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Public perceptions of policy enforcement and illegal mining: Insights from three mining regions of Ghana

[1]Asante, J., [2]*Peprah, W.K., [3]Adu, B.O-S, & [4]Osei-Kuffour, F.

[1]Institute of Leadership and Governance, Pentecost University, Accra, Ghana, https://orcid.org/0009-0003-0533-282.
[2]*School of Business Administration, Andrews University, USA, https://orcid.org/0000-0002-6802-2586,
[3]Institute of Leadership and Governance, Pentecost University, Accra, Ghana https://orcid.org/0000-0002-4734-0972
[4,1]School of Business, Valley View University, Oyibi, Accra, Ghana, https://orcid.org/0000-0002-9714-6238
* Corresponding author. Email: peprah@andrews.edu

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ABSTRACT

Illegal mining (galamsey) poses acute environmental, health, and governance risks in Ghana. Guided by deterrence, institutional, and co-production theories, this quantitative, descriptive-correlational study examines public perceptions of policy enforcement and illegal mining across three mining regions (Ashanti, Eastern, and Western) of Ghana. A proportional random sample yielded 297 respondents who completed 5-point Likert scales. Internal consistency was acceptable for Policy Enforcement ($\alpha = .73$) and Illegal Mining ($\alpha = .88$). Descriptive statistics indicated very high perceived prevalence and harms of illegal mining. Policy enforcement perceptions averaged in the agreement range, with strongest endorsements for weak law enforcement and political interference. Linear regression analysis revealed that Policy Enforcement positively predicted Illegal Mining perceptions. One-way ANOVA revealed no gender or regional differences; small significant effects emerged for age (18–25 < 36–45), education (Secondary < Postgraduate/Primary on selected contrasts), and occupation (Formal employment > informal employment). Findings suggest that perceived enforcement fragility marked by politicisation and uneven sanctions coexist with heightened awareness of galamsey harms. Implications include insulating enforcement from political influence, improving inter-agency coordination, and embedding community co-production and livelihood alternatives to achieve credible, legitimate, and sustainable compliance.

1. Introduction

Illegal mining is a global phenomenon with severe implications for environmental sustainability, public health, and socioeconomic stability. Across regions such as South America, Asia, and Africa, unregulated mining activities have devastated forests, polluted rivers, and disrupted community livelihoods (Hilson, 2017). Countries like Peru, Indonesia, and the Democratic Republic of Congo have all grappled with illegal mining's destructive impacts, from mercury contamination and biodiversity loss to conflicts over land and governance weaknesses (Veiga et al., 2019). These global experiences underscore the complex intersection of poverty, weak regulation, and natural resource dependence that drives illicit mining activities worldwide.

In Ghana, illegal mining locally known as "*galamsey*" represents one of the most pressing environmental and governance challenges. While small-scale mining has historically served as a livelihood for many rural communities, illegal forms of the activity have surged over the past decades, often involving heavy machinery, river dredging, and the indiscriminate use of toxic chemicals such as mercury and cyanide (Hilson & Potter, 2018). The consequences are profound: deforestation, loss of arable land, degraded water bodies, soil contamination, and biodiversity depletion (Boateng et al., 2016). Beyond ecological harm, illegal mining poses health risks to communities, fosters unsafe working conditions, contributes to social vices, and denies the state significant revenue needed for development (Ansah et al., 2019; Yeboah, 2023).

Despite the clear dangers, Ghana's policy responses to *galamsey* have yielded limited success. Successive governments have rolled out interventions ranging from legislative reforms, task forces and military deployments to initiatives intended to formalize artisanal mining (Ministry of Lands and Natural Resources, 2017; Jawula, 2025). Yet, these measures have not eradicated the problem. Weak enforcement, corruption, political interference, and community resistance have undermined these efforts, allowing illegal mining to persist and even expand (Baddianaah et al., 2022; Yeboah, 2023).

This situation reveals a critical research gap: while numerous policies have been introduced, the Minerals and Mining Act, 2006 (Act 703) which is the main law governing mining

activities and licensing, with the Minerals Commission Regulations, 2012 (L.I. 2182) supplementing it, providing a framework of the procedure of enforcement of small-scale mining. At the operational level, the governments have launched Operation Vanguard (2017) a military-police taskforce, and the Inter-Ministerial Committee on Illegal Mining (IMCIM, 2017), National Anti-Illegal Mining Operations Secretariat (NAIMOS), and Blue Water Guards initiative as a coordinated cross-ministerial response. Alternative livelihood policy introduced was the Community Mining Scheme (2018) which aimed at transferring the illegal miners to licensed mining activities. This was followed by Operation Halt (2019 and 2021) which targeted galamsey in forest reserves and water bodies. The most recent and current crackdown on galamsey (2024, 2025, 2026) has been sought under different administrations, and many years on, this indicates the enduring and increasing character of the issue.

Although there are apparent government efforts to combat illegal mining through policies aimed at addressing this issue, there remains a significant knowledge gap. This study fills a gap in the illegal mining literature in Ghana by examining how anti-illegal mining policies are perceived by citizens and mining-affected communities. Whereas previous studies have focused mainly on environmental impacts, economic effects, and policy frameworks, this study brings in the social perspective needed to understand policy effectiveness, fairness, and legitimacy. In doing so, it provides evidence that can support more participatory, credible, and sustainable anti-illegal mining governance in Ghana. There is inadequate evidence of their actual effectiveness, as well as limited exploration of community perceptions of these enforcement mechanisms. Without a grounded understanding of why illegal mining thrives despite persistent government action, designing sustainable, inclusive, and enforceable solutions will remain elusive. This study, therefore, seeks to examine the impact of policy enforcement against illegal mining in Ghana, contributing to the broader discourse on resource governance in developing economies. This study seeks to answer the following research questions from the perspectives of citizens in the following three main mining regions in Ghana (Ashanti, Western, and Eastern Regions):

What is the extent of illegal mining in Ghana?
What is the level of Ghana's government policy enforcement in reduction of illegal mining?
How does Ghana's government policy enforcement significantly account for reduction in illegal mining in Ghana?
Is there a significant difference on the perspective of the following on illegal mining in Ghana:
Gender
Age
Level of Education
Occupation
Region

2. Review of related literature

Although there is apparent government effort to combat illegal mining through policies aimed at addressing this issue, there remains a significant knowledge gap in understanding how these policies and their enforcement are perceived by the communities and citizens most affected or involved in mining activities. Existing literature mainly focuses on the environmental and economic immediate impacts of illegal mining or offers a top-down analysis of policy frameworks (Asiedu & Antwi-Agyei, 2021; Frimpong & Gyasi, 2020). However, the lived experiences and perceptions of Ghanaians regarding the effectiveness, continuation, and justice of policy enforcement in illegal mining are limited. Without this crucial perspective, policy making and implementation risk losing touch with ground realities, potentially leading to unintended outcomes or policies that are ineffective. Therefore, this research aims to address this gap by critically examining the effects of policy implementation on illegal mining from a solely Ghanaian perspective.

By capturing social perceptions, the study will better understand policy gaps, community involvement, and environmental governance, providing evidence-based information to improve policy effectiveness and sustainable resource management. Despite various policy interventions aimed at controlling illegal mining in Ghana, enforcement remains weak, allowing environment-damaging (galamsey) activities to persist. Although legislation and regulations exist, there has been little attention to the perspectives of those directly affected by these measures regarding their effectiveness. Hence this paper can further support improved environmental regulation and enhance the socially beneficial outcomes of anti-illegal mining policies.

This research will specifically benefit several key stakeholder groups and actors. To Ghanaians and the public, this study will ensure that the voices of ordinary people are heard and considered in policy implementation and development. This will lead to improved and sustainable resource management practices that directly serve their interests and ultimately result in better environmental governance, enhancing their living standards and ensuring the preservation of natural resources for future generations.

To the local communities affected by Illegal Mining, the study will prioritise the opinions of communities directly impacted by illegal mining. The results will outline their perceptions on policy enforcement, highlight areas where policies are perceived as externally imposed or discriminatory, and advocate for greater involvement in decision-making. This aims to enhance more participatory and equitable anti-illegal mining initiatives that address local needs and concerns.

