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Article

The role of auditing culture in sustainable mining practices: A review of Ghana's mining sector

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Abstract: The study looks at Ghana's mining industry's audit culture and green mining practices about their social responsibility to the communities where their mines are located. Results: According to this study, the economic motivations of mines and green mining are inversely related. Even large mining companies incur significant costs associated with their green mining initiatives because they require a different budget each year, which has an impact on their ability to maximize wealth. Conversely, mines with strong green mining initiatives enjoy positive public perception, and vice versa. Ghanaian mines do not have pre- or during-mining strategies; instead, they only have post-social and post-environmental methods. The best method for evaluating mines' environmental performance in the community in which they operate is, according to this study, social auditing. This is primarily influenced by the mine's audit culture, but it is also influenced by the auditor's compliance with audit processes, audit guidelines, and, ultimately, the audit firm's experience. The analysis confirms that Ghana's mine environmental performance is appallingly low since local audit firms are not used in favor of foreign auditors who lack experience or empathy for the problems encountered by these mining communities. Last but not least, corporate social responsibility (CSR) is connected to Ghana's development of green mining, either directly or indirectly. Whether the mine adopts a technocrat, absolutist, or relativist perspective on mining will determine this. The study discovered that, in contrast to the later approach, the first two views generate work in a mechanistic manner with little to no consideration for CSR.

Keywords: green mining; mining companies; audit firms; sustainability; Ghana

1. Introduction

Your eyes will notify you of the limitations of the road ahead if you are traveling down a straight, level stretch of a country roadway. The road finally disappears when the two edges eventually converge to a point. In a similar vein, you might think that the closest school bus is larger than the farthest away if you observe ten of them traveling in a line. You will perceive these things, but your brain will also tell you that neither view is true, based on logical reasoning and prior knowledge. The road will likely remain and the buses will remain the same (Dunn and Mitchell, 2016).

While mining activities will have a significant impact on some aspects of a nation, such as the immediate society in which they are conducted, the immediate natural environment, and all plant and animal species, those who live far from the mining community and, as a result, have different perspectives on mining activities will not experience these effects. This implies that the short-term effects of mining are not evenly distributed throughout the country. However, the long-term impact will be seen throughout the country as a result of adverse climate changes and the extinction of some animal and plant species. No doubt, humans worked out tens of thousands of

years ago that the way items look to us depends on where we place ourselves concerning those objects (Dunn and Mitchell, 2016). The demand for safe mining is a powerful and growing campaign in Ghana. Given the terrible effects of gold and other resource mining on the environment and livelihoods, as a patriot, you have no alternative but to join the movement for Ghana's liberation from these destructive activities. Mining has occurred for a long time in all mineral-rich countries. Mining activities in Ghana are becoming more complex over time. As a living testimonial, I have witnessed the evolution of the search for minerals. It all began with a simple search for gold whenever there was heavy rain. This is because rain wipes away the earth's surface, leaving the majority of minerals like gold and diamonds naked on the ground. This was the simplest approach to collecting such materials. As time progressed, the demand for more gold and diamonds increased, altering the face of simply looking for gold whenever there was heavy rain to manually excavating for gold. The second way of extracting gold harmed the environment and society, although not as much as the last and most advanced method of gold extraction. Foreign investors introduced this ever-advancing method of extracting gold and other minerals in Africa. Foreign investors seeking more gold and other minerals introduced more advanced machines, blasts, and so on. Foreign investors, in their quest to maximize their profits, have little or no regard for the environment or the lives of humans and animals. The first and second approaches were surface mining, which allowed the lands to be transformed back into agricultural usage. The most recent one involves deep underground excavating with bulldozers and excavators, supported by the use of information and communication technologies. This has resulted in higher damage to flora and the loss of several animal species in Ghana (Dwumfour et al., 2018). The most catastrophic aspect of modern gold mining practices is the devastation of water bodies that were formerly a source of drinking water and sustenance for Ghanaians. This is all due to the greed and financial goals of mining enterprises, which have replaced the traditional and historic method of gathering gold with Western materialism. Ghana is unquestionably a resource-rich country in West Africa, blessed with a variety of natural and mineral resources. It receives foreign investment from practically every developed country. Previous big investors included the United States of America, the United Kingdom, and the Netherlands. However, there appears to be a paradigm shift from Western to Eastern investors, with China and India dominating investment in Ghana and the majority of resource-rich African countries. China is currently Ghana's most important trading partner, providing a market for the country's natural resources. China's investment in Ghana is quickly rising, with the majority of projects involving natural resources, particularly minerals (Merem et al., 2021).

2. Literature review

2.1. Mining industry in Ghana

Green mining is a holistic approach to the mining industry that aims to provide a safe, efficient, and sustainable environment. Zhou et al. (2020) analyze the index system of green surface mining in China based on three attributes: Safety, efficiency, and the environment. Their findings show that the environment is the most important feature of green surface mining, followed by efficiency and safety. Their research

concluded that the top five green mining success indicators were the use of new technology, the starting-off rate of equipment, science and technology input to total investment, the number of accidents (decreased), and production (raised). Their study also shows that more improvements are needed to overcome water, air, waste, and sound pollution, as well as attention to land reclamation and post-mining land uses, both of which are important considerations in green mining. In examining the impact of green mining on the mining industry's operations, the use of new technology and capital/investment accessible to the mining industry are addressed. Capital/investment availability: enormous mining businesses have access to enormous amounts of capital to fund innovation and extensive research. There are numerous mining businesses in Ghana; however, not all of them are registered on the Ghana Stock Exchange Market. The use of new technology: The use of new technology in the mining industry has a significant impact on mining in Ghana. New technology has completely altered the face of mining in Ghana (Emmanuel et al., 2018).

AngloGold Ashanti is currently implementing several transformational technology-based solutions, such as autonomous drilling, real-time fatigue detection and monitoring, accident collision avoidance, vehicle condition monitoring, plant anomaly detection, robotic platform automation, and training bots. The increase in competitiveness of the mining sectors has an impact on their modernization in terms of the deployment of new advanced technologies. To be successful in this area, the mining business must examine cost reduction methods, before and post-production safety strategies, and product quality improvement. Green mining will not only introduce new technology, but it will also largely eliminate outdated mining technology. This will shift the mining technological horizon. The green mining strategies will create an atmosphere of knowledge and skill transformation in the mining industries as well as in the mining communities. This transformation embeds continuous learning and education in the mining industry. This will lead to a shift to technical qualifications from craftsman-like qualifications.

