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Artisanal and small-scale gold mining governance and cross-sectoral policy coherence in Ghana

Enoch Adranyi [a,*], Lindsay C. Stringer [b], Henrice Altink [c]

[a] Department of Environment and Geography,Department of Politics (Interdisciplinary Global Development Centre (IGDC)), University of York, York, YO10 5DD, UK
[b] York Environmental Sustainability Institute, Department of Environment and Geography, Wentworth Way, University of York, York, YO10 5NG, UK
[c] Interdisciplinary Global Development Centre (IGDC), Department of History, University of York, York, YO10 5DD, UK

1. Introduction

Artisanal and small-scale mining (ASM) involves low-tech, labour-intensive mineral processing and extraction. ASM is an essential way of life for about 45 million people around the world (World Bank, 2020) and makes an important contribution to economic development in many developing countries. In Ghana, Malawi, and Peru, ASM supports foreign exchange, employment, income, and livelihood diversification for both skilled and unskilled workers (Adranyi et al., 2023; Kamlongera, 2011; Malone et al., 2021). Africa has around 10 million artisanal miners, most unlicensed, extracting gold, diamonds, bauxite, and more (World Bank, 2020). In Ghana, gold is the primary mineral extracted by around 1 million ASM workers. The artisanal and small-scale gold mining (ASGM) sector now accounts for about 35% of the nation's gold production (Fig. 1). The global demand for gold and other minerals is expected to grow, with prices continuing to rise, driven by expanding urban populations and the shift to low-carbon, metal-intensive energy technologies.

In Ghana and globally, most ASM workers operate informally without necessary licenses and permits, using poor mining techniques and substandard environmental, social, and governance practices. Environmental impacts include land degradation, river pollution, and mercury exposure, posing health risks (Bansah et al., 2018). Socially, ASGM pressures traditional livelihoods like agriculture and creates tensions between miners and landowners (Boadi et al., 2016). Economically, the lack of technical and financial support leads to underdeveloped market mechanisms and informal lending systems, leaving miners vulnerable to exploitation (Hilson and Maconachie, 2020). This situation also contributes to smuggling and illicit financial flows through tax evasion and illegal foreign exchange (Kalokoh and Kochtcheeva, 2022). Overall, informality presents significant challenges for all stakeholders, especially for miners, resulting in precarious livelihoods, lack of legal rights, insecure land tenure, and dangerous working conditions. Poor mining practices lead to low mineral recovery rates and earnings, while a lack of technical knowledge and access to finance perpetuates the cycle of informality (Pedersen et al., 2021).

There is broad consensus among scholars, policymakers, and governments that ASM should be formalized, integrating it into the formal economy through a standardized legal framework governed by a central state system (Geenen, 2012) and appropriate regulatory and policy actions (Hilson et al., 2017). Formalization would transition actors from the informal to the formal sector, addressing ASGM's issues and benefiting both operators and governments (Amankwah and Anim-Sackey, 2003; Echavarria, 2014).

However, across SSA and elsewhere formalization processes often fail due to factors such as partisan politics, corruption, rent-seeking behaviour of government officials, administrative bureaucracy, lack of capacity to enforce laws and the government's prioritization of the expansion of large-scale mining (Fold et al., 2014; Hilson and Potter, 2005; Kumah, 2022; Verbrugge, 2015). Hilson (2002) attributes the persistence of informal ASGM in SSA to inappropriate laws and policy frameworks that governments are unwilling to directly address. However, ineffective governance frameworks can exacerbate inequalities, especially if licenses are expensive or formalization processes are unachievable for the poorest miners.

An effective legal framework should address legal issues pertaining to ASGM across its entire value chain. Despite its importance, there is a notable lack of analysis examining how current legal frameworks interact along the ASGM value chain. Exploring the challenges of formalization across this value chain can reveal where existing laws and policies may be incompatible with actual ASGM operations, thereby perpetuating informality. This study addresses this challenge by examining the legal aspects impacting ASGM from extraction to market, with the aim of informing policy and enhancing regulatory measures.

Existing studies have focused on reviewing regulations and policies within the ASGM sector (Adu-Baffour et al., 2021), but there is a lack of analysis of policy coherence between ASGM and other productive sectors sensitive to mining activities. This gap hinders full understanding of

* Corresponding author.
E-mail addresses: esa524@york.ac.uk (E. Adranyi), lindsay.stringer@york.ac.uk (L.C. Stringer), henrice.altink@york.ac.uk (H. Altink).