To policymakers and Government Agencies (e.g., Ministry of Lands and Natural Resources, Inter-Ministerial Committee on Illegal Mining), this study offers crucial evidence-based insights into the practical effectiveness and societal impact of existing anti-illegal mining policies. The results will allow policy makers to pinpoint weak areas in the policies, solve the problem of weak coordination of institutions, mandate clash and political interference and come up with more dependable and believable policies of enforcing such policies. It will also help guide the planning of future policies that are better in meeting the needs of the people and can be able to deliver long run environmental sustainability.

To environmental Governance and advocacy organisations dedicated to environmental protection and good governance,

will find this study invaluable. This research will be of great value to organizations that have a mission to protect the environment and ensure the proper functioning of a government. It gives empirical evidence about the way people perceive environmental governance which points to inadequacy in community participation and enforcement of policies. This knowledge can be used to advocate, hold establishments accountable and to support more effective resource management systems that are less opaque in Ghana.

The government of Ghana has taken several policy and regulatory measures to curb the menace of illegal mining (galamsey) (Hilson, 2017). These measures include the Minerals and Mining Act, 2006 (Act 703), creation of the Inter-Ministerial Committee on Illegal Mining, and the formation of the Operation Vanguard military-police task force to disrupt unlicensed mining operations in 2017 are some of the most important ones (Ministry of Lands and Natural Resources, 2017).

Recent literature on illegal mining in Ghana reveals that the country's reactions, have been mostly concerned with legal-regulatory control, the formalisation of the artisanal and small-scale mining (ASM), militarised enforcement, and cross-sector or inter-agency coordination (Adranyi et al., 2024; Bansah, 2023; Bansah et al., 2022). Even though this policy blend indicates a continuity of government focus on galamsey, extant research indicates that its efficacy is debatable, as formal regulations have not continuously resulted in credible, coordinated and locally execution outcome (Adranyi et al., 2024; Staeferfeldt & Stacey, 2025). At the legal and regulatory level, Ghana still bases its controls on the Minerals and Mining Act, 2006 (Act 703) which forms the statutory framework in regulating mining activity and criminalising mining activities that are carried out in the absence of the requisite mineral rights. Nonetheless, current literature states that the continued existence of illegal mining cannot be attributed to the lack of law, but instead, the failure by the law to be implemented, monitored, decentralised, and coordinated in relation to the mining-sensitive sectors (Adranyi et al., 2024). Adaranyi et al. (2024), in a study discover that the artisanal and small-scale mining (ASM) governance is not actually decentralised in Ghana. That there is partial coherence between mining policy and other sectors, and that the system is characterised by the lack of intersectoral coordination and poor monitoring. These results indicate that the ineffectiveness of policy in combating illegal mining has been undermined by a lack of cohesiveness in the broader governance framework and not merely by legal ineffectiveness (Adranyi et al., 2024).

One of the strands of the recent literature looks at formalisation as a policy solution. Which is meant to transition miners out of informality into a legal and environmentally controlled system by licensing, overseeing, and organized access to mining areas (Bansah, 2023). However, the literature demonstrates that this strategy has yielded mixed outcomes in Ghana. Bansah (2023) lists nine aspects influencing formalisation and believes that corruption and political interference, as well as the integration of political actors in informal mining, have weakened the process. In the same vein, Kumah (2022) demonstrates that, despite the efforts to formalise, regulation has been mostly unsuccessful and that a significant percentage of small-scale mining continues to take place beyond the control of the state. But more importantly, the work by Kumah proves that the grassroots views of miners are relevant, as they are still able to work illegally due to institutional and practical constraints inherent in the formalisation regime itself (Kumah, 2022). Collectively, the research indicates that formalisation in Ghana has been frequently sought as an administrative remedy to a social, political, and livelihood-based issue (Bansah, 2023; Kumah, 2022).

Recent practice has taken this objection a step further and demonstrated that formalisation may become a process of exclusion when it is dictated downwards without due regard to the local survival conditions. Issifu (2026) claims that formalisation in Ghana has been associated with centralised licensing and permitting regime and militarised enforcement measures which put the livelihoods of miners at stake. The research argues that miners are not mere subjects of regulation, but dynamic participants who oppose, adjust to and bargain their survival in a contentious mining environment based on interviews and focus group discussions with ASM operators (Issifu, 2026). It is a valuable contribution since it redefines illegality as not a failure to comply, but rather a reaction to marginalisation, exclusionary governance and struggle to survive (Issifu & Woodworth, 2026).

The other important stream of literature revolves around militarised enforcement, such as bans, raids, and seizure of equipment and military-led actions to keep illegal mining at bay. This is one of the most observable aspects of the anti-galamsey campaign in Ghana, particularly during times when the issue of polluted rivers, forest degradation, and agricultural harm is of high concern (Bansah et al., 2022). Nonetheless, empirical literature lends an increasing amount of scepticism to its effectiveness in the long term. Bansah et al. (2022) find in their study that the application of military force would have minimal and short-lived impact on the elimination of informal artisanal mining in the absence of corrective actions to address the reasons behind the desire to engage in the mining process. The research thus indicates that enforcement that is grounded in the use of force could bring short-term disruption without bringing about a lasting solution (Bansah et al., 2022).

This concern is supported by more recent work that states that militarised interventions can have unintended consequences. As argued by Bansah (2025), in fact military operations have the potential to increase the level of environmental destruction in informal mining areas by pushing the miners to new and less controlled ecological zones. Similarly, Ofosu et al. (2024) opine that anti-illegal mining policy in Ghana cannot be deciphered outside the overall political ecology of ASM because the motivations of illegal mining are geographical, socio-economic, technological and institutional and not necessarily criminal. These studies, when looked at together, go against the idea that harsher punishment always leads to better environmental governance (Bansah, 2025; Ofosu et al., 2024).

In a similar vein, more recent work on environmental governance and political contestation states that illegal small-

scale gold mining in Ghana continues to exist as it is entrenched in a politically charged and socially legitimised context. As noted by Staeffeldt and Stacey (2025), sites are still present even when their operation is attempted to be stopped by the government, and in most cases, they are locally legitimized, seemingly politically impunity, and increasingly participating in local and national political economies. This implies that the enforcement of anti-illegal mining is not a technical issue of rule enforcement, but one that is mediated by the local reliance on mining livelihoods, political interests, and inequitable state power (Stærfeldt and Stacey, 2025). This view point is useful in explaining why technically sound anti-illegal mining might not have lasting effects in practice (Staefert and Stacey, 2025). The state has deployed laws, formalisation programmes, and military crackdowns, yet the evidence repeatedly points to weaknesses in legitimacy, coherence, coordination, and implementation (Adranyi et al., 2024; Bansah, 2023; Bansah et al., 2022; Issifu & Woodworth, 2026; Ofosu & Arthur-Holmes, 2025).

Although these Government measures reflect political will, there is empirical evidence that these measures have shortcomings for long-term success. Asamoah and Osei-Kojo, (2016) argue that enforcement is usually weak due to poor institutional coordination, duplication of roles and political interference at the local level. In the case study of the Bekwai Municipality, they revealed that despite clear national directives, the implementation was in most cases derailed by logistical issues, corruption and the informal ties of local elites and illegal miners. Frimpong and Gyasi (2020) also claim that the credibility of any policy enforcement activity, and its effect as a deterrence, is diminished by political patronage or when those with political weight on their side are treated with kid gloves and the practice of selective enforcement when the high-status actors are immunized, the credibility and deterrence efficiency of policy enforcement is impaired.

In addition, one of the major weaknesses of the enforcement activities lies in the fact that local communities are not incorporated into decision-making. According to Wireko-Gyebi et al. (2020), miners and communities or locals of Ashanti and Western Regions perceived enforcement interventions as something forced on them and discriminative often. Although military raiding resulted in arrests and prosecution of these illegal miners has been the order of the day, but Chinese illegal miners and bigger players who are under political indulgence rarely faced any punishment. This feeling of unfairness or lack of justice creates mistrust and diminishes the community agreement with state actions and even may result in violent confrontation in other cases. Moreover, Atta-Darkwah, (2020) points out that educational and community-based monitoring could supplement enforcement. The survey-based analysis that he conducted showed that regions where local leaders and locals were particularly involved in anti-galamsey movements recorded more sustainable drops in illegal mining patterns. These results indicate that the lack of open, consistent and participatory enforcement strategies will ensure that policies remain unpopular and achieve minimal results in reducing environmental degradation and illegal mining.