Lööw et al. (2019) study Mining 4.0—The Impact of New Technology from a Workplace Perspective and assert that responsibility, teamwork, and production flow comprehensive understandability become the new demand, an insight which can be obtained from process-dependent qualifications to process-independent qualifications. The previously known tacit knowledge of the workforce is transformed into theoretical knowledge, which is then digitalized and employed in computers and cell phones. In March 2005, the International Labor Organization (ILO) reported on Global Employment Trends for Women that, despite significant efforts to reduce the negative impact of mining activities on the environment and society, the death rate, injury rate, and illness rate among mine workers remain high. However, the study provides imperative insights as to whether green mining impacts health in Ghana. The most significant asset in the mining sector is the employees' assurance about their health in the mining working environment. Many studies have been undertaken on the health and safety of mining enterprises. The majority of these researchers focused primarily on health and safety without considering organizational risk. These organizational hazards include supervisory actions, changes in power structure, or changes in management structure, among other things. Komljenovic et al. (2017) conducted a study on organizational risks and focused on mine safety improvement in a complex

operational and business environment. They argue that to acquire a clear image of organizational performance level, careful consideration must be given to organizational elements in low-situation analysis, and in this case, every management method must be considered as a risk control mechanism or system. In this regard, green mining has the potential to address or resolve several health and safety concerns in the mining industry. This leads to a better and clearer understanding of how green mining affects health in Ghana. Green mining entails using all available avenues to ensure that the sacredness of the environment is maintained while also prioritizing human, plant, and animal lives in their day-to-day mining tactics. It entails the use of technology, afforestation, and the decrease of pollutants that are deposited in water bodies and soil, resulting in a significant reduction in agricultural production, and finally into the atmosphere, causing ozone depletion (Wang et al., 2020). The use of technology in the mining industry to pursue green mining in Ghana has had a mixed influence, ranging from beneficial to bad. In Ghana, various green mining activities are now underway.

2.2. The theory of corporate social responsibility

Mines cannot exist without any obligation to society. But what are the miners' duties to society and the environment in developing green mining in Ghana, given their economic interests? Many people define corporate social responsibility (CSR) as the execution of specific tasks and activities in a community by a business, just like any other person in society (Fatima et al., 2023). The majority of arguments have been given in favor of and against firms performing and failing to perform societal responsibilities as individuals in a society. However, companies' performance or non-performance of societal tasks carries some negative connotations. Being socially responsible (SR) exposes the organization to several obstacles. However, being socially responsible is up to the mining management and funders of the operation. The mining industry must be the most active participant in CSR among all industries. This industry destroys the ecosystem, both below and above ground. This damage affects not just the current generation but also the future generations. Mining activities have massive environmental, human, and animal costs, and their societal duty must be proportionate to the impact they have on people. An organizational environment encompasses a wide range of characteristics that influence ethical or immoral decisions within an organization (Kish-Gephartetal, 2010). Nonetheless, the ethical atmosphere influences a mining company's decision to be socially responsible rather than ethical culture (Gorsira et al., 2018). The mine members' ethical climate influences their decision to begin CSR in Ghana. The ethical climate in which the mine operates determines which interests should be prioritized and which ethical principles should be utilized to make such decisions. **Figure 1** depicts the dynamics of the ethical atmosphere in mining firms. By aligning mine objectives with CSR imperatives and building an ethical responsibility culture, mining companies in Ghana can negotiate the difficulties of green mining while satisfying their commitments to society and the environment.

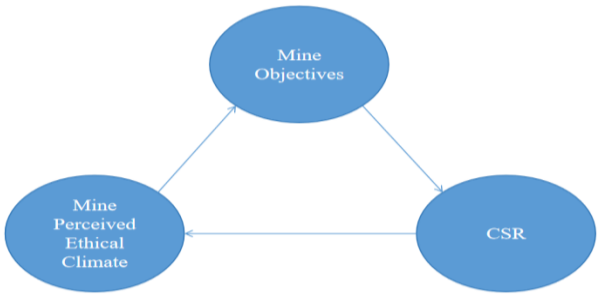

Figure 1. The ethical climate of the mining company.

When considering whether to take on social responsibility, a mining corporation may examine other ethical criteria. Egoistic reasoning maximizing (self-interest), benevolent reasoning maximizing (total interests), or the mechanistic method, principles style, may be relevant to their concerns (Gorsira et al., 2018). This type of ethical judgment benefits only the mining firm, with little regard for society. In contrast, in a benign context of ethical decision-making, mining firms make decisions that help others. This approach considers societal needs. However, the long-term campaign would also extend to the education the mine gives to the community on the impacts of its operations. Stemn (2019) studied the analysis of injuries in Ghanaian mining. However, the long-term strategy would also include mining and educating the community on the effects of its operations. Their focus was on what role education plays in mine-related accidents in Ghana. They conducted an injury study in the Ghanaian mining industry and identified priority areas for research. Their investigation included five Ghanaian mining enterprises. Industry sectors and research priorities. Their investigation included five Ghanaian mining enterprises. They discovered that over the last ten years, 202 individuals had been injured or killed at Ghana's five mines. Nakua et al. (2019) investigate the injury rate and risk variables among small-scale gold miners in Ghana, concluding that the mining incidence rate is 289 per 1000 employees. These accidents typically occur among underground workers. Small-scale miners are disproportionately affected by mining-related incidents. According to Nakua et al. (2019), this is primarily due to a lack of safety training and instruction for mining workers. Most mining businesses employ inexperienced and illiterate adolescents. According to Ahlerup et al. (2020), young adolescents working in mining had lower educational attainment than adults. Barnewold et al. (2020) investigate the identification of digital technologies and digitalization trends in the mining industry and discover that large-scale mining companies appear to select and apply digital technologies that are appropriate for their needs, whereas companies with lower production rates do not implement currently available digital technologies to the same extent. Small-scale mining enterprises may require additional digital transformation solutions that are suited to their skills and needs and appropriate for their scale of operations. Nonetheless, a negative potential could arise during the transition process. Early on, Bainbridge recognized issues with automating new operations. Tyuleneva (2020) explores the challenges and opportunities for regional mining industry digitalization. Their analysis highlighted the benefits of implementing digital technologies in the mining industry. The application of technology or digitalization of the mining process aids in improving the system of production failure

prediction, effective usage of resources and equipment, and monitoring the implementation of production plans. Through the use of institutional theory, Famiyeh et al. (2021) advance knowledge of sustainable solutions and provide insightful information about what makes a sustainable system—especially when considering developing nations such as Ghana.

2.3. Audit culture

In recent years auditing has gone beyond the traditional and primitive way of ensuring accountability in business organizations. Due to environmental concerns and the impact of mining on human lives and plant species, auditing has gone beyond business as usual. Many corporations incorporate into their financial statements how they are performing sustainably. Hilson and Murck (2000) affirm in Garrod and Chadwich (1996) asserted that the integration of audit, review, and monitoring practices with high environmental management tools helps manage environmental problems that occur in the mining industries. Traditionally, auditing serves as a technical tool that provides independent systematic assurance to providers of funds and other stakeholders through the evaluation of an organization's records, data, and operational and financial performance to ensure that both qualitative and quantitative characteristics of the organization's dealings are accurately met. For a successful and reliable auditing, the audit work must be carried out with consideration to both financial and non-financial performance data. This study, in dealing with audit culture in mining industries focused mainly on corporate governance rather than financials in ascertaining the linkage between audit culture and green mining. The question of whether audit culture in mining industries could lead to green mining is not solely the responsibility of only the mining industries but a coherent and combined effort of both the mining industry and the regulatory authorities in Ghana. The recent three-member committee on dynamite explosion in the Western Region (Applause) of Ghana has revealed the deficiencies in both the operation and the work of the mining industries as well as the mining regulatory bodies in Ghana. The three-member committee report was tendered before the parliament of Ghana even though not made available online for the public. The investigation was conducted following Mineral and Mining (Explosives) Regulations, 2012 (L.I. 2177). There were regulatory breaches on the part of Maxam Company on the manufacture, storage, and transportation of such explosives.

