Health Sciences Investigations Journal

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ISSN Online 2704-4890 | ISSN Print 2720-7609

Online first publication

Original Research Article

HSI Journal (2024) Volume 5 (Issue 2):710-718. https://doi.org/10.46829/hsijournal.2024.6.5.2.710-718

Open Access

Decentralisation, informal mining, and environmental health: A political ecology perspective on Ghana's mineral wealth management

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Special Edition on Galamsey

Received January 2024; Revised March 2024; Accepted May 2024

Abstract

Background: In Ghana, a transformative shift is reshaping the management of natural resources by transferring authority from centralised bodies to local governance structures. This pivotal change aims to empower stakeholders at the grassroots level to oversee resource governance. Concurrently, efforts to formalise mining activities seek to bring regulation and structure to mining rights. This evolving institutional change has sparked intricate dynamics among multiple actors, each striving to shape institutional reforms and influence the distribution of mineral resources.

Objectives: Rooted on insights from political ecology, this study aims to profoundly examine the ramifications of decentralisation on formalisation endeavours, particularly delving into the detrimental impacts of informal mining, commonly known as galamsey in Ghana.

Methods: Focused on Dokrupe and Tinga communities, the study employed a mixed-method approach to engage with a diverse array of stakeholders, including members from water user associations, traditional leaders, gold committees, youth groups, heads of the District Assembly's sub-committees and household heads for both qualitative and quantitative data.

Results: The findings underscore the critical need to situate the adverse effects of informal artisanal mining within the broader context of stakeholders' strategic adaptations following the partial implementation of decentralisation. Notably, the reluctance to delegate power to local stakeholders in managing mineral wealth stands out, potentially fueling informal mining practices. This, in turn, worsens environmental degradation and triggers significant health crises among miners and community residents. The policy recommendations emphasised in this paper underscore the urgency of absolutely decentralised, robust environmental regulations and participatory decision-making processes.

Conclusions: The paper advocates for empowering local communities through education and engagement initiatives to foster sustainable mining practices and mitigate negative health impacts. These recommendations are crucial in steering towards more inclusive, community-driven resource governance, ultimately promoting sustainable development and healthier mining practices in Ghana's mining communities.

Keywords: Decentralisation, environmental health, galamsey, mineral wealth and political ecology

Cite the publication as Adam JN (2024) Decentralisation, informal mining, and environmental health: A political ecology perspective on Ghana's mineral wealth management. HSI Journal 5(2):710-718. https://doi.org/10.46829/hsijournal.2024.6.5.2.710-718

INTRODUCTION

Since the 1970s, various international donor communities have frequently lent their support to the decentralisation of natural resource management in Ghana. The underlying belief is that decentralisation would shift governance responsibilities to local-level stakeholders and, in turn, yield a variety of favourable results, encompassing responsible mining, mine safety, reducing health risk and promoting checks and balances [1,2]. Nevertheless, it is worth noting that research on decentralisation of natural resource management primarily focuses on its structural and organisational variants while paying less attention to the actual consequences [3,4]. Consequently, this paper undertakes an examination of informal mining, also known as galamsey, in the Ghanaian context and its consequences on the environment and health of miners and the local population within the broader context of decentralisation and formalisation reforms championed by the global north. In recent times, the decentralisation and the formalisation of rights in resource management and utilisation are gaining more attention in the global south because of the negative impacts of informal

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mining practices [5,6,7]. Decentralisation refers to the transfer of control over natural resource management from a central government to a variety of local government actors [1,4]. The assumption is that shifts in rights and authority over natural resource management will augment local participation in the governance process and enhance protection from over-exploitation [8]. Consequently, the Provisional National Defence Council Law (PNDCL) 207 was enacted to empower local government to grant business permits to local entrepreneurs in mining and to implement strict environmental laws [9]. Simultaneously, the Minerals and Mining Law of 1986 was passed to criminalise artisanal and small-scale mining. The reason was to promote and protect the mines of foreign multinational businesses [9,10]. Three years later (1989), three important laws affecting the mining sector were promulgated. One such law is the Provisional National Defence Council Law 218, which was enacted to begin a licence system and establish support centres across the districts to aid the formalisation of informal artisanal and small-scale mining. Section 83(a) of the Minerals and Mining Act 2006 (Act 703) also grants Ghanaians aged 18 years or more the opportunity to obtain mining licences and concessions. The advantages of formalisation of rights of informal mining, especially gold ore mining, are varied, including enabling traceability of gold ore extracted and promoting responsible mining at upstream and downstream levels to minimise the negative consequences [6,7].