Deterrence theory and institutional theory form the theoretical framework of this study. Drawing on principles of criminology and public policy, Deterrence Theory suggests that people are less likely to engage in criminal activities when they believe the likelihood of punishment is high, certain, and swift (Becker, 1968). Applied to illegal mining in Ghana, the theory recommends that effective enforcement, characterised by regular surveillance, arrests, prosecution of citizens, foreigners, illegal mining investors, and prominent politicians, as well as visible repercussions, should help curb galamsey activities. However, empirical evidence shows a lack of deterrence due to inconsistent policy application. Frimpong and Gyasi, (2020) found that, despite initial successes in Operation Vanguard-sponsored military interventions, these efforts failed to sustain deterrence because many arrests went unprosecuted, and enforcement was perceived as politically selective. The absence of a credible threat or punishment reduces the perceived cost of illegal mining, thereby encouraging its persistence. This theory also emphasises that having laws alone is insufficient; there must also be a perception among the public that enforcement is credible, just, and impartial.

Participatory Design / Co-Production theory by Elinor Ostrom in the 1970s, is employed to examine how involving local communities and stakeholders in the design and implementation of anti-illegal mining policies can lead to more effective and sustainable outcomes. It emphasizes collaborative approaches where citizens and authorities work together to co-create solutions. The theory emphasizes Citizen Involvement (active participation of local communities in policy development and enforcement), Shared Responsibility (joint ownership of problems and solutions between citizens and authorities), Contextualized Solutions (policies and interventions tailored to local needs and realities, and Empowerment (Strengthening the capacity of communities to address illegal mining.

Institutional Theory defines the effect of organizational structures, norms, and rules on behavior and judgment within society (Scott, 2004). Within the frame of this study, institutional theory helps in analysing how the effectiveness of policy enforcement by formal institutions (laws, regulatory bodies) and informal systems (local customs, political influence, community norms) is affected within the context of mining governance in Ghana. According to Asamoah and Osei-Kojo (2016), the weaknesses in the institution, which include duplication of tasks by various agencies, lack of effective inter-agency coordination, and the interference of influential stakeholders, affect the outcome of enforcement. Furthermore, the concept of an institutional coalescence, by Borrell et al. (2025), where there is an overlap of informal institutions, including traditional authorities and local elites, converges with official state institutions or agencies and distorts enforcement boundaries. This generates contradictions which leave enforcement failures through which illegal mining proceeds with implied consent. Institutional theory therefore provides a platform through which not only the aspect of policy design can be understood, but also the dynamic nature of implementation, legitimacy and social acceptance, which are important in exploring the perceptions of Ghanaian citizens.

The effects of illegal mining are devastating to the communities (Mensah et al., 2015). Though it presents short-term solutions to the financial needs of these miners, galamsey has contributed to the loss of farmlands, water pollution, and high deforestation (Taylor, 2024). These effects are especially disturbing to rural communities that depend on agriculture and fishing as the main sources of livelihood. The promise of monetary gain through illegal mining is destroying a sense of community cohesion, pitches communities against each other and threatens economic stability in years to come (Osman et al., 2022). The ecological effects of the galamsey business are terrible and multifaceted (Taylor, 2024). Also, illegal miners have infringed on large-scale mining concessions and forest zones considered to be protection zones, thereby presenting complicated jurisdictional and enforcement dilemmas that, in fact, have led to clashes resulting in injuries and deaths (Gaisie, 2024).

Different countries across the world are implementing various measures to counter illegal mining, all of which have met varying levels of success and come with its own set of challenges. Brazil has a militarised enforcement approach to illegal mining, as is seen with Operation OD-TIMU in 2024, when the dismantling of the major illegal mining infrastructure in the Munduruku Indigenous Territory led to extreme economic damages to the criminal groups (Souza et al., 2022). This strategy involves persistent patrols of security forces and Indigenous affairs-oriented agencies to prevent miners never succeed in entering lands. There is also the exploration of alternative livelihood programs by Brazil, including cassava farming and handicrafts but scaling is still a problem. The Oro Legal Program in Colombia has made headway in formalization of artisanal miners thereby reducing mercury consumption by 98 percent and contributing to the rehabilitation of 17,000 hectares of land in addition to the generation of large legal sales of gold due to the transparency of the supply-chain (Robles et al., 2022). In Indonesia, technology is being used to track down deforestation that is driven by mining, especially coal and they have put a moratorium of the issuance of licenses in the prime forest areas even though major coal industry lobbyists have been trying to have it removed (Krasovskii et al., 2018). Together, these present a complex relationship between the enforcement efforts, economic alternative and political commitments in the quest to deal with illegal mining problems in different countries of the world.

Table 1. Comparative policy impacts

Country	Key Measure	Outcome	Weakness	Source
Brazil	Military evictions, Federal police operations and patrols in Munduruku Indigenous Land	Temporary disruption of illegal mining activities in Munduruku territory	Miners migrated to other protected areas, and Policy inconsistency	Wisentainer, 2024; Wenzel, & Mendes, 2025; Gabay, 2025)
Ghana	Specialized courts, Multi-agency anti-illegal mining crackdown	500+ excavators seized, 1,486 arrests	Continued environmental damage; enforcement challenges persist	Government of Ghana, 2025; Mawuenyafia, 2025
Colombia	Formalisation through USAID-funded Oro Legal programme	Reviewed 600+ operations; 11 formalisation projects; reduced mercury use	Limited reach relative to scale of illegal ASGM and dependent on selective participation	Doyle, (2020)
West Africa	Chemical seizures (INTERPOL), INTERPOL operation against illegal mining	200+ arrests; seizures of chemicals, explosives, and mining equipment	Persistent demand for opioids. Ongoing criminal adaptation and cross-border mining operations	INTERPOL (2025)

The Ghanaian government has, over the years, implemented various strategies to combat illegal mining through the enactment of laws, the establishment of task forces, and regulatory bodies (Yeboah, 2023). Measures such as Operation Vanguard and the Inter-Ministerial Committee on Illegal Mining have been introduced to help the government regulate mining operations (Ministry of Lands and Natural Resources, 2017). However, Asamoah and Osei-Kojo (2016) argue that the ineffectiveness of such interventions arises from weak institutional coordination, political interference, and lack of resources. These regulatory measures are often seen as unreliable and handled haphazardly, with limited impact on long-term consequences (Frimpong & Gyasi, 2020).

The recent research studies have underscored the importance of local participation and the opinions of people in the effectiveness of anti-galamsey policies. According to Wireko-Gyebi et al., (2020), they emphasise that most small-scale miners do not feel considered in the decision-making processes, and therefore they resist and show poor adherence to mining regulations. In the same vein, Atta-Darkwah (2020) notes that, to ensure effective enforcement, community participation should be an inherent part of the process, given that individuals at the local level are usually the most direct

beneficiaries of mining activities and targets of crackdowns by the state. The fact that communities feel that enforcement is unfair or biased undermines trust and decreases cooperation (Boateng, 2020).