3. Methodology

The research employs two primary methodologies. These approaches serve as the foundation for this article, which educates future scholars on the use of theories in mining sectors in the pursuit of alignment and adherence to green mining in Ghana. The theoretical framework of this study is heavily based on Peter Drucker's principles of scientific management. Drucker emphasized the importance of proper execution to achieve effective management. In the context of this research, Drucker's theories provide insights into the importance of aligning mining practices with ethical considerations and societal needs rather than solely focusing on profitability and wealth maximization. Drucker's ideas serve as a lens through which to analyze the

management practices and decision-making processes within Ghana's mining sector. The empirical component of this research entails a thorough examination of mining operations and auditing culture in Ghana's mining industry. This empirical study uses data from reliable sources, such as government reports and publications from Ghanaian mining agencies. These sources provide valuable insights into industry practices, regulatory compliance, and environmental impacts.

4. Results and findings

4.1. An overview of green mining in Ghana

4.1.1. The effect of green mining on the mining industry in Ghana

This analysis distinguishes between Ghana Stock Exchange listed (GSE-listed) and non-listed mining businesses. As previously stated, the only way for a mining firm to increase its use of technology or implement new technology in its operations is through the availability of investment. This study reveals that large mining corporations have greater access to investment and therefore use modern technologies in their operations. This study focuses on four of Ghana's biggest mining corporations.

Reviewing Ghana's mining business requires examining its issues and potential, notably in sustainable practices and auditing culture. **Table 1** shows the main mining companies and their capital investments, but a deeper look is needed to appreciate the complexity. Ghana's mining sector's sustainable mining practices depend on auditing culture. Current discourse lacks a rigorous study of how auditing techniques affect environmental and social sustainability. Identifying and analyzing the obstacles to auditing culture's sustainability promotion is necessary to close this gap. Advanced technology may improve mining productivity, but it also increases cybersecurity risks. These threats must be addressed in the auditing culture to protect sensitive data and operational integrity. Implementation of staff skills determines auditing success. Workers with low skills may hinder audits and sustainability initiatives. Investment in training and capacity development is crucial. Inadequate infrastructure and inconsistent internet access hinder audits. Audits may fail without dependable communication networks, resulting in monitoring and compliance gaps. Emphasizing auditing culture's role in tackling these issues helps relate them to sustainable mining. Auditing ensures accountability, transparency, and continual development, promoting environmental and social responsibility. The debate of Ghana's mining industry gives useful insights into its operational environment, but auditing culture's essential role in sustainability needs further attention. Stakeholders can harmonize sustainable mining in Ghana by recognizing and resolving particular concerns and stressing audits.

Table 1. Four (4) top mining companies in Ghana.

Mining company	Continent	Operations	Stated capital
AngloGold Ashanti	Africa, America, Australia	12	US $3,364,000,000
Asante Gold Corporation	Africa-Ghana	6	C $20,366,275
Newmont Ghana	Africa, Australia, North America, and South America	14	$18,248,000
Golden Star Resources	Africa-Ghana	1	US $520,320,000

Source: Ghana Stock Exchange-GSE.

4.1.2. Employment situation in Ghana

Employment is a major issue in many African countries, including Ghana. Ghana's mining sectors play a critical role in releasing the majority of the Ghanaian population from the country's cripplingly high unemployment rate. Nonetheless, most African countries have seen a significant reduction in unemployment as a result of mining. The question is, how does the advent of green mining affect employment in Ghana? Green mining in the mining industry contains numerous aspects that originate from the introduction of new technology, digitization of previously manual mining systems, knowledge, skills, and technical education. In many job sectors, the introduction of new advanced technology results in job losses for employees. This situation is greatly anticipated in the mining industry. However, a closer look at the impact of green mining in Ghana on employment will either confirm or deny this fact. Green mining, which tries to use all available resources to reduce the disastrous impact of mining activities on the environment and people's lives, may enhance employment on one continuum while creating unemployment on another. The two primary continuums are as follows:

Going green implies putting an end to all unlawful mining and other mining activities that hurt people's lives and the environment. In effect, virtual mining uses technology to replace the current manual mining method, reducing or eliminating mining's harmful impact on the environment and lives. Green mining initiatives, which involve the use of innovative technology, will necessitate the involvement of professionals. As a result, some mine workers will lose their jobs. The greater damage would fall on the Ghanaian people who rely on Galamsey, as green mining is a concerted effort by the government, mining industries, mining authorities, communities, and media. Many Ghanaians, as well as foreigners, engage in illegal mining activities. These folks will lose their jobs once green mining efforts are adopted. The reduction of illegal mining activities in Ghana, which results in job losses, is less important than maintaining the environment for human existence and future generations. The fight against illicit mining is to protect the survival of human, plant, and animal species. Nonetheless, this technique will help to protect our water bodies while also restoring the deteriorated ecology and water bodies. The other continuum will result in more experts gaining or being employed to use the new technology. Community members might serve as the primary monitoring tools for ensuring the success of becoming green in mining towns. These community members are tasked with producing monthly reports on the sites entrusted to their care. This creates jobs in the community and ensures the viability of green mining efforts. The topic of whether green mining affects employment in Ghana could be answered by looking at the mining company's ownership in Ghana (**Table 2**). There are approximately twelve main mining enterprises in Ghana. Of these twelve significant mining businesses, only two are owned and operated by Ghanaians. This assumes that illegal mining is actively promoted by Ghanaian residents. If these unlawful mining ventures are not directed by indigenes, they act as vehicles for foreign nationals to engage in illegal mining in Ghana. The following are Ghana's largest mining companies:

Table 2. List of major mining companies and their ownership structure in Ghana.

Name	Ownership of Mine	Location in Ghana
Adamus Resources Ltd	Adamus Resources (Australia)	Nkroful
AngloGold Ashanti Iduaprem Mine	AngloGold Ashanti (South Africa/Ghana)	Tarkwa
AngloGold Shanti Ltd	AngloGold Ashanti Ltd (South Africa/ Ghana)	Obuasi
Central African Gold Ltd	Central African Gold Plc (UK)	Bibiani
Chirano Gold Mines Ltd	Redback Mining now Kinross (Canada)	Bibiani
Gold Fields Ghana Ltd	Gold Fields (South Africa), IAM Gold (Canada)	Damang
Gold Fields Ghana Ltd	Gold Fields (South Africa), IAM Gold (Canada)	Tarkwa
Golden Star Prestea/Bogoso	Golden Star Resources (USA)	Bogoso
Golden Star Wassa	Golden Star Resources (USA)	Akyempim/Benso
Keegan Resources Ghana Ltd	Keegan Resources Inc. (Canada)	Esaase/Asumura
Newmont Ghana Gold Ltd	Newmont Mining Corp. (USA)	Kenyasi
Perseus Mining Ghana Ltd	Perseus Resources (Australia)	Ayanfuri

Source: Extracted from Ghana Chamber of Mines (2010).