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why informality persists despite formalization efforts. Addressing ASGM issues without considering its effects on other sectors that sustain rural livelihoods risks unforeseen negative impacts on these activities. Effective ASGM governance requires integration across multiple sectors. Understanding how ASGM policies interface with policies in mining sensitive sectors is vital to enhancing ASGM formalization outcomes, as well as promoting sustainable ASGM activities in support of other economic activities and livelihoods (Nilsson et al., 2012). To the best of our knowledge, this is the first paper to address this critical gap by considering policy coherence across the mining-sensitive sectors (mining, land, agriculture, environment, water and development), ultimately informing a more holistic and sustainable approach to ASGM governance. These sectors were selected due to their considerable interactions with ASGM operations on the ground (Adu-Baffour et al., 2021; Nyame and Blocher, 2010; Tschakert, 2009).

Policy coherence, defined as "the systematic promotion of mutually reinforcing policy actions across government departments and agencies, creating synergies towards achieving the agreed objectives" (OECD, 2004) is crucial for effective formalization. Policy coherence analysis can span policy formulation, content, and implementation across sectors (Nilsson et al., 2012). This policy analysis considers policy content (objectives, design, and instruments) and implementation at regional and district levels (Antwi-Agyei et al., 2017). Analyzing policy coherence can reveal strategies to enhance synergies and co-benefits within policy areas linked to ASGM governance, reducing conflicts among objectives, instruments, and implementation processes. Coherent policy-making can support governments, institutions, and sectors in navigating trade-offs transparently and equitably (Shawoo et al., 2023).

This paper focuses on Ghana, the largest gold producer in Africa and a country that provides a compelling case due to its steady evolution in ASGM. Since the mid-1980s, Ghana has developed and adopted a legal and institutional framework that governs both its large and small-scale mining industries, aiming to promote, formalize and regulate the mining sector (MLNR, 2014; Teschner, 2012). Despite the government legalizing the ASGM sector in 1989 and imposing regulations for responsible mining, informal ASGM remains prevalent (Kumah, 2022). Findings from this study could, therefore, have wider implications for SSA and beyond. The study aims to examine Ghana's current legal and regulatory framework and analyse intersectoral policy coherence concerning ASGM governance, with a particular focus on formalization. It asks: Do existing laws and regulations on ASGM formalization address the main activities along the sector's value chain? To what extent is mining policy coherent with policies of other mining-sensitive sectors regarding sustainable ASGM? What challenges impact policy coherence between the mining sector and the other mining-sensitive sectors, thereby affecting ASGM formalization outcomes? By addressing these questions, the study provides insights that could have wider implications for the SSA region and globally.

2. Literature review

ASGM interacts with various sectors of the society and impacts them in different ways, including critical ones such as development, agriculture, land, environment and water. As such, ASGM governance can be challenging. Poor governance, characterized by inadequate policy design that fails to consider the objectives and interests of other vital sectors, can undermine efforts to formalize and make ASGM sustainable (Maconachie and Conteh, 2021).

ASGM affects livelihoods in mining communities and influences both rural and national development. Most ASGM communities in Ghana exhibit low development levels, relying heavily on natural-resource-based livelihoods. Informal ASGM practices, characterized by rush or seasonal activities, often fail to support community development, as migrant miners typically do not invest locally (Kumah, 2022). Rapid expansion of ASGM has severely impacted forests, farmlands, and waterways, creating disparities in livelihood opportunities and exacerbating social issues such as poor health and safety, disruptions to agriculture, and tensions between miners and landowners (Pedersen et al., 2021; Boadi et al., 2016).

The transient nature of informal ASGM underscores the need for a formalized and regulated sector to drive sustained development. Since the mid-1990s, ASGM formalization in Ghana and SSA has been supported by donors, multilateral agencies, and governments (Hilson et al., 2017, 2022). Despite increased attention, ASGM in Ghana remains largely informal and faces governance challenges (Bansah et al., 2018). Likewise, in Zimbabwe, ASGM formalization policies tend to benefit the politically connected, reinforcing patronage systems and favouring elite groups, while excluding most ASGM miners (Mkodzongi and Spiegel, 2019). This existing scholarship points towards the urgent need to align ASGM policies with development-focused policies to boost ASGM formalization efforts.

