enshrines the right to an environment that is not harmful to health or well-being, embedding the principles of environmental protection and sustainable development into the country's constitutional framework. This constitutional recognition underscores the fundamental importance of a healthy environment. To further operationalize these principles, the National Environmental Management Act (NEMA) of 1998 and subsequent environmental laws and measures provide a comprehensive framework for environmental protection, conservation, and mitigation. These legislative tools aim to address the right to a healthy environment while regulating activities that impact the environment, ensuring sustainable development, and safeguarding natural resources for future generations [43].

In 1973, the Occupational Diseases in Mines and Works Act (ODMWA) was introduced to provide compensation for miners affected by occupational diseases. However, the benefits offered under the Act were significantly higher for white miners compared to those for other racial groups, reflecting the deeply entrenched racial inequalities of the time. This disparity in compensation highlighted the systemic discrimination within the mining sector and reinforced the broader social and economic inequities that existed during the apartheid era in South Africa [44]. Coal mining imposes significant external costs on both the surrounding environment and the local communities. While some of these impacts can be estimated, others are difficult to quantify. At its core, coal mining is inherently disruptive and environmentally destructive. Open-cast mining, for example, involves the removal of vast quantities of soil and rock overburden to

access coal seams, often leading to the destruction of regional aquifers. The process generates massive piles of solid waste, including coal refuse, which are prone to spontaneous combustion. Furthermore, leachate from these waste heaps is frequently acidic, contributing to widespread acid mine drainage. This contamination can severely impact both surface and groundwater, exacerbating environmental degradation and posing long-term risks to local ecosystems and water resources [45]. Closure planning has been a legal requirement in South Africa since the Minerals Act of 1991, which mandated the submission of an Environmental Management Programme (EMP), the implementation of rehabilitation efforts, the allocation of financial provision for closure activities, and the application for a closure certificate. This framework aimed to ensure that mining operations are conducted with due consideration for long-term environmental restoration and sustainable land use post-mining. By setting these requirements, the law sought to mitigate the environmental impacts of mining and ensure that operators are financially responsible for the reclamation and rehabilitation of the land once mining activities cease [46].

3. Results and Discussion

Table 2: Mining policies in Sustainable Environmental Management/Practice.

No	country	Policy	Environmental Practice
1	**S/Leone**	**Mines and Minerals Development Act**	**<u>Obligations of holders</u>** **(1)** Before commencing any licensing activity, the holder shall obtain the legally required authorizations, licences, permits and approvals from the Environmental Protection Agency and other government agency as prescribed. **(2)** A holder obligated to prepare an environmental screening report or environmental impact assessment, shall as prescribed undertake public consultations intended to inform and generate feedback in relation to potential environmental and social impacts of licensing activities from citizens' perspectives. **(3)** A holder shall submit— (a) an environmental and social management plan in a form prescribed for each license type that shall contain sufficient information and data to be able to determine whether the environmental and social management actions shall be and are effective; (b) an updated environmental and social management plan whenever a material change to the license activities is proposed and such change can reasonably be expected to impact environmental and social conditions. In addition to the legal requirements under the laws of Sierra Leone, with respect to environmental impact assessments prepared under this Act, as prescribed, inclusion of social,

			health and safety impacts, measures for mitigations and costed budget shall be included[47].
2	**Ghana**	**Mines and Mineral-Act-2006**	1.Before undertaking an activity or operation under a mineral right, the holder of the mineral right shall obtain the necessary approvals and permits required from the Forestry Commission and Environmental Protection Agency for the protection of natural resources, public health and the environment. 2. Without limiting subsection (1), a holder of a mineral right shall comply with the applicable Regulations made under this Act and any other enactment for the protection of the environment in so far as relates to exploitation of minerals[48].
3	**Australia**	**Environment Protection and Biodiversity Conservation Act 1999(EPBC Act)**	It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places - defined in the EPBC Act as matters of national environmental significance. The EPB Act enables the Australian Government to join with the states and territories in providing a truly national scheme of environment and heritage protection and biodiversity conservation. The Department of the Environment designs and implements the Australian Government policies and programme to protect and conserve the environment, water and heritage and promote climate action. The EPBC Act provides a legal framework to protect and manage matters of national environmental significance. The EPBC legislation implies to any activity that likely to have a significant matter of national significance.