4.1.3. Health

Ghana's mining industry contributes significantly to the country's economic prosperity. This sector contributes significantly to Ghana's Gross Domestic Product (GDP). It is without a doubt one of Ghana's largest employers. Mining has an effect practically everywhere in Ghana. However, Ghana's mining industry has had setbacks, which is causing concern. Mining industries, despite their significant contributions to Ghana's diverse economic engines, have certain negative consequences. They cause a variety of socioeconomic problems, including the elimination of water sources, flora, animal life, and even human lives. The industry also causes health-related illnesses and diseases in both the workers and the communities in which it operates. The Government sponsors an annual national tree-planting day. The primary purpose of the Green Ghana program is to revive the deteriorated environment to ensure the survival of plant and animal species, as well as the health and safety of human life. The goal for 2022 was to plant 20 million trees in Ghana. The use of technology has also contributed to a reduction in safety and health concerns in Ghana. Mining 4.0 allows Ghana's mining industry to work virtually. Manual mining is almost dead. The majority of Ghanaian mining businesses are automating and computerizing their entire mining operations. The use of technology and automation in mining activities helps to ensure miners' safety and health. Most mining companies in Ghana require workers to wear sensor clothing that allows them to detect imminent threats such as exposure to dangerous or toxic chemicals and gases, as well as the exact timing of explosions. The mining industry uses technology to mimic the entire mining process to predict potential difficulties (health and safety issues), as well as mine efficiency and production.

Green mining may also be known as mobile mining. In the past, the mining sector faced major health and safety issues. The health and safety issues arose as a result of challenges in conveying information from employees to management and vice versa. Communication is critical in underground mining since even a minor delay in relaying information can have fatal consequences. The accident will have an impact not only

on lives but also on the mining company's profitability. However, with the advancement of technology in mining data and production simulation, employee-employer communication flows smoothly, decreasing mining health and safety concerns. Managers use geo-fencing to configure miners' or employees' mobile devices, allowing managers to give them alerts when they approach unsafe regions. Previously, lithium mining firms avoided this kind of mining because lithium destroys subsurface water and harms the ecosystem for agricultural purposes. In the southern United States, lithium mining businesses are gradually implementing a new approach known as lithium brine extraction, mobile lithium extraction processes, and selective absorption technology to lessen lithium's impact on the environment and water bodies. The mining industry's futuristic vision is that it must not just be concerned about the health and safety of its workers but also seek creative ways to reduce its environmental, community, and ecological footprints.

4.1.4. Politics and governance

Politics and governance have a significant impact on Ghana's mining industry. Various administrations have deferred rules and regulations governing mining activities in Ghana. The intensity of both legal and criminal mining activities grows year after year and progresses through several stages in the mining industry. In Ghana, policymakers establish a space for both legal and criminal mining activity. Most politicians in Ghana are perpetrators of illicit mining. In Ghana, some people are directly involved in illegal mining. Politics and governance perspectives on mineral extraction in Ghana in recent decades do not correlate with or are not directly relevant to the sustainability agenda for mineral mining in Ghana because politicians and political affiliates make their investments with the knowledge that such investment projects will only work temporarily as long as it is economically viable to exploit wealth from the mines. The politics and governance mechanisms governing mining activities in Ghana are little more than a scarecrow in a rice farm, designed to scare the cowardly and uncourageous. Politicians and administrations in Ghana tend to be unaware of the serious consequences of mining activities on the lives of Ghanaians. They appear to develop camouflage policies, and the majority of them do not conform to the rules and regulations governing mining in Ghana. There are two sorts of wealthy people in Ghana. They are politicians and one-person churches. Politicians accumulate fortunes and send their children to foreign nations for a better existence in a well-preserved environment. Their motivations are unitary rather than absolutist, but they want power in absolutism. They propose policies and processes that will benefit the entire country. These are forms of politics. Although successive governments have discussed the subject of environmental conservation in Ghana, their efforts, regulations, and processes have all been focused on the activities of the Environmental Protection Agency, the Ghana Chamber of Mines, and other organizations. These institutions are insufficient since their operations are concentrated in offices and urban areas rather than the direct communities affected by mining activity in Ghana. The argument for mining has been raised in favor of the economic benefit it provides to the country rather than the preservation of life and the environment for future generations. Dependence on these institutions would imply that the government has completely failed to address the issue of mining in Ghana. The regulations governing

environmental management and the management of mining's environmental impact vary by country. Adopting another country's environmental regulations may not be fully effective in that country. While most countries in Europe and certain parts of America have mature environmental regulation systems, some countries in South America, Africa, and Asia are still in the early stages of developing their own. Ghana has never felt a more proactive government approach to maintaining sustainability than that outlined by President Akuffo Addo. However, there are still some dubious and wealthy politicians whose responsibility is not to Ghana's inhabitants but to themselves and their families. These individuals hamper the government's ability to implement its vision of Green Ghana and combat unlawful and hazardous mining activities. Nonetheless, certain unpatriotic Ghanaians lead and encourage methods of engaging in illicit mining with foreign nationals for personal gain. A more recommended proactive management technique is for the government to hire community members who will function as environmental watchdogs while keeping their identities disguised. This is a more proactive management strategy that addresses the environmental effects of mining at the source.

4.1.5. Society

There is no doubt that green mining and society may have a good correlation. Green mining is a shared mindset among society and mining corporations. The most powerful campaigner in the green mining campaign is society. Whether the license is legitimate or illegal, the society or community that surrounds the mine plays an important part in its success. The immediate society's acceptance or disapproval has an impact on the mining corporation. Similarly, mine has both a harmful and positive impact on the society in which it works. However, in Ghana, the situation differs. Most mining villages in Ghana engage in a 'give and take' transaction with the mine, which is strongly reinforced by high and respected figures in society. They are less concerned about the long-term effects of the mine's harmful influence on the local community. In other countries, society determines the rules and regulations of the game for mining countries. In Ghana, mining firms make use of unscrupulous community leaders as well as poverty levels to exploit unsuspecting social members. The mining firms hire many Ghanaians with low skills and education to influence them and pay them a lower rate, a situation similar to that of Ghana's private workers. The graphs in **Figure 2** depicts the salary of Ghanaian mining workers, and **Figure 3** depict the salary of American mining workers.

Figure 2. Average wage for mining workers in Ghana.

Source: salaryexplorer.com.

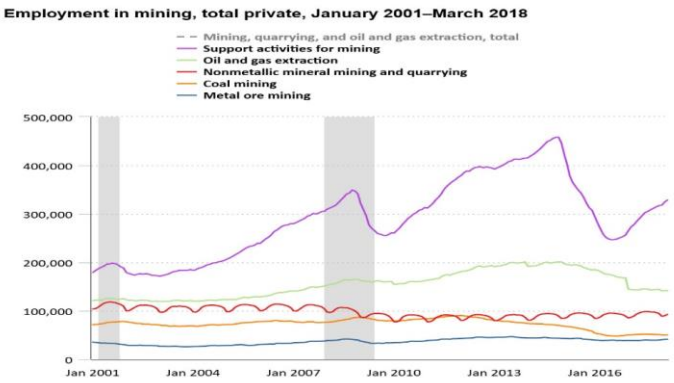

Figure 3. Average wage of mining worker in the United States of America.