There is a growing critique that the formalisation processes of informal miners are affected by high costs, bureaucracy, and perceived bias in the distribution of mining licences and concessions. This can contribute to aggravating unintended outcomes. For example, the challenges of formalisation of mining rights can force people to engage in galamsey, leading to environmental degradation and poor safety compliance. This is because their mining practices are usually not supervised for strict compliance in terms of chemical use, safety protocols and legal trading of the gold ore extracted [7,11,12]. There are also increased concerns that the revenue of informal mining can be used to promote and support various forms of crime and crime-related activities. Drawing insights from political ecology [13,14], this research investigates the implications of informal mining within the broad context of decentralisation of natural resource management, formalisation measures, and their associated institutional mechanisms. A political ecology lends a concrete analysis of power dynamics among local power-holding stakeholders, state agencies, and local miners. Political ecology helps to explain how the rules of the game that regulate resource management and use are constantly shaped within a specific historical, political-legal, and socio-economic context influenced by power relations [15]. A political ecology perspective enables the analysis of who benefits, when they benefit and who bears the brunt of the mismanagement of resources in the distribution processes [14]. In other words, the political ecology perspective can enable the analysis of the agency of social groups in the redistribution processes occurring in decentralised natural resource management [9,15].

Against this backdrop, the paper endeavours to offer a comprehensive and nuanced understanding of the implications of informal mining on the environment and health of miners and local populations. Thus, the study asks: What strategies do stakeholders use in the management of mineral wealth? How do the strategies applied by stakeholders in managing local mineral wealth contribute to exacerbating the adverse impacts of informal mining on health, the environment, and the affected communities? How do the local communities respond to the negative effects of informal mining, and which measures do they employ to address these impacts? In this paper, two lines of arguments are presented: Firstly, the paper demonstrates that the strategies used by the diverse stakeholders in the management of the mineral wealth and the adverse consequences of informal mining are a result of Ghana's implementation of partial decentralisation. Secondly, the adverse consequences compel communities to unite against their dispossession of natural resources. The case study area of the Bole district in Ghana's Savannah region stands as a pivotal context for examining the intricate dynamics between decentralisation policies, formalisation initiatives, and the exploitation of gold ore resources.

Adam et al. [9] underscore the significance of this region in understanding how these elements interact within the mining landscape. Within Ghana's legal framework, the extraction of gold ore is profoundly shaped by a complex amalgamation of public policies, mining rights, and customary laws. This framework directly influences Ghanaians' access to small-scale mining rights, concessions, and the subsequent mining practices that unfold. In this context, the legal status of a miner holds immense sway over the nature of mining activities. Adam et al. [9] and Ntewusu [16] both elucidate this point, indicating that the legal framework dictates whether mining practices will be responsible or otherwise.

This legal framework essentially becomes the linchpin determining the legitimacy, rights, and practices surrounding gold ore extraction in Ghana. Consequently, the dynamics between decentralisation policies, formalisation endeavours, and the on-ground realities of mining practices are deeply enmeshed within this legal framework. Moreover, the Bole district's specific geography and socio-economic context further accentuate the complexities in the interplay between decentralisation, formalisation, and mining practices [16]. Understanding these dynamics within this specific locale is crucial for comprehending the broader implications and challenges inherent in the governance and management of mineral resources, particularly gold ore, in Ghana. The region serves as a microcosm that encapsulates the multifaceted relationships and influences shaping the mining landscape within the broader national and legal context. The

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subsequent section provides a detailed exploration of the materials and methods employed to collect data from pertinent stakeholders, aiming to comprehend the intricate dynamics of informal mining in the communities of Dokrupe and Tinga. Section 3 unveils the intricacies of the negative impacts on miners' health, environmental degradation, and the overarching influence of informal mining on local livelihoods. Section 4 navigates the nuanced arguments presented in the paper, dissecting the implications for policy, governance, and community resilience in the face of informal mining's far-reaching impact. Finally, the conclusion encapsulates the research's significance, implications, and contributions to the discourse surrounding informal mining in these communities.