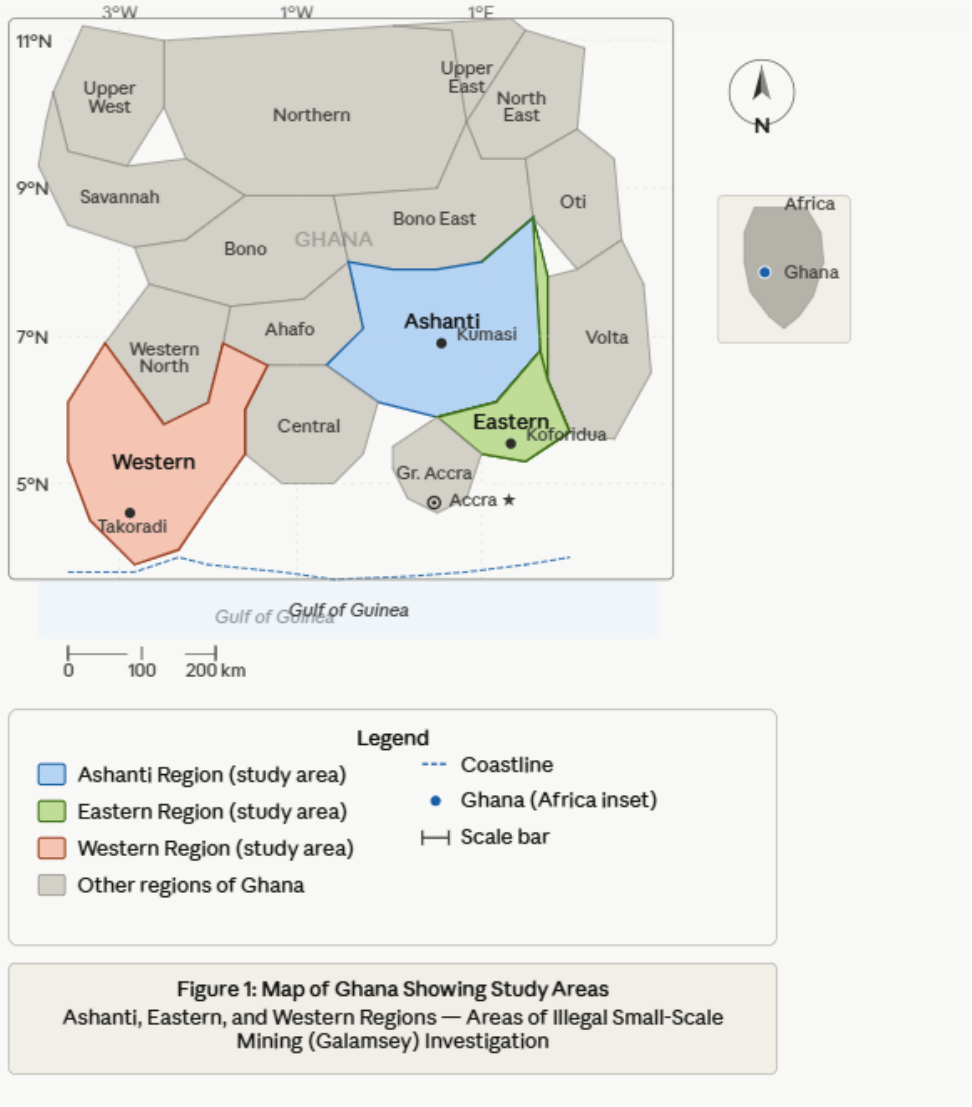

Figure 1: Map of Ghana Showing Study Areas
Ashanti, Eastern, and Western Regions — Areas of Illegal Small-Scale Mining (Galamsey) Investigation

3. Methodology

This study employed a quantitative, descriptive-correlational research design to address the research questions, wherein Research Questions 1 and 2 were assessed using descriptive statistics, while Research Questions 3 and 4 were examined through correlational analyses (Creswell & Creswell, 2017). The research was conducted across the Asante, Eastern, and Western regions of Ghana, where illegal mining is prevalent, encompassing a total population of 10,426,701 as per the 2021 Population and Housing Census conducted by the Ghana Statistical Service (GSS). A proportional random sampling technique was applied to select 400 respondents, guided by Yamane's (1967) formula for determining sample size. The regional distribution of respondents included 209 from Asante (126 retrieved, 60% response rate), 112 from Eastern (94 retrieved, 84% response rate), and 79 from Western (77 retrieved, 97% response rate), yielding an overall retrieval of 297 questionnaires (74%).

The research design used in this study was quantitative, descriptive-correlational research design to investigate the factors that affect illegal mining in Ghana. Research Question 1 and 2 were addressed through descriptive statistics and Research Questions 3 and 4 were explored using Pearson correlation coefficient (Creswell and Creswell, 2017). In this way, the analysis of demographic variables and views on policy enforcement could be conducted comprehensively. The research was carried in the Asante, Eastern, and Western regions of Ghana because they are the regions where illegal mining (galamsey) is prevalent.

A proportional random sampling technique was used to select a sample of respondents from a total population of 10,426,701 across the three regions, as reported by the Ghana Statistical Service (GSS) in the 2021 Population and Housing Census. The sample size was determined using Yamane's (1967) formula, yielding a sample size of 400 respondents. The final sample distribution was: 209 respondents from Asante, 112 from Eastern, and 79 from Western, yielding a total of 297 completed questionnaires (74% response rate). Participants were selected based on their direct involvement or proximity to illegal mining activities. The sample had a gender distribution of 57.9% female (n = 172) and 42.1% male (n = 125). The age distribution was primarily in the 18-35 years group (49.5%), with a broad range of educational backgrounds, including 43.8% with tertiary education. Most respondents were employed (27.9%), followed by farmers (21.5%) and traders (18.2%).

Structured questionnaires were used to collect data, which were administered in person, and a pre-test was carried out to guarantee reliability and validity. All participants were informed of their involvement and confidentiality assured. The demographic characteristics were summarised using descriptive statistics and Pearson correlation coefficient was employed to examine relationship between variables like age, education and perceptions in mining policies. All analyses were done with a significance level of $p < 0.05$.

The research instrument consisted of a 5-point Likert scale measuring continuous variables. The reliability analysis demonstrated acceptable internal consistency, with Cronbach's alpha values of .73 for the Policy Enforcement scale (5 items) and .88 for the Illegal Mining scale (12 items), consistent with Nunnally's (1978) threshold of .70 for adequate reliability. Given that the sample size exceeded 30, the Central Limit Theorem justified the use of parametric statistical tests (Field, 2018). Descriptive statistics (means and standard deviations) were used to analyse Research Questions 1 and 2. Linear regression analysis was conducted to address Research Question 3, and a one-way analysis of variance (ANOVA) was performed to analyse Research Question 4.

4. Results and discussion

The study respondents of 297 participants, most of whom were female (n = 172, 57.9%), with males comprising 42.1% (n = 125). Participants were distributed across age groups as follows: 18–25 (n = 63, 21.2%), 26–35 (n = 84, 28.3%), 36–45 (n = 88, 29.6%), 46–55 (n = 47, 15.8%), and 56–65+ (n = 15, 5.1%). Cumulatively, 49.5% were aged 18–35, indicating a predominantly young-to-midcareer cohort, with the largest single group in 36–45. Educational attainment was led by tertiary education (n = 130, 43.8%), followed by secondary education (n = 68, 22.9%), no formal education (n = 40, 13.5%), postgraduate (n = 32, 10.8%), and primary education (n = 27, 9.1%). Overall, the sample was relatively highly educated, with nearly two-thirds reporting secondary or higher qualifications. Regarding occupation, respondents identified as employed (n = 83, 27.9%), farmer (n = 64, 21.5%), trader (n = 54, 18.2%), student (n = 53, 17.8%), and unemployed (n = 43, 14.5%). Taken together, economically active categories (employed, farmers, traders) accounted for the majority. Participants were drawn from the Ashanti Region (n = 126, 42.4%), Eastern Region (n = 94, 31.6%), and Western Region (n = 77, 25.9%), indicating a regionally diverse sample concentrated in the Ashanti.

As shown in Table 2, on a five-point scale (1 = strongly disagree to 5 = strongly agree), respondents reported very high perceptions of illegal mining prevalence and harm (composite $M = 4.30$, $SD = 0.52$; $N = 297$), strongly agreeing that galamsey is widespread, locally damages the environment, poses health risks, generates national economic losses, and is fuelled by youth unemployment. These convergent perceptions align with prior Ghana-focused research documenting environmental degradation, water pollution, farmland loss, and community disruption linked to illegal mining (e.g., Asiedu & Antwi-Agyei, 2021; Frimpong & Gyasi, 2020; Mensah et al., 2015; Taylor, 2024). The relatively larger dispersion around environmental-impact and unemployment items (SDs ≈ 0.90) suggests place-based heterogeneity consistent with evidence that exposure and enforcement intensity vary across districts and regions (Wireko-Gyebi et al., 2020).