There appears to be a significant gap between the wages provided to mining workers in Ghana and those in the United States. Some may claim that comparing mine worker wages in Ghana to those in the United States is dishonest. However, the sort of work performed in mines in the United States is identical to that done in mines in Ghana. When seen in absolute terms, the salary trend in the United States resembles that of Ghana. If Ghanaian mining workers were better off with Ghs10,600 five years ago, they would be far worse off now that the cost of living in Ghana is rising due to the country's rising dollar exchange rate. Assume a Ghs5 (10600/5 = $2120) dollar rate five years ago; mine workers in Ghana are worse off now since the dollar rate in Ghana is around Ghs14 (10600/14 = $760). The wage provided to Ghana's mining workers has been reduced by 64%. In this study, three of these factors may characterize a resilient society dealing with the impact of mining firms. To reduce or eliminate the negative impact of mining, Ghanaian societies must ensure that stricter checks on the equipment and technology used by mining companies in their mines are conducted before they give their approval to operate. This could be accomplished by developing societal groups whose mission and goal are to audit the equipment and technologies used in these mines to avoid low-tech and inefficient equipment that hurts the environment and the lives of Ghana's mining communities. In addition to those provided by the government and its commissions, mining societies must have their own rules and norms of engagement for mining corporations to follow. Mining societies must also conduct pre- and post-operator competency checks on these mines to guarantee that they do not operate in whatever way they desire. This will ensure that they employ skilled miners.

Inadequate education:

Mining corporations in Ghana are more interested in attracting top officials than in improving their business image in the communities where they operate. The preliminary phase of mining begins with consultations with communities, government officials, other companies, and numerous stakeholders. It is a negotiation to determine the costs and benefits of pursuing such a business in the community. In this sense, management techniques must be set out for consideration by all participants. Profits and losses are explored. At this time, predicting community requirements is challenging because they are directly proportional to the influence of society. For example, during the first stage of negotiations, the society or community would be There is a strong interest in good schools, roads, water, and royalty payments.

However, as the mine proceeds, civilization will face a completely unexpected outcome. This would spark a separate campaign to address additional requirements, such as the construction of new hospitals and the reimbursement of hospital costs for people whose health is harmed as a result of the mine.

Human behaviour:

The mining industry has the highest rate of occupational accidents and fatalities. This industry is regarded as the riskiest in Ghana. There is a call for effective occupational health and safety management to protect lives in this industry (Gyekye, 2003). Causal attributions of Ghanaian industrial workers for the occurrence of a devastating mining accident in Ghana in a small town 300 km from Accra, Ghana's capital city. This severe tragedy claimed the lives of 17 miners and 500 non-miners. On January 20th, there was an injury in the blink of an eye (**Figure 4**). As previously noted, the mining company's recklessness in shipping extremely dangerous dynamites was a significant contributing factor to this disaster. According to the after-accident audit report, the transporter of this highly explosive chemical was an amateur with no or little knowledge of what they were transporting and thus could not provide a better warning to community members about the nature of what was about to happen after the vehicle collided with a motorcycle. The majority of these mining communities have had no or little education on the dangers of mining activities and what these deadly weapons could accomplish. The occurrence may potentially have influenced human behavior. The neighborhood was more sympathetic and naiver to the catastrophe than evacuating to preserve lives. Above all, these people have no understanding of these dangerous substances, and no education has been provided to them by the mining firms operating in the town.

Figure 4. The explosion center of 20th January Appiate incident.
Source: Theafricareport.com.

Mining-related accidents are common throughout Africa, and Ghana is no exception. An examination of injuries in the Ghanaian mining industry and priority areas for research indicates that Ghana remains the leading country despite its efforts to enhance safety performance. Compared to the United States and Australia, Ghana had a higher fatality rate (0.071, 0.057, and 0.028, respectively), as indicated in **Figure 5**.

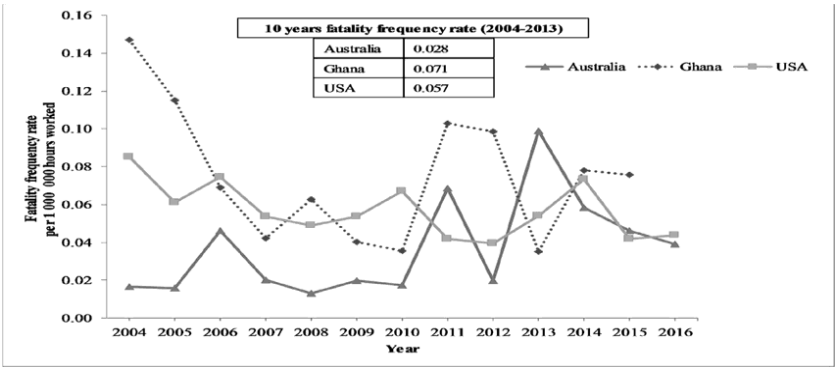

Figure 5. A comparison of mining-related incidents between Ghana, the USA, and Australia (Stemn, 2019).

4.1.6. Bridging the gap between mining events and corporate social responsibility in Ghana

Humans are fundamental to management. It entails the problem of developing skilled individuals for collaborative performance while ensuring that their strengths are effective and efficient, rendering their flaws inconsequential. This is every organization's primary mandate, and that is precisely why management is such an important determining factor. Nowadays, practically everyone works for a controlled organization, whether it is small or large, a commercial or non-business enterprise. Practically, everyone relies on management for their livelihood. As a result, one of the most basic challenges that managers in developing nations confront is locating and identifying components of their tradition, history, and culture that may be employed as management building blocks. This, however, explains the disparities in companies' economic success. Ghanaian mining businesses must recognize that management processes must prioritize human lives, a process that integrates people into mining company management and decision-making. The mining companies must also pay close attention to the culture of the communities in which they operate in Ghana. Every company enterprise is devoted to sharing ideas and achieving common goals when carrying out its activities. A mob may form if businesses do not commit to these elements. Mining firms in Ghana must have straightforward yet encompassing goals. Mining firms in Ghana must have a mission that is both clear and broad enough to meet the needs of the communities in which they operate. Mine management's initial responsibility is to consider, set, and deliver management based on objectives, values, and goals. Management must also allow the community, employees, and all community members to participate in the affairs of the mining sector and grow as demands and possibilities change. All mining industries in Ghana must provide a learning and teaching environment. Mines in Ghana must provide regular seminars, training, and education for community members at all levels, as well as non-stop training and development. There are people with a wide range of talents and expertise who can do a variety of jobs. Ensuring that the right people are doing the right jobs prevents or lowers workplace accidents. Information communication is extremely important in the mining industry. Mines must ensure that information flows freely across the working environment. Every employee and employer in the mine must consider what they want to achieve and ensure that their employees are aware of and

comprehend those goals. This type of first-hand information assists employees and employers in avoiding mine-related accidents and injuries. Measuring management performance using profitability and production bottom lines is insufficient for assessing management performance in mines. Mine management performance is better judged in terms of employee development, market share, innovation, productivity quality, and financial returns. All of these factors contribute to a mine's performance and survival. Mines may require measurement variables in a range of areas particular to their goal; nevertheless, much as humans require a variety of measures to understand their health condition and performance, mines require a variety of metrics to evaluate their health and performance. Health performance evaluation must be included in the mine's long- and short-term plans, and management must be evaluated and appraised on these metrics as well. Finally, mining firms in Ghana and around the world must grasp that the greatest method to measure success is through customer satisfaction. Deducing from t implies that the results exist only on the outside, not inside the mine. It is critical to conduct regular surveys of the communities in which mining corporations operate to determine how satisfied the community is with the mine's activities. Any firm that focuses on its internal success is more likely to fail if it does not prioritize customer happiness.