MATERIALS AND METHODS

This study utilised a mixed-method approach, integrating qualitative and quantitative methods. By combining these methodologies, the research aimed to complement the strengths of each, permitting data triangulation and validating the findings. The purposeful sampling technique was used to select Dokrupe and Tinga in the Bole district of the Savannah Region of Ghana (Figure 1) to facilitate a comprehensive understanding of the multifaceted impacts of informal mining on both the environment and human health. In Dokrupe, two traditional leaders, three gold committee executives, five members of the water user association, and 40 household heads involved in diverse livelihood activities were selected for interviews. While in Tinga, the study meticulously selected four traditional leaders, six gold committee members, seven water user association members, 58 household heads, and five youth group members. In addition, five heads of the District Assembly's sub-committees were selected and interviewed. The selection of the diverse stakeholders in the study was not influenced by a strict statistical representation often used in purely quantitative studies. The study's flexible sampling approach was aimed at capturing a wide array of perspectives and experiences related to informal mining practices in the communities. The diverse stakeholders were interviewed from February 2019 to February 2021, with scheduled visits to the communities. The methods of data collection were key informant interviews, focus group discussions, field observation, and structured questionnaires.

The key informant interviews focused on understanding the impacts of informal mining on the environment, community health, and socio-economic conditions and observed changes over time. Moreover, the Focus Group Discussions (FGDs) session provided nuanced insights into community perceptions, experiences, and concerns regarding the effects of informal mining. Organised in one of the classrooms at the community Junior High School, the FGDs fostered interactive dialogues among the diverse set of stakeholders because of the neutral space provided. Furthermore, evidence was collected through meticulous observations of the miners to understand the direct consequences of informal mining activities on water bodies, ecosystems, and the surrounding environment. This approach was pivotal in substantiating the qualitative data.