ASGM frequently intersects with agriculture in rural areas in complex ways that can be complementary or competitive. ASGM provides farmers with income diversification opportunities, investing earnings from one sector into the other (Hilson, 2016; Mkodzongi and Spiegel, 2019). The influx of migrant workers into ASGM communities also boosts demand for food crops, benefiting local farmers. However, competition arises due to shared resources like land, water, and labor,

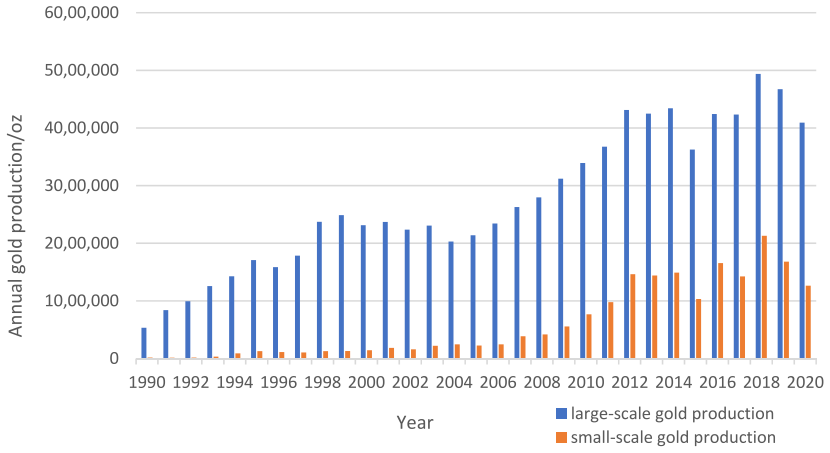

Fig. 1. Ghana's gold production in the large and small-scale sectors from 1990 to 2020.
Data source: Gold production (1990–2015) retrieved from Ministry of Finance - GHEITI Secretariat (2018); gold production (2016–2020) obtained from Minerals Commission (2021).

leading to potential environmental degradation (Hausermann et al., 2018). While existing research describes the benefits and drawbacks for miners and farmers, it lacks a policy-level analysis of the ASGM-agriculture relationship (Hilson and Garforth, 2012; Pijpers, 2014). Given ASGM's expanding scope and its growing ties to agriculture, a comprehensive analysis of their relationship is crucial.

Access to land is crucial for ASGM operations. Ghana's land tenure system is defined by customary and statutory rules. Customary land tenure, under the control of chiefs and family heads, constitutes approximately 80% of the country's land area (Ghebru and Lambrecht, 2017). Miners are required to manoeuvre customary and statutory procedures to acquire mine sites and comply with regulations to secure land titles and licenses (Frimpong Boamah et al., 2020). Studies have highlighted how existing customary land tenure practices largely dictate miners' access to land, enforcing informality of the ASGM sector (Nyame and Blocher, 2010) and how the intersection of state-based mining titling systems with customary land tenure arrangements impacts ASM formalization efforts (Mensah, 2021). For instance, marginalised groups may encounter barriers to land access and mining permits, limiting their participation in ASGM and its benefits. Sustainable ASGM thus significantly hinges on effective coordination between the institutions governing the mining sector and the land sector. However, there is limited knowledge on policy coherence and coordination between mining and land in the Ghanaian context. Understanding these dynamics is crucial for assessing ASGM's broader implications on rural livelihoods and developing sustainable practices.

Many studies have also shown that ASGM activities come with high environmental costs (Ncube-Phiri et al., 2015; Bansah et al., 2018; Ofosu et al., 2020), including land degradation, destruction of flora and fauna, air pollution, and heavy metal contamination of sediments, surface, and groundwater, particularly due to extraction and processing methods that use mercury (Arthur et al., 2016; Aryee et al., 2003; Ofosu et al., 2020). Despite ASGM formalization efforts, Ghana is experiencing significant environmental degradation from ASGM activities (Adranyi et al., 2024). Close coordination between mining and environmental sectors is necessary to promote sustainable ASGM. However, existing scholarship has not explored this coordination.

Additionally, access to clean water is essential for community development, yet the ASGM sector has led to significant deforestation and water pollution in SSA. Attempts at formalizing ASM in Africa seem to inadequately consider water management issues (Arthur-Holmes et al., 2022). In Ghana, ASGM continue to severely pollute major rivers and undermines government efforts to ensure clean drinking water (Arthur-Holmes et al., 2022). The government implemented a ban on all ASGM activities from February 2017 to December 2018, and established Operation Vanguard, composed of police and military personnel, to enforce it and combat illegal ASGM. The Ghana Media Coalition's '#StopGalamseyNow' campaign in 2017 supported these efforts, with the government launching Operation Halt in 2021 and 2022 to further combat illegal ASGM or 'galamsey'. Despite these efforts, informal ASGM remains widespread, indicating insufficient cooperation among various stakeholders and institutions necessary for successful ASGM formalization. There is a critical gap in understanding the interplay between mining and water sectors, which is essential for safeguarding water resources and promoting clean water initiatives amidst evolving ASGM practices (Hilson and Maconachie, 2020).