4.1.7. The role of stakeholder engagement in the context of green mining in Ghana

In Ghana, stakeholder engagement is crucial to the green mining industry because it encourages cooperation, openness, and responsibility among the several stakeholders engaged in the mining process. Here are some ways that including stakeholders in decision-making procedures can support sustainable practices and help green mining programs succeed:

- Community Involvement: By interacting with the local communities impacted by mining activities, mining corporations can get insight into their needs, goals, and concerns. Green mining projects can be customized by mining firms to meet local environmental and social concerns by actively including community people in decision-making processes. This strategy encourages openness and fosters mutual respect and trust between communities and mining firms, which results in more sustainable operations.
- Environmental Conservation: Through stakeholder engagement, mining corporations can obtain important information about environmental conservation strategies from government agencies, non-governmental organizations, and environmental groups. Mining corporations can reduce environmental degradation by working with stakeholders to create and implement solutions like habitat restoration projects, reforestation programs, and water conservation activities. Green mining efforts are guaranteed to be in line with the best environmental standards and legal requirements when environmental stakeholders are included in decision-making processes.
- Regulatory compliance: Ensuring compliance with environmental laws and regulations is achieved by involving government agencies and regulatory bodies in the creation of green mining initiatives. Mining businesses can have a better understanding of legislative requirements and regulations about pollution control,

waste management, and environmental protection by consulting with these stakeholders. By reducing the possibility of fines or penalties and preventing disagreements with regulatory bodies, this cooperative strategy helps ensure the long-term viability of mining operations.

- Technical expertise: Mining businesses can obtain technical expertise from academic institutions, research centers, and industry associations by engaging with stakeholders. Mining businesses can use the expertise of specialists in environmental science, engineering, and sustainability to develop and apply green mining technologies and practices. Working together with technical stakeholders also makes it easier for the mining sector to share information and develop capacity, which promotes ongoing improvements in resource efficiency and environmental performance.
- Risk management: Mining businesses can identify and reduce potential risks related to green mining efforts by involving stakeholders in decision-making processes. Mining corporations can evaluate the social, environmental, and economic risks associated with their activities and create proactive measures to mitigate them by requesting feedback from relevant stakeholders. By reducing negative effects on nearby populations, ecosystems, and livelihoods, this risk-informed strategy improves the overall resilience and sustainability of mining projects.

4.1.8. The importance of conducting thorough environmental impact assessments in the mining industry

Environmental impact assessments (EIAs) are needed by the mining sector to understand, quantify, and mitigate environmental risks. These reasons demonstrate the importance of complete EIAs and their ability to mitigate impacts on neighboring ecosystems and communities:

Environmental Impact Assessments (EIAs) help mining companies and government agencies identify potential environmental impacts of their activities. Soil erosion, air pollution, water quality, habitat degradation, and biodiversity loss are evaluated in EIAs to reveal the complex linkages between mining and the environment. This knowledge is needed to make informed project design, site selection, and mitigation decisions to protect adjacent ecosystems and communities.

Identifying vulnerable areas: EIAs identify areas vulnerable to mining activities and particularly vulnerable to their consequences. These include wetlands, forests, biodiversity hotspots, and endangered species habitats. Mapping and delineating environmentally relevant regions may help mining companies prevent irreparable damage to local ecosystems and wildlife.

EIAs evaluate the impact of many mining projects and other development activities in a region. EIAs consider the combined impacts of many stressors on the environment, such as habitat fragmentation, pollution, and land use changes, to identify synergistic or cumulative effects that may worsen environmental deterioration. This comprehensive technique helps mine planners and managers prevent or reduce cumulative impacts on neighboring ecosystems and populations.

Stakeholder engagement: EIAs enable public and stakeholder participation in decision-making. EIAs ensure that local people, indigenous groups, environmental

organizations, and other stakeholders' concerns, perspectives, and traditional knowledge are included. This participatory strategy fosters environmentally and socially responsible mining by fostering transparency, trust, and collaboration between mining businesses, government authorities, and affected communities.

Implementing mitigation measures: EIAs provide effective management and mitigation strategies to minimize environmental impact from mining operations. Manage erosion, recover and restore damaged areas, execute water management plans, avoid pollution, and conserve biodiversity. Implementing these mitigation methods into project planning and design may help mining companies reduce their environmental impact on adjacent ecosystems, water resources, and air quality.

4.2. Audit culture

4.2.1. The impact of audit culture on gold mining in Ghana

Both internal and external audit activities served as technical tools for ensuring compliance and adherence to rules and regulations. In most situations, they function as a tool for wealth generation as well as a technical instrument that ensures strong reliance on shareholders and the community in which the mining business operates. The impact has an effect on living organisms beneath and on the earth's surface, as well as those in the air. **Table 3** shows the top five mining corporations in Ghana, which are Gold Fields Tarkwa Mine, Newmont-Akyem Mine, Newmont-Ahafo Mine, Adamus Resources, and Anglo Ashanti Limited. The auditors and top executives of each company are identified, demonstrating a prevalence of foreign ownership and audit firms among these important participants in Ghana's mining sector.

Table 3. Top 5 mining companies in Ghana and their respective auditors.

Mining company	Audit firm	President/vice
Gold Fields Tarkwa Mine	-	Michiel Van Der Merwe (non-Ghanaian) 90% foreign-owned
Newmont-Akyem Mine	Rogers and Company PLLC	Tom Palmer (completely foreign-owned)
Newmont-Ahafo Mine	Rogers and Company PLLC	Tom Palmer (completely foreign-owned)
Adamus Resources	-	Mr. Mark Connelly
Anglo Ashanti Limited	Ernst and Young Inc.	Alberto Caderon (non-citizen)

Unfortunately, the majority of Ghana's active mining enterprises do not make their accounts accessible online. It makes it extremely difficult to determine the genuine picture of mining activities in Ghana. This endeavor to conceal critical information from public consumption explains their extremely low environmental performance. The idea that auditing gives assurance to economic investors may be incorrect if auditing is used to ensure that mining companies perform effectively in terms of environmental impact. Most mining corporations include an environmental performance report as part of their annual report. However, there appeared to be a significant gap between what they sold on the market and how they operated on the inside. Most mining corporations aim to create a positive image of their environmental performance on the outside but behave differently on the inside. This situation is referred to as organizational reality. Mining environmental performance audits could be used to assess how well these companies have done in terms of environmental

impact. When conducting an environmental performance audit in the mining industry, auditors must pay close attention to environmental variables such as air and water pollution, waste and environmental management systems, and biodiversity. Amidst all of these characteristics, there may still be some difficulties in selecting and deciding the scope of the audit. There is a rising need for guidance for auditors when selecting and designing audits on mining environmental consequences. The guide provides a clearer understanding of the ownership structure, scope, and exploratory mining access right through to mining, processing, and waste disposal, as well as mining regulatory laws in the host country, conventions, protocols, standards, treaties, codes, and related mining environmental recommendations. This demonstrates that traditional auditing must consider not just the economic dimension of shareholders but also the social and environmental aspects. There appeared to be a bigger disparity between mining environmental performance audits and traditional audits. This is due to the higher cost of satisfying societal and environmental requirements. The audit must be structured to consider both the environmental impact of mining and the host government's reaction. Understanding the environmental concerns and solutions of the host government is important for the audit of mining environmental performance (MEV). The study modifies Porter's five forces model (**Figure 6**) to help auditors better understand the many pressures that must be considered when planning an audit of environmental performance in mining companies.