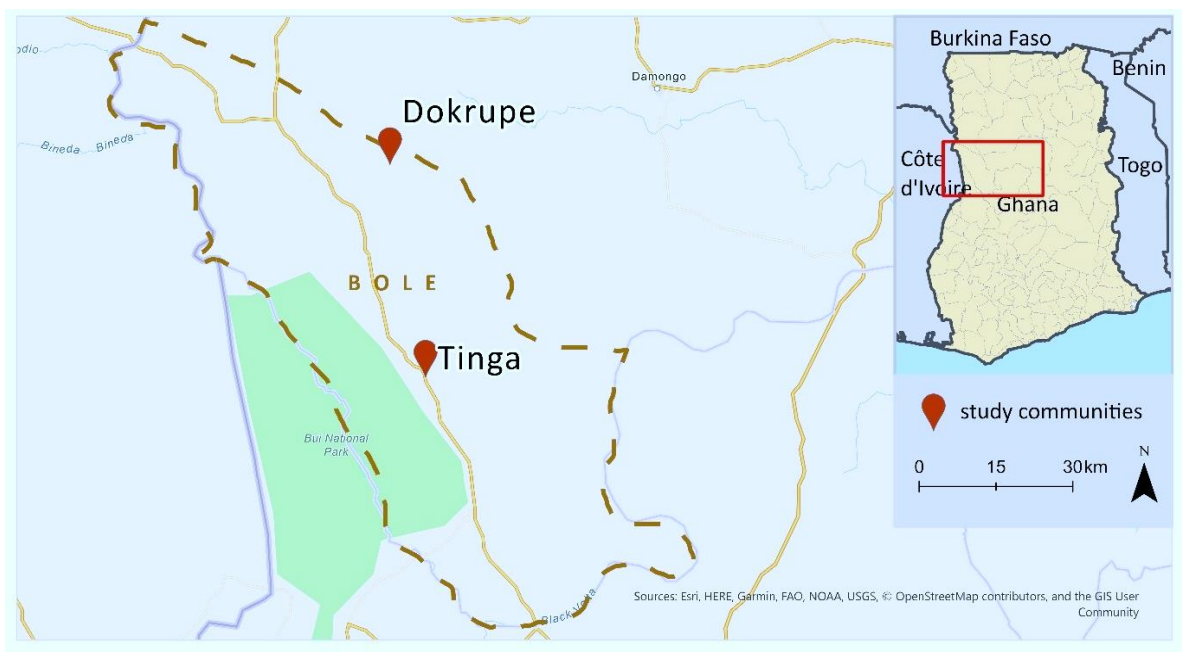

Figure 1. Location of the two study communities in Bole administrative map

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A structured questionnaire was designed to gather quantitative data to facilitate statistical analysis. The use of multiple data collection methods was to enhance the triangulation of data and to ensure robustness, credibility, and depth in the findings. On the one hand, qualitative interviews were recorded in field notebooks, which culminated in codes and were organised into themes for the in-depth analysis of the data. The quantitative data, on the other hand, were entered into Microsoft Excel (Microsoft 365, 2021) for frequency and percentage analysis. The data from both the qualitative and quantitative methods were integrated to facilitate a more comprehensive picture of the study findings. For example, while the qualitative data are presented in narrative and descriptive forms and backed with quotations, the quantitative data were presented to indicate the prevalence quantum of the responses.

RESULTS

This section presents the stakeholders' strategies and the formal and informal rules involved in the local management of mineral wealth. The stakeholders include the district assembly, the Minerals Commission, traditional leaders, gold ore committees, and informal artisanal miners. The section also presents a summary of the findings in Table 1. The establishment of the district assembly under PNDCL 207 was intended, among others, to empower it to oversee responsible mining practices through the issuance of business permits and monitoring [9,10]. Yet, a reluctance to decentralise authority has hindered the effective enforcement of environmental regulations within the local communities. Insights from the heads of the District Assembly's sub-committees emphasise the reluctance of local government authorities to devolve power to enforce environmental regulations in local communities. This hindrance perpetuates a cycle where environmental governance remains compromised, negatively impacting the community's ability to ensure responsible mining. The responses of the heads of the sub-committee in the District Assembly suggest that the Assembly is looking up to the Minerals Commission to ensure responsible mining in the local communities. This perception seems to suggest a lack of coordination between the District Assembly and the Minerals Commission.

The Minerals Commission holds a crucial position in the management of mineral wealth in the local communities. It is mandated to ensure responsible mining practices, prevent gold ore smuggling, and supervise the processes of license and mining concessions to qualified individuals and entities [9]. However, challenges, including inadequate staff, logistics and equipment, impede the smooth operations of the Minerals Commission. These challenges affect the Commission's ability to supervise and monitor gold ore mining. It also finds it hard to provide adequate mining support to legitimate operators. The survey conducted in 2019 shows that 98% of local miners depend on traditional authorities and their structures to participate in informal mining. In Ghana, the Land Act 2020 (Act 1036), pursuant to clause 8 of Article 36 of the Constitution, mandates traditional leaders to manage stool, skin, or family land. As such, section 13(2) of Act 1036 states that "A chief, tendana, clan head, family head or any other authority in charge of the management of stool or skin, or clan or family land, is a fiduciary charged with the obligation to discharge the management function for the benefit of the stool or skin, or clan or family concerned and is accountable as a fiduciary". In the local communities in Bole, traditional chiefs are responsible for granting surface land to individuals [17], although they recognise that the state has the prerogative to issue mining concessions to Ghanaians for small-scale mining. However, the absence of the Minerals Commission grants traditional chiefs an opportunity to give illegal permits for the extraction of gold ore. The traditional chiefs strategically allow local structures like the gold committees to evolve to manage the distribution of mining permits. In addition, they also grant miners permits to cut logs and use the available water resources to support mining activities.