			The EPBC approval may be required for certain action or activities that affect Australia environment, for example when mining or exploration activities may impact on water resources [41].
4	**South Africa**	**Mineral and Petroleum Resources Development Act 28 of 2002**	**<u>Environmental reports to be compiled for application of mining right</u>** 1.An environmental impact assessment contemplated in section 39(1) of the Act is a process which results in the compilation of – (a) a scoping report contemplated in regulation 49: (b)and followed by an environmental impact assessment report contemplated in regulation 50. **<u>Contents of environmental impact assessment report</u>** The contents of an environmental impact assessment report must include the following: (a)An assessment of the environment likely to be affected by the proposed mining operation, including cumulative environmental impacts; (b) an assessment of the environment likely to be affected by the identified alternative land use or developments, including cumulative environmental impacts; (c) an assessment of the nature, extent, duration, probability and significance of the identified potential environmental, social and cultural impacts of the proposed mining operation, including the cumulative environmental impacts;

			(d) a comparative assessment of the identified land use and development alternatives and their potential environmental, social and cultural impacts; (e) determine the appropriate mitigatory measures for each significant impact of the proposed mining operation; **Environmental management programme** An environmental management programme contemplated in section 39(1) of the Act must include the following: (a)A description of the environmental objectives and specific goals for- i. mine closure; ii. the management of identified environmental impacts emanating from the proposed mining operation; iii. the socio-economic conditions as identified in the social and labour plan; and iv. historical and cultural aspects, if applicable; **Environmental management plan** (1) An applicant whose application for a prospecting right or mining permit was accepted in terms of the Act, must submit an environmental management plan at the office of the Regional Manager in whose region the application was lodged within 60 days from the date of notification by the Regional Manager. (a) An environmental management plan, must

			substantially be in the standard format provided by the Department and must contain- (b) an assessment of the potential impacts of the proposed prospecting or mining operation on the environment, socio-economic conditions and cultural heritage, if any; (c) a summary of the assessment of the significance of the potential impacts, and the proposed mitigation and management measures to minimize adverse impacts and benefits; (d) financial provision which must include- (i) (ii) the determination of the quantum of the financial provision contemplated in regulation 54; and (ii) details of the method providing for the financial provision contemplated in regulation 53; (e) planned monitoring and performance assessment of the environmental management plan; (f) closure and environmental objectives; (g) a record of the public participation undertaken and the results thereof; and an undertaking by the applicant regarding the execution of the environmental management plan[49].

Mining policies in Sierra Leone, Ghana, Australia, and South Africa all place significant emphasis on environmental sustainability. These policies clearly stipulate that any mining company seeking to obtain a mining operation license must first conduct an environmental impact assessment (EIA) or produce a screening report. The Environmental Protection Agencies

(EPAs) in these countries serve as the primary stakeholders responsible for safeguarding the environment. They are entrusted with the authority to issue permits or approvals that allow mining companies to commence full-scale operations. This regulatory framework is aligned with other governmental bodies tasked with the protection of natural resources, public health, and environmental well-being.

Strong mining policies in these respective countries emphasize environmental and social management. These policies are clearly articulated in the various mining acts, which require that license holders submit an Environmental and Social Management Plan (ESMP) for each license type. The ESMP must contain sufficient information and data to assess whether the proposed environmental and social management measures will be effective.

In terms of fully sustainable environmental management, the respective acts and regulations outline clear goals for environmental protection. Therefore , the implementation strategies and approaches vary across countries. For instance, Australia utilizes advanced technologies to manage mining operations and protect its environment and natural resources, whereas Sierra Leone relies primarily on policy formulation and enforcement, with limited technological application in environmental protection for long-term sustainability.

Sierra Leone's mining policies face significant challenges in achieving sustainable environmental management. While the legal framework, including the Mines and Minerals Act of 2009 and the EPA Act of 2008, has been established, weak governance, inadequate enforcement, and poor institutional capacity have undermined their effectiveness. The study identifies several contributing factors, including limited financial resources and a lack of coordination among government agencies, which have hindered effective environmental protection in the mining sector.

However, the government of Sierra Leone plays an eminent role in protecting the environment through its regulations, management, and funding provided. This is done through regulating environmental protection laws and also regulations or rules to manage environmental resources through agencies. In 2009, the government enacted the Mines and Mineral Act that replaces previous acts that lay emphasis on environmental sustainability.