From a deterrence theory perspective, the uniformly high agreement that harms are severe coexists with the persistence of galamsey, implying an insufficient or non-credible deterrent (Becker, 1968). Empirical accounts of selective or inconsistent enforcement arrests without prosecution, perceived political patronage, and unequal treatment of powerful actors undercut the "certainty" and "swiftness" dimensions necessary for deterrence, thereby lowering the expected cost of offending (Frimpong & Gyasi, 2020; Hilson, 2017). Participants' strong concern about health and environmental risks, combined with their acknowledgment of macroeconomic losses, indicates that risk salience alone is not enough; without credible, impartial sanctions, perceived benefits of illegal mining (e.g., immediate income) continue to outweigh perceived costs for many actors.

The findings are also coherent with institutional theory, which explains how formal rules and informal norms jointly shape behaviour (Scott, 2004). Reports of weak coordination, mandate overlaps, and political interference point to institutional misalignment that dilutes policy implementation capacity (Asamoah & Osei-Kojo, 2016). Where informal institutions (e.g., local elites, traditional authority networks) coalesce with or subvert formal enforcement, boundaries blur and enforcement gaps emerge, enabling continued illegality (Borrell et al., 2025). This institutional lens helps explain why high perceived harm does not automatically translate into effective compliance.

At the same time, respondents' strong agreement that youth unemployment contributes to illegal mining is consistent with literature emphasizing opportunity structures and labour-market pressures as proximate drivers (Osman et al., 2022). Here, co-production/participatory design theory (Ostrom) offers a complementary pathway: when communities are meaningfully engaged in rulemaking, monitoring, and benefit-sharing, compliance improves and enforcement gains legitimacy (Atta-Darkwah, 2020). Evidence from Ghana and comparative contexts shows that community-based monitoring, local leader participation, and tailored livelihood alternatives can yield more durable reductions in illegal mining than militarized crackdowns alone (Robles et al., 2022; Souza et al., 2022).

Overall, the pattern of very high perceived harms paired with the attribution of causes to unemployment and weak/uneven enforcement supports a both-and policy diagnosis. First, strengthen credible deterrence, regularized surveillance, impartial prosecutions, and transparent sanctioning so that certainty and consistency of punishment are visible and trusted (Becker, 1968; Frimpong & Gyasi, 2020). Second, remedy institutional frictions clarify mandates, improve inter-agency coordination, firewall political interference, and professionalize inspection and prosecution pipelines (Asamoah & Osei-Kojo, 2016; Hilson, 2017). Third, embed co-produced solutions, co-design monitoring with communities, expand locally appropriate alternative livelihoods, and integrate youth skills programs to address the unemployment channel identified by respondents (Atta-

Darkwah, 2020; Ostrom, as cited in participatory design/co-production literature). In sum, the data substantiate the literature's core claim: enforcement without legitimacy is brittle, and participation without credible sanctions is porous. Durable progress against galamsey requires credible, impartial deterrence operating within aligned institutions, complemented by community co-governance and economic alternatives that shift incentives away from illegal extraction.

Table 2 Illegal Mining

Items	Mean	SD	Degree of Intensity	Verbal Interpretation
▪ Illegal mining (galamsey) is widespread in Ghana today.	4.4	0.655	Strongly Agree	Very High
▪ Illegal mining has significantly impacted on the environment in my community.	4.3	0.904	Strongly Agree	Very High
▪ I am concerned about the health risks associated with illegal mining.	4.3	0.77	Strongly Agree	Very High
▪ Illegal mining contributes to significant economic losses in Ghana.	4.1	0.862	Strongly Agree	Very High
▪ Youth unemployment significantly contributes to illegal mining activities.	4.2	0.933	Strongly Agree	Very High
▪ Illegal Mining	4.3	0.517	Strongly Agree	Very High

Policy enforcement items as shown in Table 3 weighed on a five-point scale (1 = strongly disagree to 5 = strongly agree), the composite Policy Enforcement score indicated overall agreement (M = 3.70, SD = 0.80; N = 297). The strongest endorsements were that weak law enforcement enables illegal mining (M = 4.50, SD = 0.77) and that political interference hinders effective enforcement (M = 4.40, SD = 0.81), alongside the perception that political actors often shield operations from shutdown (M = 4.30, SD = 0.88). Respondents agreed that law-enforcement agencies are active (M = 3.60, SD = 1.33) and expressed moderate confidence in the judiciary (M = 3.70, SD = 1.16), yet they were neutral on whether current policies curb galamsey (M = 3.40, SD = 1.34), whether military crackdowns have lasting effects (M = 3.50, SD = 1.25), whether foreign nationals are adequately punished (M = 3.30, SD = 1.59), whether chiefs enforce anti-galamsey rules (M = 3.30, SD = 1.48), and whether communities are actively involved (M = 3.30, SD = 1.45). Perceived community support for galamsey as livelihood reached agreement (M = 4.00, SD = 1.09). The relatively large dispersions on several items (SDs ≈ 1.2–1.6) indicate marked heterogeneity across locales in views about enforcement practice and actor engagement.

The pattern of high salience of politicization and capacity gaps, tempered confidence in judicial follow-through, and neutrality on the durability of military interventions is consistent with scholarship on institutional fragmentation and principal–agent frictions in Ghana's mining governance (Asamoah & Osei-Kojo, 2016; Hilson, 2017). In deterrence theory terms, respondents' views imply that the certainty and consistency of sanctions remain insufficient to alter payoff calculations (Becker, 1968); perceived shielding of offenders and uneven prosecution lowers expected costs, sustaining noncompliance.

The neutrality around chiefs' enforcement roles and community activism suggests a legitimacy and participation gap, which co-production/participatory design theory predicts will limit rule adherence unless communities are embedded in monitoring, benefit-sharing, and decision processes (Atta-Darkwah, 2020; Ostrom). Comparative evidence reinforces this action of militarized sweeps can disrupt operations but rarely produce enduring deterrence without institutional reforms and livelihood alternatives (Souza et al., 2022), whereas formalization and community-anchored programs have improved compliance and environmental outcomes elsewhere (Robles et al., 2022). Finally, the combination of agreement that agencies are active yet skepticism about outcomes aligns with institutional theory's emphasis on misaligned mandates and informal power networks that dilute policy execution and blur accountability (Scott, 2004). Taken together, the findings support policy packages that insulate enforcement from political influence, clarify and coordinate mandates, strengthen prosecutorial pipelines, and co-produce locally tailored alternatives to shift incentives away from illegal mining.

Table 3 Policy Enforcement (N= 297)

Items	Mean	SD	Degree of Intensity	Verbal Interpretation
Political mechanisms or players often protect illegal mining operations from shutdown.	4.3	0.875	Strongly Agree	Very Good
Community members generally support illegal mining as a livelihood.	4.0	1.09	Agree	Good
Weak law enforcement enables illegal mining to continue unchecked	4.5	0.767	Strongly Agree	Very Good

Current government policies are effective in curbing illegal mining.	3.4	1.335	Neutral	Fair
Traditional leaders (chiefs) are actively involved in enforcing anti-galamsey rules.	3.3	1.477	Neutral	Fair
Military crackdowns (like Operation Vanguard) have sustainably reduced illegal mining.	3.5	1.252	Neutral	Fair
Foreign nationals involved in illegal mining are adequately punished	3.3	1.587	Neutral	Fair
Law enforcement agencies are actively enforcing policies against illegal mining.	3.6	1.327	Agree	Good
I have confidence in the judicial system to deliver fair justice in cases involving illegal mining.	3.7	1.161	Agree	Good
Political interference hinders effective enforcement of policies against illegal mining.	4.4	0.813	Strongly Agree	Very Good
Community members are actively involved in combating illegal mining in my area.	3.3	1.446	Neutral	Fair
I am confident Ghana will significantly reduce illegal mining in the next five years.	3.5	1.242	Neutral	Fair
Policy Enforcement	3.7	0.796	Agree	Good

A simple linear regression examined whether Policy Enforcement predicts perceived Illegal Mining as shown in Table 4. The model was statistically significant, $F(1,295) = 63.70$, $p < .001$, explaining 17.8% of the variance in illegal mining perceptions ($R^2 = .178$, adjusted $R^2 = .175$; RMSE = 0.468). Policy Enforcement was a positive predictor of illegal mining, $B = 0.274$, $SE = 0.034$, $t = 7.98$, $p < .001$, standardized $\beta = .421$. The intercept was $B = 3.235$, $SE = 0.131$, $t = 24.73$, $p < .001$. A 95% CI for the slope (approximate) was (0.206, 0.341) indicating a robust, medium-sized effect (Cohen's $f^2 \approx .22$).