3. Methodology

A combination of extensive document reviews and qualitative document analysis was used, complemented with expert interviews of actors in mining-sensitive sectors.

3.1. Document review

To ensure comprehensive review of the legal framework, the Minerals Commission (MC)'s website (https://www.mincom.gov.gh/acts/) was searched for all current acts and regulations on mining in March 2023. Those that covered small-scale mining were selected and downloaded (see Appendix A1 for a list of Ghana's laws and regulations on ASGM, with those reviewed in italics; policy documents are analysed separately under section 3.2). Guided by the documents' 'Table of Contents' and the search word 'small-scale mining', sections and paragraphs of the acts and regulations that centred on small-scale mining were fully read and examined. Documents relating to ASGM licensing in Ghana were also sought. On MC's website, the *Small-scale and Community Mining Operational Manual 2021* was found and selected (MLNR, 2021). A search of an international database on ASM - https://delvedatabase.org/resources, produced the *Artisanal and Small-scale Mining Handbook for Ghana, 2017 by* Tychsen et al. (2017) which was selected. Also, to aid assessment of the effectiveness of the laws and regulations, a search was conducted on Ghana's audit service's website (https://audit.gov.gh) using 'small-scale mining' as the search word to find audit reports linked to ASGM. One audit report on regulating reclamation activities at small-scale mining sites was found and reviewed (Ghana Audit Service, 2021).

Study of the selected documents provided insights into ASGM formalization efforts concerning the various elements of the gold mining value chain: ASGM area designation, land acquisition, ASGM license acquisition, ore extraction and processing, gold trading, and mine closure and reclamation, and the roles of relevant stakeholders/institutions. This was followed by an analysis of the extent of coherence between the minerals and mining policy and other mining-sensitive policies (Section 3.2). Document review informed the selection of experts within the ASGM sector for interviews and served to validate findings. Interviews (Section 3.3) shed light on informal mining, the nature of the implementation of the legal framework and related formalization challenges for the ASGM sector.

3.2. Qualitative document analysis (QDA)

The policy coherence investigation used Qualitative Document Analysis (QDA) to analyse the meaning and implications of policy documents (Altheide et al., 2008). QDA uses a subjective scoring system followed by validation through expert interviews (England et al., 2018). QDA can help us understand the extent of policy coherence among mining-sensitive policies. Focus was on interpreting the meaning and implications of text within the document, rather than merely identifying the presence of keywords (Altheide et al., 2008) and we followed explicit steps designed to provide an in-depth analysis: 1) setting criteria for the selection of documents; 2) obtaining documents; 3) analysis of documents; 4) validation; 5) finalisation (Altheide et al., 2008; England et al., 2018).

Step 1 – setting document selection criteria:

We sampled the latest current government policy documents across Ghana's mining-sensitive sectors: (i) mining, ii) land, iii) water, iv) agriculture, v) environment and vi) development (Table 1)). This list is not exhaustive with regards to mining-sensitive sectors, but we focused on these because existing scholarship has highlighted considerable linkages with and sensitivity to ASGM development (Horsley et al., 2015). These sectors face a significant threat from ASGM and play a crucial role in supporting the livelihoods of the majority of Ghana's population (Arthur-Holmes et al., 2022; Bansah et al., 2018; Hilson, 2016; Mensah, 2021b), and contribute significantly to Ghana's GDP. Moreover, these sectors can directly or indirectly aid in the formalization of ASGM processes and the promotion of sustainable ASGM practices. However, it was also important to draw a manageable boundary around the study, so other sectors affected by ASGM (e.g., health and transport), which do not directly address formalization of ASGM operations were omitted. Nonetheless, considering these other sectors, along

Table 1
Current national policy documents forming the sample for qualitative document analysis.