In order to ensure good environmental management or sustainable environmental management, there is an established Environmental Protection Agency (EPA), with its key functions as described in section 12 of part three of the EPA Act of 2008 as amended in July 2010. EPA issues environmental impact licensing, enforcement and compliance, education and awareness raising on the environment, environmental policy-making and legislation, mobilises, expedites, and monitors resources for environmental management, strengthens private sector involvement in environmental management, and climate change and environmental protection.

Table 1 indicated selected economic indicators of the solid minerals sub-sector in Ghana, which shows a parameter and a percentage change in 2021-2022. Gross value added (GHC Billion) is 10.105 (2021), 12.630 (2022), and 24.99 in percentage change; contribution to GDP (%) is 4.5 (2021), 7.6 (2022), and 68.99 in percentage change; and the growth rate (%) is -11.74 (2021) and 24.99 (2022) -312.60 in percentage change.

Table 2 presented the various mining policies in the respective countries. The Mines and Mineral Development Act of 2023, which replaced the previous act in Sierra Leone. This act gives legal requirements under the laws in respect to environmental impact and with a prescribed inclusion of social, health, and safety impacts. In Ghana, the Mines and Mineral Act-2006 gives legal requirements for any mining operation; there shall be permits from the Forestry Commission and the Environmental Protection Agency for the protection of natural resources. Likewise, in Australia there is a legal framework to protect and manage the ecological communities, and it is also implied in South Africa.

Challenges in Implementing Sierra Leone Mining Policy

1. **Lack of Autonomy of the EPA** .

This lack of autonomy is also evident in the mentioned 2011 statutory document. According to this instrument, the EPA has no power to stop or halt the operations of any mining company even when that company is in breach of the law. The EPA's mandate stretches only to issuing fines in the case of non-compliance. It is only the MMR that has the authorisation to suspend the operation and/or cancel a mineral right[50]. In liue of this, minining companies often do not adhear to strict enviornmental laws.

2. **Legal Contradictions, Institutional Overlap and Contestations**

   In addition to contradictions within the NMA 2009 and EPA Act 2008, the influence of politics and personal ties on the application of laws have had a significant influence in the mining sector, often derailing the ability of mining (artisanal) to contribute to the SDGs. With respect to environmental laws, the lack of clarity in the EPA Act 2008 on how the costs of environmental assessment licences should be calculated has led to contestations between the NMA, EPA and mining companies[51].

3. **Inadequate Coordination Across Government Entities**:

Environmental awareness has strong ties to the political ideology of environmentalism. Environmentalism is a broad philosophy and social movement that emphasizes the importance of protecting the natural environment and promoting sustainable practices to address environmental issues. Developing countries often face significant challenges when it comes to environmental issues[24].The coordination among states institutions involved in the mining sector are poor that has led to the overlapping responsibilities, inenfficiencies, and also gaps in policy implentation. For instance, both the NMA and EPA have the sole responsibilities for monitoring the country's environemnt but their efforts may overlap becouse their roles are not clearly defined. This may lead to ineffectiveness in policy implementation or enforcement.

4. **Low Transparency**

The mining sector suffers from an extreme lack of transparency. There is a lack of information at all levels that creates mistrust and ignorance about the financial position or intentions of government and companies. Some companies do not have websites and provide no financial information on their activities, including their tax payments. Koidu Holdings, the largest diamond company, established a website only in 2008; it still does not publish an annual financial report that is available to the public. Government provides only sporadic figures about mineral production, and those figures that are published probably understate the

amount. It does not publish a figure showing how much the country earns from mining overall[52].

4. Poor Capacity

There is a severe lack of capacity in all government departments associated with mining, for example, assess and collect revenues such as income taxes, collect basic geological information and monitor mining operations with the requisite skills. For example,the GDO, whose main purpose is to value diamonds for export and collect export taxes, employs just 13 people. The MMR is woefully short of technical capacity, qualified human resources and equipment, which reduces its ability to monitor the sector and also to negotiate on equal terms with the companies. Although the 1996 Act stipulates that expatriates can be employed only when there are no competent nationals for the job, the Ministry of Labour, Social Security and Industrial Relations has insufficient capacity to vet work permits; thus 'companies more often than not do what they like', a recent study commissioned by the World Bank notes[52].

5. Enduring Corruption

The prevalence of corruption is well-recognised. The director general of the MMR has stated that 'reducing corruption and rent seeking' is one of the challenges facing the department, which he recognises 'has had a reputation for corruption'. The head of the President's Task Force, while reviewing mining contracts with companies, has said that 'the public sector is marked by rent-seeking and these are the people we put in front of international investors'. Sierra Leone is ranked 142nd out of 163 countries in Transparency International's Corruptions Perceptions Index.The problem is endemic in Sierra Leonean society[52].