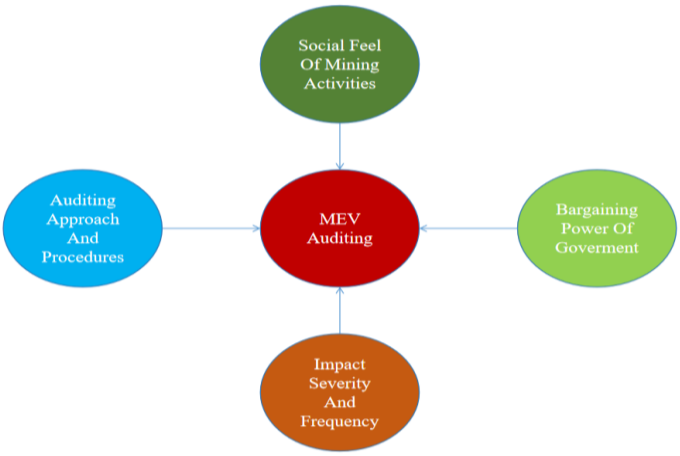

Figure 6. Mining environmental performance audit forces (Porter's 5 forces).

The influence of mining activities is felt strongly by the community in which the mining firm operates. This can take many forms, including air and environmental pollution, social vices, waste management systems, and so on. The uproar in society will increase the government's bargaining leverage to strengthen or create new legislation governing mining activities. This will be determined in part by the severity of the impact, which will change the auditor's auditing plan, techniques, and procedures.

4.2.2. Audit culture variables that lead to green mining in Ghana

- Open channel communication: The greatest issue in corporate governance is the level of stakeholder involvement in company affairs, as well as communication between stakeholders, management, employees, and other shareholders. It was

determined that stakeholder engagement through social auditing aids in identifying commitment, building confidence, and promoting cooperation between stakeholders and corporations. Engaging a professional audit team to determine the extent of stakeholder involvement in the mine's business will help market the mining company to outsiders. Some of these stakeholders could better describe the impact of mining on their community and provide solutions.

- Cross-sector collaboration: The whole mining activity is a network. This means that one sector depends on the other sector to function successfully. There must be strong coordination among the various mining functions. This must be developed about motivational determinants: necessity, mining resource dependency, efficiency, innovation opportunities, improved relations among stakeholders, reputation and mining publicity, and engagement of mining employees.
- Accident-cost analysis is the first concept introduced in this book to illustrate how auditing might lead to green mining in the mining industry. The study devises this novel technique to demonstrate the importance of preventing accidents rather than waiting for them to happen and suffering clean-up costs. This article proposes that the audit procedure be focused on the mine's plan for preventing accidents and injuries.
- Recruitment Quality: To achieve green mining in Ghana, the auditing procedure must ensure that strict standards are followed. Qualified staff must be employed, and inexperienced employees must be trained by experienced workers.
- Creating awareness among Ghana's gold mining businesses about the importance of ecological and socially responsible mining practices. Given the multiple difficulties raised in this study, it is critical to erase the harmful effects of mining in Ghana. Mines must prioritize stakeholder and environmental responsiveness while dealing with legal and ethical challenges. To create green mining, mines must also educate the general public and their employees on current mining industry trends. Local auditors may be knowledgeable about mining in Ghana and have a direct impact on mining in Ghana. This would enable them to establish better audit methods for assessing the mine's environmental performance.

4.2.3. Internal and external audits' role in the mitigation of negative environmental impacts

Internal and external audits play a critical role in identifying and addressing negative environmental impacts associated with mining operations. Through comprehensive environmental risk assessments, auditors evaluate the potential environmental hazards and risks posed by mining activities, such as land degradation, water contamination, and habitat destruction. They assess the effectiveness of mitigation measures implemented by the company to minimize these impacts, such as revegetation programs, water treatment facilities, and community engagement initiatives. Auditors also review the company's emergency response plans and contingency measures to ensure preparedness for environmental emergencies, such as chemical spills or natural disasters. Internal and external audits serve as essential mechanisms for ensuring environmental compliance, promoting best practices, and mitigating negative environmental impacts in the gold mining industry in Ghana. By

conducting thorough assessments of mining operations and providing actionable recommendations for improvement, audits contribute to the sustainable management of natural resources and the protection of local ecosystems and communities.

4.3. Case studies

AngloGold Ashanti's technological advancements:

One of Ghana's top mining firms, AngloGold Ashanti, has made large expenditures in technical developments to boost productivity and lessen its negative effects on the environment. To improve productivity and safety in their operations, for example, they have added sensor-equipped machinery and automated drilling systems. This case study demonstrates how industry-wide technological innovation can be stimulated by green mining programs.

Community engagement at Newmont Ghana:

Newmont Ghana has taken an active role in addressing environmental issues and promoting sustainable mining methods in the local communities. Newmont has proven its commitment to social responsibility through stakeholder consultations and community development initiatives. This case study emphasizes how crucial open communication and cross-sector collaboration are to the advancement of green mining.

Environmental performance audit at gold fields Tarkwa mine:

The Gold Fields Tarkwa Mine's environmental performance audit identified opportunities for waste management and pollution control improvement. The mine was able to lessen its environmental impact by putting the audit's suggestions into practice, like upgrading monitoring systems and applying cleaner technology. This case study shows how an audit culture can result in observable enhancements to green mining projects.

Training and development at Adamu's resources:

To guarantee adherence to environmental rules and encourage sustainable mining operations, Adamus Resources has placed a high priority on personnel training and development. Through its investment in safety training and skill development initiatives, Adamus has encouraged a culture of environmental care among its employees. The aforementioned case study underscores the significance of hiring qualified candidates and educating mining staff about ecological responsibility.

5. Conclusion

This research investigated the advantages and challenges that Ghana's mining sector experiences due to the implementation of environmentally friendly mining practices and the adoption of an audit culture. Mining activities in Ghana have a significant and escalating influence on both the environment and the population. Ghanaian mining activities now use a mix of advanced and basic technology, necessitating a well-rounded approach to mitigate environmental harm. In 2016, the Ghanaian government initiated the Green Ghana initiative as a response to these concerns. The program's objective is to counteract the detrimental impacts of mining by the yearly planting of a minimum of 1,000,000 new trees. However, addressing the social and environmental problems caused by mining requires a multifaceted approach.

- Recommendations for policymakers

- Improve and enforce environmental regulations to ensure mining businesses follow best practices.
- Encourage stakeholder engagement: Collaborate with government agencies, mining businesses, and local communities to develop sustainable mining policies that emphasize community well-being and address environmental concerns.
- Invest in monitoring and enforcement: Fund mechanisms to ensure mining activities comply with environmental regulations and minimize negative impacts.
- Promote green technology: Provide financial incentives and tax breaks to mining companies to invest in eco-friendly practices and technology that promote sustainability and reduce environmental deterioration.
- Support research and development: Fund research on innovative ecologically friendly mining practices, including waste management, pollution reduction, and ecosystem restoration.