Ghana's active Policy document	Policy vision/goal	Source of document; accessed between April 9, 2021 and March 27, 2023.
Minerals and Mining Policy of Ghana, 2014 (MLNR, 2014).	"The policy seeks to establish a comprehensive and forward-looking framework for mining that catalyses sustainable development."	https://www.mincom.gov.gh/wp-content/uploads/2021/06/Mineral-and-Mining-Policy-Ghana.pdf.
National Agriculture Investment Plan, 2018–2021; so was likely due for review in 2022 (MOFA, 2018).	"The Government is committed to transforming the agricultural sector with the aim to modernise the sector to catalyse industrial transformation of the rural economy resulting in national economic development."	http://mofa.gov.gh/site/publications/policies-plans/316-national-agriculture-investment-plan-ifj.
National Land Policy, 1999. Policy to be reviewed periodically, no date specified (MLNR, 1999).	"The Land Policy of Ghana aims at the judicious use of the nation's land and all its natural resources by all sections of the Ghanaian society in support of various socio-economic activities undertaken in accordance with sustainable resource management principles and in maintaining viable ecosystems."	https://www.fao.org/faolex/results/details/es/c/LEX-FAOC163491/
National Water Policy, 2007. Policy to be reviewed periodically, no date specified (MSWR, 2007).	"… the overall goal of the National Water Policy is to "achieve sustainable development, management and use of Ghana's water resources to improve health and livelihoods, reduce vulnerability while assuring good governance for present and future generations"."	https://www.gwcl.com.gh/national_water_policy.pdf
National Environmental Policy, 2012. Need to review mentioned but with no date (MESTI, 2012).	"… to manage the environment to sustain the society at large"	https://www.fao.org/faolex/results/details/fr/c/LEX-FAOC174489/
Medium-term National Development Policy Framework 2022–2025 (NDPC, 2021).	"The vision of the medium-term policy framework as adopted from the Coordinated Programme for Economic and Social Policies (2017–2024) is: "create an optimistic, self-confident, and prosperous nation, through the creative exploitation of our human and natural resources, and operating within a democratic, open and fair society in which mutual trust and economic opportunities exist for all"."	https://ndpc.gov.gh/media/MTNDPF_2022-2025_Dec-2021.pdf

with areas such as education, could provide interesting avenues in follow-on research.

Step 2 - obtaining documents:

Internet searches located the sector policies on the websites of government agencies and other credible sources (Table 1).

Step 3 - analysis of documents:

The documents were systematically examined to determine whether sustainable ASGM was being considered, how it was addressed; and whether those statements were coherent with the other documents assessed. The analysis employed a content analysis approach (Stemler, 2001) based on scoring criteria to assess coherence (Table 2). This content analysis step consisted of four stages.

First, each policy was analysed for its dominant objectives, strategies, and narratives relating to six key themes: i) support for artisanal and small-scale miners, ii) land use management, iii) ASGM-agriculture connection, iv) water management, v) sourcing of gold and vi) land degradation/reclamation using a content analysis approach (England et al., 2018; Stemler, 2001). As principles/objectives and strategies were identified, the discursive context in which they were found was noted. This led to identification of specific keywords that were linked to the three building blocks of sustainable development: i) economic keywords – livelihoods, finance/credit facility, licence or permit acquisition, mineral trading, business skills; ii) Social keywords – compensation, community rights, land rights, mineral rights, land use management/-planning, water use/management; and iii) environmental keywords – land/soil degradation, water pollution, wastewater discharge, and buffer zone protection.

The second stage used these keywords to analyse the parts of each document where they were located that set out strategies/measures concerning the mining-sensitive sectors: mining, land, water, agriculture, environment and development. These strategies/measures were assessed based on the content of the sentences or paragraphs in which the keywords appeared, providing specific background context and insights into government plans and priorities. The keywords and strategies were then grouped together, synthesized, and entered into tables for each policy, enabling cross-comparison of the main emphases in each sector and providing key contextual information.

During the third stage of the content analysis, we searched for the keywords within the respective themes, which were used to assess the extent to which the other policy documents referred to the same issues. A score was then applied to the level of coherence, ranging from 3 (High

Table 2
Scoring criteria to assess coherence (adapted from Le Gouais and Wach, 2013).

Type of Coherence	Description of Coherence	Score
High coherence	Strong inter-sector policy coherence across mining, agriculture, land, water, environment, and development sectors. The policy devotes specific attention to ASGM governance mechanisms that safeguard formalization and sustainable development of the ASGM sector. It includes detailed complementary activities and plans.	3
Partial coherence	Policy supports inter-sector coherence regarding ASGM governance mechanisms for the sustainable development of the ASGM sector but is less clear how it could be achieved. A few plans and activities are listed but the information provided is not comprehensive.	2
Limited coherence	Policy supports inter-sector coherence in relation to ASGM governance mechanisms that foster sustainable development of the ASGM sector, mostly in the form of general statements. No details on activities or plans to achieve the policy goals are provided.	1
No coherence	No evidence that inter-sectoral statements are coherent and/or coordinated.	0