6. **Community Discontent and Lack of Involvement**:

Unequal power relations between local residents and the GOSL as regards access and control of land for mining have contributed to company–community conflicts. As in most Sub-Saharan African countries, the GOSL retains exclusive rights to subsurface minerals regardless of land ownership and has increasingly granted mining concessions to large-

scale operators, predominantly, in postwar years. Although such action may fulfill the government= national interests, it competes with local actors' interests, often to the disadvantage of the latter. The GOSL also exerts coercive power over mining communities in favor of corporations and government=national interests. Even though community members opposed mining concession due to potential adverse socioeconomic impacts, the GOSL detained dissenting community members for some time and issued a mining concession. The lack of representation of local residents in concession negotiation further heightened tension[53].

Taken together, while Sierra Leone has made strides in developing mining policies, the implementation of these policies faces significant challenges. Addressing issues such as weak institutional capacity, poor coordination, corruption, legal system inefficiencies, and community involvement is critical to ensuring the long-term sustainability of the mining sector and its ability to contribute to the country's development.

Conclusions

Despite the economic benefits of mining, its environmental impacts can be highly destructive. Mining operations contribute to biodiversity loss, depletion of soil nutrients, increased pollution, and the contamination of water bodies through the release of chemicals and mining waste. Additionally, mining often leads to deforestation, contributes to climate change, and disrupts local ecosystems. Socially, mining can have detrimental effects on communities, including increased school dropout rates, early marriages, prostitution, and the spread of infectious diseases. These social issues can erode the fabric of local communities, leading to long-term negative consequences for future generations. Economically, mining can disrupt local economies by clearing farmlands, destroying valuable economic trees, damaging protected

forests, and undermining traditional heritage sites. These activities not only diminish the resources available to local communities but also hinder the development of sustainable livelihoods.

Therefore, to mitigate these adverse impacts, it is crucial to develop and implement robust policies and regulations that guide mining operations. These policies must prioritize environmental protection, social well-being, and sustainable economic practices to ensure that mining contributes to long-term development without compromising the health of the ecosystem or the welfare of local communities.

Recommendation toward Sierra Leone mining policies

While this study provides valuable insights into Sierra Leone's mining policies, there are several areas that require further investigation to deepen understanding and inform future policy development. Future research should focus on:

1. **Longitudinal Health Studies**: Conduct long-term health studies to assess the sustained impact of mining-related pollutants on local communities. Tracking health outcomes over time, especially for vulnerable populations like children, the elderly, and pregnant women, will provide a more comprehensive understanding of how mining pollution affects public health. This research should also guide the development of mining policies that address both individual and environmental health concerns more effectively.
2. **Environmental Restoration and Reclamation Practices**: Examine the effectiveness of environmental restoration and land reclamation practices in post-mining areas. Research into best practices for rehabilitating degraded lands will offer valuable insights for future efforts in reclaiming mining-impacted environments. While policies and regulations exist, there is a need for stronger enforcement mechanisms to ensure compliance and successful implementation of these practices.
3. **Impact of Policy Changes on Regulatory Effectiveness**: Investigate how recent changes in mining policies have influenced the effectiveness of regulatory frameworks. Understanding how policy updates impact compliance, community satisfaction, and environmental outcomes will be critical for refining governance structures. This research can inform

strategies to improve the enforcement of mining regulations and enhance the overall effectiveness of policy.

4. **Capacity Building for Regulatory Agencies**: Government and development partners should invest in strengthening the capacity of regulatory bodies such as the National Minerals Agency (NMA) and the Environmental Protection Agency (EPA). This includes providing advanced technologies, enhancing staff expertise through capacity-building programs, and ensuring competitive compensation to attract skilled professionals. Empowering these agencies will ensure more efficient and diligent implementation of mining policies and regulations.

By addressing these areas, future research can help guide more sustainable mining practices, improve regulatory oversight, and promote better health and environmental outcomes for communities in Sierra Leone.

Conflict of Interest

The authors declare that there are no conflicts of interest related to this study. They affirm that they have no financial, personal, or professional relationships that could have influenced the conduct or reporting of this research. All decisions regarding study design, data collection, analysis, interpretation of results, and manuscript preparation were made independently and objectively, without any external influence or bias.

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