Table 4. Linear Regression

Model Fit Measures

					Overall Model Test			
Model	R	R^2	Adjusted R^2	RMSE	F	df1	df2	p
1	0.421	0.178	0.175	0.468	63.7	1	295	< .001

Omnibus ANOVA Test

	Sum of Squares	df	Mean Square	F	p
Policy Enforcement	14.0	1	14.04	63.7	< .001
Residuals	65.0	295	0.220		

Note. Type 3 sum of squares

Model Coefficients - Illegal Mining

Predictor	Estimate	SE	T	p	Stand. Estimate
Intercept	3.2358	0.1303	24.73	< .001	

Omnibus ANOVA Test

	Sum of Squares	df	Mean Square	F	p
Policy Enforcement	0.274	3	0.034	7.98	< .00
		1		21	0.4

Higher scores on Policy Enforcement (i.e., stronger agreement with items indicating political interference, capacity gaps, uneven sanctions, and mixed institutional engagement) were associated with higher perceived prevalence and harm from illegal mining. Substantively, respondents who view enforcement as politicised or inconsistently applied also perceive galamsey as more widespread and damaging. This aligns with deterrence theory, where the *certainty, celerity,* and *severity* of sanctions are perceived as weak or uneven, the expected costs of offending fall, and sustaining noncompliance (Becker, 1968). It also accords with institutional theory, which attributes implementation failure to mandate overlaps, coordination gaps, and informal power networks that dilute formal rules (Scott, 2004; Asamoah & Osei-Kojo, 2016; Hilson, 2017). In short, perceived enforcement fragility travels with heightened perceptions of illegal mining intensity. The positive slope indicates that the enforcement environment, as experienced and observed by citizens, is *signal-rich* for understanding illegal mining outcomes. Where respondents see political shielding and uneven prosecution, they also report greater harm, a pattern consistent with evidence that selective enforcement undermines deterrence and emboldens actors (Frimpong & Gyasi, 2020). Furthermore, variance in policy-enforcement views (large SDs in Table 3 items) tracks the place-based heterogeneity reported in community studies, where local elites and informal institutions can blunt formal directives (Wireko-Gyebi et al., 2020; Borrell et al., 2025). While the present model is cross-sectional and perception-based (no causal claim), the results are directionally coherent with comparative experiences where military sweeps or headline policies without credible, impartial follow-through rarely generate durable deterrence, whereas formalisation and co-produced monitoring yield more persistent compliance gains (Robles et al., 2022; Souza et al., 2022).

Practically, the findings suggest three levers (a) restore credibility of deterrence by insulating investigations and prosecutions from political influence and regularizing sanction pipelines; (b) repair institutional seams by clarifying mandates and coordinating enforcement agencies; and (c) embed co-production with communities to raise legitimacy and lower reliance on illegal livelihoods. Notably, $R^2 = .178$means most variance remains unexplained, consistent with literature highlighting additional drivers labour-market pressures, opportunity structures, and resource governance incentives that should be modelled alongside enforcement perceptions in future work.

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A one-way ANOVA tested whether gender predicted perceptions of illegal mining as shown in table 5. The effect was not significant, $F(1, 295) = 0.659$, $p = .418$, $\eta^2 = .002$, $\eta^2_p = .002$, indicating a trivial effect size. The post-hoc comparison (female vs. male; Tukey-adjusted) likewise showed no meaningful difference, mean difference = −0.049, SE = 0.061, $t(295) = -0.812$, $p = .418$, $d = -0.10$, with a 95% CI that spanned zero [−0.327, 0.136].

Table 5. One-Way ANOVA of Gender Differences in Perceptions of Illegal Mining.

Dependent Variable: Perceptions of Illegal Mining

	Sum of Squares	df	Mean Square	F	p	η^2	η^2p
Overall model	0.176	1	0.176	0.659	0.418		
Gender	0.176	1	0.176	0.659	0.418	0.002	0.002
Residuals	78.880	295	0.267				

Post Hoc Comparisons – Gender

Comparison								95% Confidence Interval	
Gender	Gender	Mean Difference	SE	Df	t	p_{tukey}	Cohen's d	Lower	Upper
Female	- Male	-0.0493	0.0608	295	-0.812	0.418	-0.0954	-0.327	0.136

Source: Author's fieldwork (2025)

Perceptions of illegal mining do not differ by gender in this sample. Given the negligible effect sizes ($\eta^2 \approx .002$; $d \approx -0.10$), any gender-related variation is practically insignificant. This aligns with governance scholarship emphasizing structural and institutional conditions such as enforcement credibility, coordination among agencies, and local power dynamics rather than demographic attributes, chiefly shape attitudes toward illicit resource extraction and its enforcement.

Policy communication and intervention design need not be gender-differentiated for this outcome; resources are better directed toward systemic levers (credible, impartial enforcement; inter-agency coordination; community co-production) that more directly influence illegal-mining dynamics.

A one-way ANOVA tested differences in perceived illegal mining across five age groups in Table 6. The omnibus effect was significant, $F(4, 292) = 2.87$, $p = .023$, $\eta^2 = .038$, $\eta^2_p = .038$, $\omega^2 = .025$, indicating a small effect. Tukey post-hoc tests showed that the 18–25 group reported significantly lower scores than the 36–45 group (mean difference = −0.255, SE = 0.084, $t(292) = -3.03$, p_tukey = .022). All other pairwise comparisons were not statistically significant after Tukey adjustment.

Table 6. One-Way ANOVA of Age Group Differences in Perceptions of Illegal Mining

	Sum of Squares	df	Mean Square	F	p	η^2	η^2p	ω^2
Age Group	2.99	4	0.749	287	0.023	0.038	0.038	0.025
Residuals	76.06	292	0.260					

Post Hoc Tests

Post Hoc Comparisons of Age Groups on Perceptions of Illegal Mining

Comparison							
Age Group		Age Group	Mean Difference	SE	df	t	p_{tukey}
18-25	-	26-35	-0.16865	0.0851	292	-1.9827	0.277
	-	36-45	-0.25518	0.0842	292	-3.0295	0.022
	-	46-55	-0.25839	0.0984	292	-2.6267	0.068
	-	56-65 and above	-0.28222	0.1466	292	-1.9247	0.307

Post Hoc Comparisons of Age Groups on Perceptions of Illegal Mining

Comparison							
Age Group		Age Group	Mean Difference	SE	df	t	p_{tukey}
26-35	-	36-45	-0.08653	0.0779	292	-1.1114	0.800
	-	46-55	-0.08974	0.0930	292	-0.9653	0.871
	-	56-65 and above	-0.11357	0.1431	292	-0.7939	0.932
36-45	-	46-55	-0.00322	0.0922	292	-0.0349	1.000
	-	56-65 and above	-0.02705	0.1426	292	-0.1897	1.000
46-55	-	56-65 and above	-0.02383	0.1514	292	-0.1574	1.000

Source: Author's fieldwork (2025)

Perceptions of illegal mining vary modestly by age, with younger respondents (18–25) rating its prevalence/harms lower than mid-career adults (36–45). The small effect sizes suggest age explains limited variance in perceptions. A life-cycle or exposure account may apply mid-career cohorts are more likely to manage households, farms, or businesses and to interact with local governance processes, potentially heightening salience of environmental and enforcement problems. Within a governance lens, cohort differences may reflect variation in institutional contact and policy touchpoints rather than stable attitudinal divides.