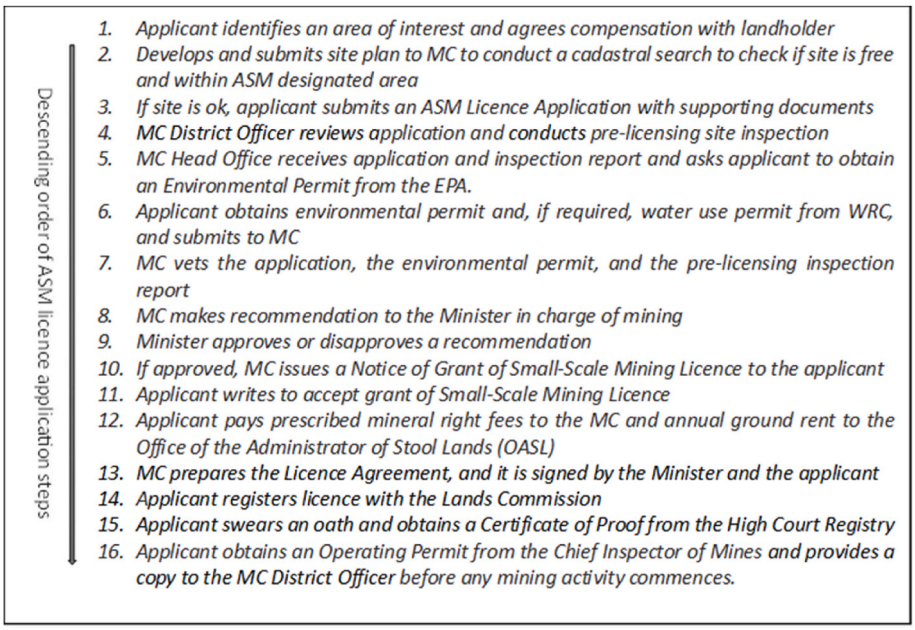

Fig. 2. Procedures for Acquiring an ASGM Licence in Ghana.
Authors' construct, adapted from (Tychsen et al. (2017) and (MLNR (2021).

coherence) to 0 (no coherence) based on scoring criteria adapted from Le Gouais and Wach (2013) (Table 2).

The score for each policy considered the score for each theme, and then finding the mean coherence score across the themes for each policy (Section 4.2).

The fourth stage of the content analysis assessed the coherence of policies relative to each other. This averaged the two values obtained in stage three (Section 4.2).

3.3. Expert interviews

The final two steps in the QDA process - validation and finalisation – involved expert interviews. Respondents were those providing guidance on policy formulation and/or those responsible for implementation of laws, regulations, and policies at national, regional and district levels within the mining-sensitive space. Following ethical approvals, eight expert interviews were undertaken in Ghana between October and December 2021. Experts were selected from national (Accra), regional (Eastern region) and district (Atiwa West) levels through purposive sampling. Experts included three officers from the Minerals Commission (one at head office, and two at the regional office, Koforidua); one environmental officer from the Environmental Protection Agency, who works both at the national and Eastern regional offices; one regional Lands Commission officer; two agricultural officers (one at Eastern regional office, and one at Atiwa West district office); and one officer from Atiwa West District Assembly. Atiwa West was selected as the district focus as it has seen a rapid recent increase in ASGM activities in an area that was previously largely agricultural.

Interviewees commented on ASGM informality and formalization challenges and identified associated issues on policy coherence and institutional linkages between the mining sector and the other mining-sensitive sectors regarding ASGM governance and scored the extent of inter-sector policy coherence based on the criteria in Table 2. To ensure anonymity, information is not provided on the name, role or title of interviewees. Interviews were recorded with permission and transcripts were coded according to sectoral themes and policy priority areas analysed using thematic analysis. When audio recording was not ideal, e.g., noisy space due to being in a busy office, handwritten notes were taken.

The validation process involved comparing the QDA scores on the coherence between minerals and mining policy and other mining-sensitive policies with the scores provided by the interviewees (Table 5). This comparison aimed to identify similarities or differences and to provide clarifications and interpretations of the results to finalize the process, ultimately determining what they imply for the overall extent of coherence.

This study was limited to the state sector and its institutions, considering how government agencies developed and implemented policies and laws. Views from civil society and other non-governmental agencies are not captured, leaving this avenue open for future research.

4. Results

Section 4.1 presents findings regarding the analysis of legal framework of Ghana's ASGM sector, focusing on the various stages involved in the ASGM value chain, the institutions involved, and the linked roles, addressing research question one. Research question two is tackled under Section 4.2 and it offers an analysis of policy coherence between the mining policy and other mining-sensitive policies; and presents experts' views on policy coherence. Section 4.3 focusses on challenges to policy coherence and implementation issues in the ASGM sector, addressing research question three.