The dominance of the gold ore committees and their potential oversight of informal mining activities cannot be overemphasised. The committees, comprising influential community members closely associated with traditional leaders, wield significant authority in shaping informal

Table 1. Roles, challenges, and interactions of stakeholders in mineral wealth management

Stakeholders	Roles	Challenges/issues	Interactions/relationships
District Assembly	Oversight through business permits and monitoring.	Reluctance in devolving authority impacting environmental governance.	Lack of coordination with the Minerals Commission.
Minerals Commission	Overseeing mining operations, mitigating environmental impacts, licence issuance	Inadequate staff, logistics, and equipment affecting operations.	Weak relationship with informal miners
Traditional leaders	Granting surface land rights, supervising mining permits, providing resources	Absence of Minerals Commission in the communities allows traditional leaders to gain control.	Collaboration with gold mining committees for supervision.
Gold mining committee	Authority in shaping mining activities, collecting fees/taxes, providing support.	Considerable power in mining activities, symbiotic relationship with miners.	Preference to operate under traditional authorities for local support.

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mining activities. The gold committees also maintain a symbiotic relationship with the miners. The committees grant loans to distressed miners, rent mining equipment and tools to under-resourced miners, arrange buyers, and provide escort security for the transportation of unrefined gold to southern Ghana, especially Kumasi. The committee's statement is as follows: "There is no doubt that we hold considerable power in the mining space. We are only accountable to the traditional leadership and are mandated to ensure that every miner is registered and pays appropriate fees for the development of the communities. We also provide financial and security support for people in need in the community" (Executive member of the gold committee in Tinga, FGD, 23.3.2019).

Over 84% of informal miners perceive mining licences and concessions as structured along patrimonial lines, favouring individuals with political or financial clout. The expression below succinctly encapsulates the perception of a local miner: "I am 20 years old and qualify to possess a mining licence. Yet, the high cost of licence processes is a key obstacle. I feel that the system silently favours people who have political and family connections with the Minerals Commission, leaving some of us without any influence and burdened by excessive fees such as the payment of bribes. This inflexibility in licensing procedures is stifling our ambitions for conducting legitimate operations" (Local miner in Dokrupe, FGD, 18.5.2019). The financial constraints and perceived favouritism challenge the fairness and equity of the formalisation process as stated in the Minerals and Mining Act 2006 (Act 703).

Nearly 92% of the local miners reported that the Minerals Commission is understaffed to provide them with the necessary support services they require. As a result, the majority of local miners opt to operate under traditional leadership and the gold committees. According to a local miner in Dokrupe, the traditional leaders and gold committees are "their life jacket in the ocean". Thus, the findings show that most of the stakeholders involved in the management of mineral wealth have failed, leading to the hijacking of mineral resources by traditional leaders and their allied structures (see Table 1). This outcome results in environmental challenges, which negatively affect local communities, miners, and their families. The next section presents the effects of informal mining in the local communities.

Effects of informal mining

This section shows how the aftermaths of informal gold ore mining extend far beyond mere environmental damage and illustrates that the effects of galamsey seep into the local communities and corrode their health, livelihoods, and ecosystems. This section also highlights both the shared and differing impacts of informal mining in Table 2. The findings show that the negative impact of mining is multifaceted. The findings demonstrate that the hazardous conditions prevalent in the mining sites, such as lack of safety protocols and proper infrastructure, significantly heighten the risk of accidents and injuries. Some of the miners indicate that the collapse of rudimentary tunnels and accidents involving heavy machinery are regular occurrences, leading to severe injuries of over 37 miners and even four fatalities of miners in Dokrupe.

The lack of proper ventilation in the mine and exposure to harmful substances poses significant health risks to these miners. Also, the rise of galamsey has become a breeding ground for the spread of several types of sexually transmitted diseases. The transient nature of the workforce, coupled with limited access to healthcare and preventive measures, has fostered a rapid transmission of sexually transmitted infections among 83 people in Dokrupe over the two-year study period. As miners move in and out of the area, this mobility has inadvertently contributed to the

Table 2. Comparative impacts of informal mining on Dokrupe and Tinga communities

Impacts	Dokrupe	Tinga
Health impacts	Higher incidence of miner injuries and illnesses due to accidents and exposure to harmful substances.	Miners suffer similar dangers and health issues but comparatively lesser intensity.
	High reports of sexually transmitted diseases	Concern for loss of herbal resources but less emphasis compared to Dokrupe.
	Substantial loss of traditional medicinal herbs.	
Environmental impacts	Severe water pollution, deforestation, contamination with toxic substances	Similar severe water pollution, deforestation, contamination.
	Reduced water usage for daily activities due to pollution concerns.	More prominent water scarcity issues affecting various aspects of daily life.
Livelihood impacts	Reduced agricultural yields.	High death rates of fish.
	High livestock mortality rates.	Decline in fishing, affecting nutrition and income
Economic impacts	Businesses growth, agricultural productivity, and potential tourism affected significantly	Economic strain due to illness but not as severe; less impact on potential economic activities.