Risk communication and enforcement outreach may need age-tailored framing e.g., targeted engagement in schools and youth programs to elevate salience among 18–25 year-olds, and co-production efforts with mid-career community leaders to convert concern into sustained monitoring. Given the small ω^2, policy impact is likely greater when focusing on systemic levers (credible, consistent sanctions; inter-agency coordination; community co-governance) while using age-specific messaging as a complement rather than a primary strategy.

A one-way ANOVA tested differences in perceived illegal mining across five educational levels as shown in Table 7. The omnibus effect was significant, $F(4, 292) = 3.59$, $p = .007$, $\eta^2 = .047$, $\eta^2_p = .047$, $\omega^2 = .034$, indicating a small effect. Tukey post-hoc tests showed that the Secondary group reported significantly lower scores than the Postgraduate group (mean difference = 0.340, SE = 0.109, $t(292) = 3.13$, p_tukey = .017) and the Primary education group (mean difference = 0.330, SE = 0.116, $t(292) = 2.85$, p_tukey = .037). All other pairwise comparisons were not statistically significant after Tukey adjustment.

Table 7. Differences in Perceptions of Illegal Mining by Educational Level: One-Way ANOVA and Post Hoc Tests

	Sum of Squares	df	Mean Square	F	p	η^2	η^2p	ω^2
Educational Level	3.70	4	0.926	3.59	0.007	0.047	0.047	0.034
Residuals	75.35	292	0.258					

Post Hoc Tests

Post Hoc Comparisons - Educational Level

Comparison								
Educational Level		Educational Level	Mean Difference	SE	df	t	p_{tukey}	Cohen's d
No formal education	-	Postgraduate	-0.2500	0.1205	292	-2.0750	0.234	-0.4921
	-	Primary education	-0.2394	0.1265	292	-1.8917	0.324	-0.4712
	-	Secondary education	0.0904	0.1012	292	0.8935	0.899	0.1780

Post Hoc Comparisons - Educational Level

Comparison								
Educational Level		Educational Level	Mean Difference	SE	df	t	p_{tukey}	Cohen's d
Postgraduate	-	Tertiary education	-0.0360	0.0919	292	-0.3915	0.995	-0.0708
	-	Primary education	0.0106	0.1327	292	0.0802	1.000	0.0210
	-	Secondary education	0.3404	0.1089	292	3.1262	0.017	0.6702
	-	Tertiary education	0.2140	0.1002	292	2.1351	0.208	0.4213
Primary education	-	Secondary education	0.3298	0.1156	292	2.8540	0.037	0.6492
	-	Tertiary education	0.2034	0.1074	292	1.8931	0.323	0.4004
Secondary education	-	Tertiary education	-0.1264	0.0760	292	-1.6626	0.459	-0.2488

Source: Author's fieldwork (2025)

Perceptions of illegal mining vary modestly with education: respondents with Postgraduate and Primary education expressed higher perceived prevalence/harms than those with Secondary education, while differences involving No formal and Tertiary education were not reliable. The small effect sizes indicate education accounts for limited variance in perceptions. One plausible reading is exposure and informational channels: postgraduate respondents may track governance and environmental reporting more closely, whereas primary-educated respondents may experience localized impacts firsthand; by contrast, secondary-educated respondents may have comparatively lower salience.

Risk communication could be segmented by education: evidence-rich messaging for highly educated audiences and community-anchored, place-based messaging for basic-education communities. Consistent with governance scholarship and deterrence frameworks, perception gaps are unlikely to close without credible, even-handed enforcement and clear institutional coordination; thus education-tailored outreach should complement, not substitute for, systemic measures that enhance the certainty and impartiality of sanctions and involve communities in co-produced monitoring.

A one-way ANOVA tested differences in perceived illegal mining across five occupational groups in Table 8. The omnibus effect was significant, $F(4, 292) = 4.10$, $p = .003$, $\eta^2 = .053$, $\eta^2_p = .053$, $\omega^2 = .040$, indicating a small-to-moderate effect. Tukey post-hoc tests showed that respondents in formal employment reported higher perceived illegal-mining prevalence/harms than students (mean difference = 0.282, SE = 0.089, $t(292) = 3.17$, p_tukey = .015) and traders (mean difference = 0.282, SE = 0.089, $t(292) = 3.19$, p_tukey = .014). All other pairwise comparisons were not statistically significant after Tukey adjustment.

Table 8. Differences in Perceptions of Illegal Mining by Occupation: One-Way ANOVA and Post Hoc Tests

	Sum of Squares	df	Mean Square	F	p	η^2	η^2p	ω^2
Occupation	4.21	4	1.052	4.10	0.003	0.053	0.053	0.040
Residuals	74.85	292	0.256					

Post Hoc Tests

Post Hoc Comparisons - Occupation

Comparison								
Occupation		Occupation	Mean Difference	SE	df	t	p_{tukey}	Cohen's d
Formal Employment	-	Farmer	0.0602	0.0842	292	0.715	0.953	0.1189
	-	Student	0.2820	0.0890	292	3.168	0.015	0.5570
	-	Trader	0.2821	0.0885	292	3.187	0.014	0.5572
	-	Unemployed	0.1100	0.0951	292	1.156	0.776	0.2173
Farmer	-	Student	0.2218	0.0940	292	2.359	0.130	0.4382
	-	Trader	0.2219	0.0936	292	2.372	0.126	0.4383
	-	Unemployed	0.0498	0.0998	292	0.499	0.987	0.0984
Student	-	Trader	8.74e-5	0.0979	292	8.92e-4	1.000	1.73e-4
	-	Unemployed	-0.1720	0.1039	292	-1.656	0.463	-0.3398
Trader	-	Unemployed	-0.1721	0.1035	292	-1.663	0.458	-0.3399

Source: Author's fieldwork (2025)

Perceptions of illegal mining vary by occupational status. Workers in formal employment perceive the issue as more prevalent and harmful than do students and traders, whereas farmers and the unemployed do not differ reliably from other groups after correction. The effect sizes suggest that occupation explains a modest share of variance. One interpretation is exposure and information asymmetry; formally employed respondents often with greater engagement in institutional processes and media may be more attuned to enforcement, environmental, and economic consequences, while students and traders could prioritize immediate livelihood or academic concerns, reducing perceived salience.

Communication and enforcement outreach may be tailored by occupation. For students and informal-sector traders, use localized, practice-oriented messaging (e.g., water safety, health, and livelihood risks) and embed co-produced monitoring with community stakeholders to strengthen legitimacy. For formally employed groups, emphasize policy follow-through, transparent sanctioning, and reporting channels to convert concern into sustained support for credible, impartial deterrence. Because ω^2 indicates only modest explanatory power, the largest gains are still expected from systemic levers consistent sanctions, inter-agency coordination, and participatory governance while occupation-specific messaging serves as a complementary A one-way ANOVA tested differences in perceived illegal mining across three regions (Ashanti, Eastern, Western) as shown in Table 9. The omnibus effect was not significant, $F(2, 294) = 0.068$, $p = .935$, $\eta^2 = .000$, $\eta^2_p = .000$, $\omega^2 = -.006$, indicating a negligible effect size. Consistent with the omnibus test, Tukey post-hoc comparisons were non-significant: Ashanti vs. Eastern (mean difference = −0.015, SE = 0.071, $t(294) = -0.21$, p_tukey = .975), Ashanti vs. Western (mean difference = −0.027, SE = 0.075, $t(294) = -0.36$, p_tukey = .931), and Eastern vs. Western (mean difference = −0.012, SE = 0.080, $t(294) = -0.15$, p_tukey = .988).