4.1. Mining laws, regulations and institutional arrangements regarding ASGM formalization

Ghana has an extensive legal framework for the mining sector. Laws regulating Ghana's ASGM sector have evolved significantly since the first act in 1989 (Appendix A1). Presently, the Minerals and Mining Act, 2006 (Act 703) (as amended by the Minerals and Mining (Amendment) Act, 2015 (Act 900) and the Minerals and Mining (Amendment) Act, 2019 (Act 995)), alongside the Minerals Commission Act, 1993 (Act 450) provide the framework for regulating mining in Ghana (Ghana Government, 1993, 2006, 2015, 2019). They highlight state ownership of minerals in their natural states, various licensing schemes, and the powers of relevant regulatory institutions. The Ministry of Lands and Natural Resources (MLNR) and the Minerals Commission (MC) have primary responsibility for the mining industry in Ghana. The MC is 'responsible for the regulation and management of the utilisation of

Table 3
Coherence of policy documents regarding key themes on sustainable ASGM (score 3 = high coherence; 2 = partial coherence; 1 = limited coherence; 0 = no coherence).

Ghana	Mineral and mining policy	Agriculture Policy	Land Policy	Water Policy	Environmental Policy	National development Policy
Support for small-scale miners	N/A	(0) No specific information regarding support for ASGM miners.	(2) Supports equitable access and optimum usage for all land use types including mining. Recognises that every socio-economic activity is consistent with sound land use through sustainable land use planning in the long-term. No specific activities.	(3) Recognises adequate protection of water sources in mining areas and balancing competing demands of water between mining and communities. Details policy measures and actions.	(2) Contains statements on promoting equitable access to, and sustainable use of the natural and cultural resources, and ensuring environmentally sustainable lifestyles and activities to achieve sustainable development. Few plans listed.	(2) Recognises the need to facilitate sustainable use and management of natural resources to support the development of rural communities and livelihoods but lacks detailed support strategies for miners. Details some strategies.
Land use management	(2) Recognises a need to manage land use conflicts and guarantee the rights and interests of landowners and local communities regarding benefits accruing from the use of land during mining. Highlights some regulations that provide detailed guidance on compensation issues.	(0) Recognises the importance of sustainable land management practices in agriculture and the security of land tenure. But no evidence of mining-agriculture land use planning and management. No plans or actions suggested.	N/A	(3) Acknowledges the principle of coordinating water resources planning with land use planning. Provides a number of actions.	(2) Recognises the importance of integrating environmental concerns in development planning and land allocation. Details management activities.	(3) Recognises the need to promote efficient and effective land administration. Detailed strategies provided.
Water management	(3) Recognises that activities of illegal miners pollute water bodies. Consents to the granting and enjoyment of water rights in connection with mining. Miners must obtain the requisite licence from the Water Resources Commission.	(1) Supports water conservation and irrigation systems to ensure availability of water for multiple uses. No plans and activities on protection of water bodies.	(2) Recognises the protection of water bodies and the environment. Provides some plans e.g., minimum of 100 m off the high-water mark of water bodies should be declared as protected areas.	N/A	(3) Supports efforts to protect the various watersheds and buffer zones, tackle water pollution and resolve conflicts between the different users of water. Details management activities	(3) Highlights promotion of sustainable water resources development and management. Strategies provided.
ASGM-Agriculture connection	(0) Recognises the need to strengthen inter agency collaboration in the development of mineral resources, but no specific mention of collaboration with agricultural sector. No approaches or plans stated.	(0) Does not recognise a need for ASGM and agricultural sector alignment. No plans stated.	(1) Recognises inter-ministerial working groups to resolve user conflicts and harmonise land resource use among competing users. No activities provided.	(2) Recognises cross-sectoral issues related to water-use, including those on mining and agriculture. Details some policy actions.	(0) No explicit reference to inter-sector alignment between mining and agriculture. No plans detailed.	(1) Recognises the need to sustain agriculture and rural development. Provides detailed strategies, but no reference to inter-sector alignment between mining (ASGM) and agriculture. No plans detailed.
Gold sourcing	(2) Seeks to support improving miners' access to finance through fair market prices for minerals, trading of minerals through appropriate licensing, and control of illicit dealings. No strategies or intersectoral actions provided.	N/A	N/A	N/A	N/A	(0) No reference to inter-sector links between ASGM and development regarding gold sourcing and support systems needed. No detailed plans identified.
Land degradation/ reclamation	(3) Notes that land use choices impact healthy coexistence between mining and other economic activities e.g., agriculture, and mining operations should restore mined-out lands to other viable socio-economic uses. Lists regulations that provide detailed strategies and activities.	(1) Recognises that artisanal mining causes environmental degradation but does not include specific strategies to deal with it.	(2) Land use for mining needs to conform with prescribed environmental conservation principles. Details some guidelines and actions.	(2) Recognises need to ensure adequate protection of water sources in mining and other industrial areas. Provides some policy actions.	(3) Recognises importance of mining but also its environmental challenges including land and water degradation. Provides several management activities.	(3) Outlines challenges in extractive sector. Supports sustainable mining and effective linkage of the sector to rest of economy. Provides strategies to be implemented.
Mean Score	**2.0**	**0.4**	**1.75**	**2.5**	**2.0**	**2.0**

mineral resources and the co-ordination of the policies in relation to them' (Act 450, p.3).