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unchecked dissemination of sexually transmitted diseases, posing a significant health risk to both miners and the downstream stakeholders. Moreover, informal mining results in the colossal destruction of the vegetative cover, which is a major source of local herbs for the treatment of many diseases, such as stroke, ulcer, miscarriage, etc., by herbalists. The following quotation provides a deeper understanding of this dynamic: "Galamsey miners have disregarded the need to preserve our traditions and protect the vegetative cover, which is relied on by herbalists and traditional healers like me for treating serious spiritual health problems. Because of this, I now cover long distances to get certain essential herbs for the treatment of epilepsy, sexually transmitted diseases, etc." (Herbalist in Dokrupe, FGD, 26.2.2020). However, in Tinga, some herbalists have not expressed much concern about the loss of essential herbs in the surrounding environment. The reason is that informal mining is less pervasive in Tinga compared to Dokrupe, which surrounds mining sites (Table 2). The people of Dokrupe face risks associated with the environmental consequences of informal mining. The release of sediment from mining sites, the runoff of acid from mines and the discharge of highly toxic substances such as mercury, cyanide, cadmium, lead, and arsenic [18,19] infiltrate the environment and contaminate the diverse water sources, including underground water. These contaminants have detrimental effects not only on the environment but also endanger the health of local residents who rely on water bodies for daily use. Long-term exposure to these toxic substances contributes to chronic health issues, including skin lesions, cancer, vascular diseases, and kidney and reproductive disorders, impacting the quality of life for these individuals [20,21,22,23].

According to Cobbina et al.[21], the amounts of heavy metals in drinking water in Tinga are above the World Health Organization's recommended limits [24]. A poignant quotation capturing the dire consequences of informal mining came from a local miner deeply affected by the hazards of mining: "Every day, we fear for our lives working in these conditions. Accidents are a constant threat, and the poisonous substances in the water affect not just us miners but our families who rely on these resources. We are trapped between survival and endangerment, trying to eke out a living while risking our health and lives" (Local miner in Tinga, FGD, 11.5.2020). The distressing trend of a large number of community members falling sick due to exposure to these substances illustrates the direct link between environmental negligence and deteriorating health. The toll of illnesses also redefines relationships, urging the few healthy to rally more around care and support. Over 70% of household heads in the 2020 survey conducted showed that women reported going to fetch water from far places for sick people because of the transformation of the community's pristine streams into polluted havens. Therefore, many households are compelled to reduce the consumption of water for domestic use by a significant amount (Woman in Tinga, FGD, 11.5.2020). Besides, 86% of the households in the 2020 survey reported that the aquatic resources, especially fish, which are used to sustain the households' livelihood and nutrition, suffered a severe decline.

In a FGD, 7 out of 8 fishermen indicated that they currently do not harvest enough fish as compared to 20 years ago. They sometimes catch less than ten fish in over 2 hours of fishing. Some fishermen reported that the streams are sometimes flooded with dead fish during the rainy season when the runoff of acid from mines into the streams intensifies. Also, many livestock keepers lamented that the mortality rates of their livestock have increased due to the consumption of polluted water sources. A livestock keeper laments that: "I am now experiencing higher mortality rates than before. I used to experience 1 or 2 deaths of livestock in a year some 16 years ago. But last year alone, I experienced six deaths of sheep and five deaths of goats. This has reduced my income level and simultaneously increased my vulnerability to food insecurity" (Widow livestock keeper, 23.4.2020). Also, a 2020 survey indicates that over 3,000 people in both Dokrupe and Tinga often consume unwholesome vegetables irrigated from polluted water sources. Thus, the negative impacts of galamsey have serious implications for the local economy. One example is presented below: "The detrimental impact of the high

Table 3. Comparison of community responses against informal mining

Social response	Dokrupe	Tinga
Environmental protection advocacy	Less organized collective resistance.	More organized resistance The community seeks stricter regulations and enforcement. Government workers to vacate post if actions are not implemented to reduce the negative impacts of mining.
Community mobilization	Community mobilization is often aimed at supporting informal mining.	Government workers organize public meetings and forums. Government workers provide support to injured and sick people affected by mining activities.