- Recommendations for industry stakeholders
  - Implement Environmental Management Systems: Establish robust systems inside mining operations to monitor and minimize environmental effects throughout the mining lifecycle.
  - Prioritize Community Engagement: Engage with local communities to understand their concerns and include their input in decision-making to foster trust and collaboration.
  - Invest in Employee Education: Promote environmental stewardship by teaching mining personnel about sustainable processes, safety procedures, and best practices.
  - Adopt Cleaner Production Techniques: Reduce waste, resource consumption, and environmental pollution in mining operations by using cleaner production methods and technologies.
  - Promote Transparency and Accountability: Ensure stakeholders have access to accurate environmental performance and regulatory compliance information via transparent reporting and accountability frameworks.
- Recommendations for local communities
  - Environmental Protection: Strengthen legislation and supervision to protect adjacent ecosystems, water sources, and livelihoods from mining activities.
  - Engage in decision-making sessions: Speak out, provide ideas, and advocate for sustainable mining processes that prioritize community needs during consultations with mining businesses and government agencies.
  - Monitor Environmental Effects: Hold mining firms accountable by monitoring environmental impacts via community-based initiatives, citizen science projects, and collaboration with environmental groups.
  - Explore economic diversification: Reduce dependence on extractive industries and promote long-term prosperity by exploring alternatives to mining.
  - Build Local Environmental Advocacy Capacity: Empower residents to protect their rights and interests against mining-related challenges via

community organization and advocacy.

To ensure the long-term health and prosperity of people and the planet, governments, industry stakeholders, and local communities may collaborate to support sustainable mining practices and environmental stewardship in Ghana by putting these recommendations into reality. To successfully implement green mining legislation, this study emphasizes the significant obligations put on mining businesses in areas including environmental management, community-stakeholder participation, and employee education. Several recommendations for improving the sustainability of Ghana's mining industry are made after considering the case studies that are given.

Author contributions: Conceptualization, JT; methodology, JT; software, EM; validation, XW, JT and EM; formal analysis, JT, XW and EM; investigation, JT; resources, XW; data curation, JT; writing—original draft preparation, JT; writing—review and editing, XW and JT; visualization, JT and EM; supervision, XW; project administration, JT; funding acquisition, XW. All authors have read and agreed to the published version of the manuscript.

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References

Ahlerup, P., Baskaran, T., & Bigsten, A. (2019). Gold Mining and Education: A Long-run Resource Curse in Africa? The Journal of Development Studies, 56(9), 1745–1762. https://doi.org/10.1080/00220388.2019.1696959

Barnewold, L., & Lottermoser, B. G. (2020). Identification of digital technologies and digitalisation trends in the mining industry. International Journal of Mining Science and Technology, 30(6), 747–757. https://doi.org/10.1016/j.ijmst.2020.07.003

Dialga, I. (2019). A Mining Industry Sustainability Index: Experiences from Gold and Uranium Sectors. In: Development and Quantification of Sustainability Indicators. Springer.

Dunn, R. E., Mitchell, L. J., & Ward, K. (2016). The new world history: A field guide for teachers and researchers. Univ of California Press.

Dwumfour, R. A., & Ntow-Gyamfi, M. (2018). Natural resources, financial development and institutional quality in Africa: Is there a resource curse? Resources Policy, 59, 411–426. https://doi.org/10.1016/j.resourpol.2018.08.012

Emmanuel, A. Y., Jerry, C. S., & Dzigbodi, D. A. (2018). Review of Environmental and Health Impacts of Mining in Ghana. Journal of Health and Pollution, 8(17), 43–52. https://doi.org/10.5696/2156-9614-8.17.43

Famiyeh, S., Opoku, Robert. A., Kwarteng, A., et al. (2021). Driving forces of sustainability in the mining industry: Evidence from a developing country. Resources Policy, 70, 101910. https://doi.org/10.1016/j.resourpol.2020.101910

Fatima, T., & Elbanna, S. (2022). Corporate Social Responsibility (CSR) Implementation: A Review and a Research Agenda Towards an Integrative Framework. Journal of Business Ethics, 183(1), 105–121. https://doi.org/10.1007/s10551-022-05047-8

Ghana Chamber of Mines. (2022). Available online: https://ghanachamberofmines.org/wp-content/uploads/2022/07/2021-Performance-of-the-Mining-Industry-Report.pdf (accessed on 2 January 2024).

Gorsira, M., Steg, L., Denkers, A., et al. (2018). Corruption in Organizations: Ethical Climate and Individual Motives. Administrative Sciences, 8(1), 4. https://doi.org/10.3390/admsci8010004

Hilson, G., Murck, B. (2000). Sustainable development in the mining industry: Clarifying the corporate perspective. Resources Policy, 26(4), 227–238. https://doi.org/10.1016/S0301-4207(00)00041-6

Kish-Gephart, J. J., Harrison, D. A., & Treviño, L. K. (2010). Bad apples, bad cases, and bad barrels: Meta-analytic evidence about sources of unethical decisions at work. Journal of Applied Psychology, 95(1), 1–31. https://doi.org/10.1037/a0017103

Komljenovic, D., Loiselle, G., & Kumral, M. (2017). Organization: A new focus on mine safety improvement in a complex operational and business environment. International Journal of Mining Science and Technology, 27(4), 617–625. https://doi.org/10.1016/j.ijmst.2017.05.006

Lööw, J., Abrahamsson, L., & Johansson, J. (2019). Mining 4.0—the Impact of New Technology from a Work Place Perspective. Mining, Metallurgy & Exploration, 36(4), 701–707. https://doi.org/10.1007/s42461-019-00104-9

Merem, E. C., Twumasi, Y. A., Wesley, J., et al. (2021). The Assessment of China's Scramble for Natural Resources Extraction in Africa. World Environment, 11(1), 9–25. https://doi.org/10.5923/j.env.20211101.02

Nakua, E. K., Owusu-Dabo, E., Newton, S., et al. (2019). Injury rate and risk factors among small-scale gold miners in Ghana. BMC Public Health, 19(1). https://doi.org/10.1186/s12889-019-7560-0

Salary explorer. (2024). Available online: https://www.salaryexplorer.com/average-salary-wage-comparison-ghana-c82 (accessed on 2 January 2024).

Stemn, E. (2019). Analysis of Injuries in the Ghanaian Mining Industry and Priority Areas for Research. Safety and Health at Work, 10(2), 151–165. https://doi.org/10.1016/j.shaw.2018.09.001

Tyuleneva, T. (2020). Problems and Prospects of Regional Mining Industry Digitalization. E3S Web of Conferences, 174, 04019. https://doi.org/10.1051/e3sconf/202017404019

Wang, Y., Lei, Y., & Wang, S. (2020). Green Mining Efficiency and Improvement Countermeasures for China's Coal Mining Industry. Frontiers in Energy Research, 8. https://doi.org/10.3389/fenrg.2020.00018

Zhou, Y., Zhou, W., Lu, X., et al. (2020). Evaluation Index System of Green Surface Mining in China. Mining, Metallurgy & Exploration, 37(4), 1093–1103. https://doi.org/10.1007/s42461-020-00236-3