Table 9. Differences in Perceptions of Illegal Mining across Ashanti, Eastern, and Western Regions: One-Way ANOVA and Post Hoc Tests

	Sum of Squares	df	Mean Square	F	p	η^2	η^2p	ω^2
Region	0.0363	2	0.0182	0.0676	0.935	0.000	0.000	-0.006
Residuals	79.0196	294	0.2688					

Post Hoc Tests

Post Hoc Comparisons - Region

Comparison								
Region		Region	Mean Difference	SE	df	t	p_{tukey}	Cohen's d
Ashanti Region	-	Eastern Region	-0.0151	0.0707	294	-0.214	0.975	-0.0292
	-	Western Region	-0.0270	0.0750	294	-0.360	0.931	-0.0520
Eastern Region	-	Western Region	-0.0119	0.0797	294	-0.149	0.988	-0.0229

Source: Author's fieldwork (2025)

Perceptions of illegal mining do not differ by region in this sample. The null finding and trivial effect metrics suggest that regional location, by itself, explains virtually none of the variance in perceived prevalence/harms. This pattern is consistent with accounts that emphasize system-level drivers (e.g., enforcement credibility, political interference, and institutional coordination) which can operate similarly across administrative regions, thereby flattening regional contrasts in perceptions. Policy messaging and intervention design need not be region-specific for this outcome; resources may be more effectively allocated to cross-cutting, systemic levers credible and impartial enforcement, inter-agency coordination, and community co-governance mechanisms.

5. Conclusion

This study reveals a consistent public perception that illegal mining is widespread and harmful, while enforcement, though visible, is undermined by politicization, uneven sanctions, and weak community integration. The positive correlation between perceived enforcement weaknesses and the salience of illegal mining is indicative of the credibility gaps enhancing perceptions of prevalence and harm. There is a small range of differences between demographics, further suggesting that these issues are not group specific. The results provide valuable theoretical information. In line with the deterrence theory, the more the punishment is perceived to be uncertain or biased, the less effective the enforcement will be. Institutional theory describes the weaknesses in implementation and legitimacy destruction of institutions arising because of overlapping mandates, coordination failures, and informal power relationships. In terms of resource-based perspective, lack of intangible governance, including coordination, transparency, and trust limits enforcement effectiveness. Overall, the findings highlight the role of enhancing the credibility of enforcement and institutional coherence as the key to sustainable progress.

6. Implications

These findings suggest that addressing illegal mining requires moving beyond a narrow focus on enforcement intensity toward improving the overall quality of governance. Specifically, the enhancement of institutional coordination, transparency, and trust between the authorities and communities are the core factors in enhancing compliance. It is also evident in the results that the incorporation of community actors into the governance processes is important because legitimacy and participation are imperative in maintaining outcomes. In a broader sense, the research adds to the knowledge regarding the influence of perceptions of enforcement on problem salience, especially in the situations that are institutional complex.

This study documents a consistent public narrative: illegal mining is widely perceived as pervasive and harmful, while policy enforcement is viewed as active yet undermined by politicisation, uneven sanctions, and limited community integration. The positive association between enforcement perceptions and illegal-mining salience indicates that where citizens perceive weaker, less credible enforcement, they also perceive greater prevalence and harm. Null differences by gender and region, coupled with only modest differences by age, education, and occupation, suggest that system-level dynamics cut across demographic and geographic lines. In theoretical terms, deterrence is blunted when certainty and impartiality of punishment are questioned; institutional frictions (mandate overlaps, coordination gaps, informal power) dilute execution; and the absence of co-production constrains legitimacy and durability of compliance. Together, these findings underscore that sustainable progress requires both credible sanctioning and participatory governance.

7. Recommendations

First, restore credible deterrence: insulate investigations and prosecutions from political interference; standardize arrest-to-prosecution pipelines; publish enforcement dashboards (charges, convictions, asset seizures) to signal certainty and transparency. Second, repair institutional seams: clarify mandates among the Ministry of Lands and

Natural Resources, EPA, Minerals Commission, police, and judiciary; institute joint tasking and shared metrics; and resource district-level units for timely inspections and case preparation.

Third, embed co-production: formalize community monitoring committees with protected whistleblowing channels; require benefit-sharing agreements where legal small-scale mining is permitted; and integrate traditional leaders in due-process-bound roles. Fourth, reduce opportunity structures: scale alternative livelihoods (e.g., land restoration jobs, agro-processing, eco-tourism) and youth skills programs targeted to galamsey-affected districts, sequenced with enforcement to avoid backsliding.

Fifth, modernise oversight: deploy geospatial surveillance (river turbidity, forest loss alerts), link to rapid response teams, and audit procurement and custody chains for seized equipment. Finally, tailor communication: evidence-rich briefs for highly educated and formally employed audiences; practical, place-based messaging for students and informal-sector workers while maintaining a uniform emphasis on fairness, due process, and community safety. Implemented together, these measures can align incentives, enhance legitimacy, and shift behaviour toward lawful, environmentally responsible resource use.

8. Limitations of the study

There are various limitations that this study has and should be taken into consideration when interpreting the findings. The cross-sectional, perception-based design, first, does not permit causal inference; and can be influenced by recall and social desirability bias. But was mitigated by anonymity of respondents, the absence of identifying information, and use of neutrally phrased items to reduce distortion of responses. Second, there is a limitation of generalisability due to the research being limited to three mining areas (Ashanti, Eastern, and Western) and uneven response rates, which was addressed by multi-site sampling of major mining areas and follow-up to enhance response coverage. Third, the measurement scales were found to be reliable enough (Illegal Mining $\alpha = .88$; Policy Enforcement $\alpha = .73$); however, the scale was too narrow to be considered sufficiently broad, and to mitigate that, items were modified based on the literature sources. Fourth, the use of one survey instrument can create common-method variance; this was minimised by disaggregating predictor and outcome items and changing their sequence in the questionnaire. Lastly, the comparatively low explanatory power of the model (R2 =.18) implies that other variables like closeness to mining locations and media coverage were not accounted for; which was partly compensated using demographic and occupational controls. Future studies ought to be longitudinal and multilevel in nature and incorporate geospatial and administrative information to make more robust inferences.

This study has several limitations that qualify the interpretation of findings. First, its cross-sectional, perception-based design precludes causal inference and may reflect recall and social-desirability biases. Second, generalizability is constrained by coverage of only three mining regions (Ashanti, Eastern, Western), with uneven retrieval rates that may introduce nonresponse bias. Third, while internal consistency for the brief Likert scales was acceptable (Illegal Mining $\alpha = .88$; Policy Enforcement $\alpha = .73$), measurement breadth was limited and may omit salient facets of enforcement (e.g., prosecution timelines, asset forfeiture) and livelihood dependence. Fourth, the use of a single survey instrument for predictors and outcomes risks common-method variance, potentially inflating associations. Fifth, the regression explained a modest proportion of variance ($R^2 \approx .18$), suggesting omitted variables such as proximity to active sites, prior enforcement encounters, media exposure, political affiliation, and household economic reliance could confound results. Finally, illegal mining and policy enforcement dynamics are time-sensitive; the study's timing may not capture seasonal or post-intervention shifts. Future research should employ longitudinal or multilevel designs, link geospatial/administrative data, and incorporate mixed methods to enhance validity and policy relevance.

9. Policy recommendations

The policy priorities need to be on rebuilding credible deterrence by shielding the enforcement procedures against political intrusions, standardising arrest-to-prosecution procedures, and enhancing transparency by making the enforcement measures publicly available. The coordination among institutions can be enhanced by making their mandates more explicit, establishing joint operational patterns, and enhance the resourcing of the units at the district level. Clearer mandates, operational frameworks, and better resourcing of the units functioning at the district level should serve to strengthen the institutional coordination.

Embedding community participation mechanisms is equally important. The legitimacy can be strengthened by formal community-monitoring frameworks, confidential reporting, and compliance can be reinforced by benefit-sharing schemes in legitimate small-scale minerals mining districts. On the same note, alternative livelihood initiatives, including land restoration, agro-processing and eco-tourism need to be increased in the affected districts.

Lastly, enhanced accountability via modernizing oversight with geospatial surveillance and increased auditing of seized equipment, and targeted communication plans can solidify public trust, and norms of lawful, and environmentally responsible behaviour.

Disclosure of Interest

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Data from this study is available on request and will be provided upon reasonable request. Access to the dataset will follow ethical and confidentiality requirements concerning the study participants.

Author Contributions

The authors played a major role in the conception and design of the study. All of the authors participated in the responsibilities of collecting data, analysing, interpreting the findings, and drafting, revising, and proofreading the final version of the submitted paper.

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