Source: Field interviews, 2019-2021

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number of illnesses has profoundly crippled our local economy. The illness leads to hospital admissions of miners and their families, which makes the community's economic engine slow and suffocate. Business operators are struggling, and labour for agricultural activities is reducing because people have to shift roles to take care of sick people. This generates a cycle which reduces economic activities and wanes income level, leaving us grappling with hardships we never anticipated" (Retired educationist in Dokrupe, FGD, 5.2.2020).

In this section, the responses of the communities against informal mining are presented. In light of the devastating effects of informal mining, a segment of the population in Tinga has displayed a blend of urgency and resilience, calling for immediate action and stricter regulations to confront the dire environmental degradation and health issues. The demand for change stems from a profound need to safeguard not only the environment but also the health and sustenance of the community. The voice of the community, especially farmers dispossessed of their farmlands in Tinga who experience the brunt of galamsey, echoes a resolute stand against the government's inability to tackle the menace of environmental degradation and health concerns caused by informal mining. The quotation below encapsulates the feelings of local residents: "Faced with the dire consequences of mining activities, we are united to demand immediate action to safeguard our water resources and farmlands. We stand resolute and call for stringent regulations to prevent further harm in order to ensure long-term resource preservation" (Farmer in Tinga, FGD, 28.2.2021).

The community's concerted efforts reflect a shared commitment to resist further environmental crises. Consequently, government workers like nurses and teachers have supported and sponsored public meetings and forums to galvanise community support to demonstrate against the stakeholders involved in promoting informal mining [25]. These government workers have also threatened to vacate posts if immediate actions are not implemented to minimise the negative effects of informal mining (Table 3). The quotation below throws more light on the dynamic: "We are urging for sustainable practices that preserve our vegetative cover, farmlands, and water bodies, crucial for our survival and the generations yet to come. We can no longer stay quiet and watch the young contract sexually transmitted diseases such as Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome", which becomes a burden on all of us. The relatives of those who fall sick approach us for money to pay for medical bills or buy food for the sick people" (Teacher in Tinga, Interview, 28.2.2021). However, the findings in Dorkupe show that the gold committee supports informal mining and actively undertakes activities to make the operation of informal mining conducive. These include sponsoring the repair of broken bridges and culverts and bad roads linking the community and mining sites.

DISCUSSION

The empirical findings weave a complex narrative, which demonstrates that the state custodians of mineral wealth management fade, fostering an environment where informal mining thrives, perpetuating an escalating environmental crisis. This outcome jeopardises the health of miners and local communities contrary to the goal of decentralisation reform [1,2,26]. The legal framework of managing mineral resources entrusts the Minerals Commission (e.g., Act 703) with the critical task of mitigating environmental impacts and regulating mining operations. However, the Commission faces a myriad of challenges, including limited staff, equipment, and logistics. For example, limited resources hamper the Commission's capacity to effectively enforce responsible mining practices, exacerbating the proliferation of unregulated mining activities. This resource deficit pushes local miners towards informal structures such as traditional authorities and gold committees, inadvertently legitimising informal mining within local jurisdictions and perpetuating environmental and health hazards for the communities.

The District Assembly, initially positioned to oversee responsible mining practices, grapples with a glaring reluctance to decentralise authority [9,4]. This hesitation translates into weakened enforcement of crucial environmental regulations at local levels, creating a void in governance that allows informal mining to flourish virtually unchecked [5,9,28,29,30]. Hence, traditional leaders, leveraging the absence of formal oversight, wield significant influence over mineral rights and permits through gold committees. This effectively legitimises informal mining within local jurisdictions but deepens the environmental and health implications faced by the communities [10,27]. The absence of formal oversight leads to a skewed power balance [13], allowing traditional leaders to benefit from mineral wealth without adequate scrutiny or regulation, further perpetuating the cycle of unregulated mining practices. The challenges encountered by informal miners in obtaining licenses, perceived as biased and favouring individuals with political or financial influence, underscore systemic inequities within the formalisation process [6,7,11,14]. This disparity further alienates miners from formal structures, compelling them to rely on informal avenues for support and legitimisation of their mining activities. This stark divide between formal and informal mining sectors amplifies structural flaws within the regulatory framework, exacerbating environmental and health risks such as sexually transmitted diseases, injuries, and death [3,4].

Amidst this complex web of challenges, the community's unified call for change emerges as a beacon of resilience and hope. Residents, burdened by the devastating consequences of informal mining, stand united in demanding immediate action and stringent regulations to protect their environment and health. This grassroots movement [15,25], bolstered by the alignment of

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government workers with the community (e.g., Tinga), underscores a collective determination to combat irresponsible mining practices. The communal outcry illustrates a profound need for effective policy interventions to bridge the gaps in oversight and regulation. The urgency for stringent environmental policies and robust enforcement mechanisms becomes palpable in the face of escalating environmental degradation and health risks associated with informal mining. The rallying cry from the community serves as a testament to the imperative for inclusive and proactive governance structures that prioritise the well-being of miners and local residents. The interplay between formal and informal structures within the mining sector highlights the systemic challenges that must be addressed. The intricate web of stakeholders, each with their vested interests, underscores the need for comprehensive policies that foster responsible mining practices while safeguarding the environment and community health. The findings spotlight the urgency for collaborative efforts between government bodies, local authorities, and communities to devise and implement effective strategies that mitigate the adverse impacts of informal mining on both the environment and public health.

Conclusion

This study delves deeply into the complex interplay between decentralisation in natural resource management, the formalisation process, and the detrimental impacts of informal mining on miners' health, local populations, and the environment. Grounded on the political ecology perspective, this study sheds light on the intricate power dynamics and structural inequalities inherent in the governance of mineral wealth. Through a mixed-method approach encompassing surveys, interviews, focus group discussions, and observations, the research methodology meticulously captured diverse insights into the intricate landscape of informal mining.

The analysis of the collected data vividly illustrates the collective failure of stakeholders to supervise and monitor responsible mining. This unintended outcome should be understood within the context of Ghana's implementation of partial decentralisation. The failure to implement an effective decentralisation reform contributes to the cycle of environmental degradation and compromises the health of both miners and local communities. Against this backdrop, comprehensive decentralisation is a pivotal solution that will empower local authorities to exert more effective oversight and enforce stringent environmental policies through their local structures. Hence, strengthening local governance structures is crucial for ensuring responsible mining practices and robust enforcement of environmental regulations. Simultaneously, the formalisation process demands streamlined licensing procedures, reduced financial barriers, and equitable access to mining rights. These initiatives serve as catalysts in motivating miners to transition from informal to formal practices, consequently mitigating environmental damage and health risks.

The policy recommendations outlined in this paper emphasise the urgency of decentralised oversight, robust environmental regulation, and participatory decision-making processes. Empowering local communities through education and engagement initiatives can pave the way for sustainable mining practices and enhance environmental stewardship. The paper contributes to unravelling the intricate relationships between stakeholders, state agencies, and local communities, emphasising the imperative for more equitable and inclusive policies within the mining sector. Looking ahead, future research could explore the broader socio-economic implications of environmental degradation caused by informal mining. Investigating long-term economic sustainability and delving into the effectiveness of community-driven initiatives would provide invaluable insights into sustainable solutions, bridging the gap between policy and grassroots perspectives.

DECLARATION

Ethical consideration

The study adhered to international guidelines such as the Institutional Review Board of the University for Development Studies.

Consent to publish

Not applicable

Funding

None

Competing Interest

The author declares that there is no conflict of interest regarding the publication of this article.

Author contribution

None

Acknowledgement

I sincerely thank all participants and community members for their invaluable contributions and insights, which were essential to the success of this research. My gratitude also extends to the reviewers and editor, whose constructive feedback significantly improved the quality of my work.

Availability of data

Data for this work is available upon request to the author.

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