Sections 81–99 of Act 703 exclusively cover small-scale mining, dealing with land acquisition and licensing procedures, composition and functions of district mining offices, obligations of miners, mercury distribution and use, and monitoring of operations by the MC. Ghana's law does not segregate artisanal mining from small-scale mining, as is common elsewhere (e.g., in Sierra Leone). Act 703 prohibits any person, even with a right of land ownership or land title, to search, explore, prospect, or mine for minerals unless the person has been granted a mineral right. The ownership of mineral rights and provision of ASGM support services are restricted to Ghanaian nationals, operating either as individuals or cooperatives (Act703; Act 995). Fig. 2 summarises the ASGM license acquisition steps and highlights the different institutions at various levels that prospective small-scale miners must deal with to secure a licence.

Section 90 provides for the MC to establish a 'District Office' in an area designated for mining, and to appoint a district officer to head the office. Under section 90 (3), the District Office is charged with compiling a register of existing and prospective small-scale miners, supervising, and monitoring their activities, providing training and assistance necessary for effective and efficient small-scale mining, facilitating the formation of small-scale miners' associations, and submitting reports and information on small-scale mining activities in the district to the Commission. Interviews with Eastern regional MC officials at Koforidua confirmed that MC has offices at district, regional and national levels, except that current district offices are inadequate in keeping with the rapid expansion of ASGM in the country. An officer clarified: "*We have* [district] *office in Akim Oda, and Akwatia, and there are plans to open new ones, another proposed for Kwabeng to help with monitoring and application of certification.*" (MC officer 1, regional level).

4.1.1. Designated ASGM areas and land acquisition

The Minister of Lands and Natural Resources upon consultation with the MC may designate an area for small-scale mining operations of a specific mineral (Section 89 of Act 703). However, designation of ASGM areas has not been consistent across the country since 1989, as is evident in the Atiwa West District, where ASGM is active but with most miners operating without any properly designated wider area (Adranyi et al., 2023). Effective designation of ASGM areas depends on detailed geological surveys to estimate gold deposits and generate credible geological data. However, since ASGM was legalized in 1989, no annual budgetary allocation has ensured consistent, thorough geological surveys and studies for ASGM purposes (Minerals Commission, 2023a). The government is unable to boldly demarcate ASGM zones linked with appropriate geological data, which would make ASGM site acquisition more transparent and boost local investor confidence. Miners presently must find sites on their own and hope to strike gold after acquiring an ASGM license.

A prospective miner must negotiate and agree compensation with the landholder to commence the license application (Minerals and Mining (Compensation and Resettlement) Regulations, 2012 (Legislative Instrument (LI) 2175) (Ghana Government, 2012a). Where negotiating parties are unable to reach mutual agreement, the Lands Valuation Division of the Lands Commission (LC) will intervene, using state approved estimates to determine compensation payments. MC officers both at the national and regional levels confirmed that prospective miners and landowners could contact the LC during land acquisition compensation negotiations. However, a regional LC officer clarified that: "*Even though the Land Valuation Division* [of the LC] *is there to mediate and advise on compensation* [concerning ASGM]*, they don't receive regular requests for such services … inhabitants feel more comfortable discussing any disagreements using their traditional processes* [via traditional and community leadership]''. The LC has presence only at national and regional levels, so the lack of district LC offices can make it difficult for landowners to access their services, stimulating informal negotiations in ASGM land acquisition.

4.1.2. License acquisition

Mineral rights are granted by the Minister of Lands and Natural Resources through issuing of licenses to Ghanaians aged 18+, who must secure an environmental permit from the Environmental Protection Agency (EPA) and if necessary, a water use permit from the Water Resources Commission (WRC). Licenses are valid for five years and for an area no more than 10.2 ha (Section 82 (1) and Section 83 of Act 703).

Mining officials acknowledged the ASGM license acquisition processes ensured communications among mining, land, and environment institutions. The regional LC official confirmed that: "*miners upon successful acquisition of license must contact the national LC office in Accra and register the license*''. The MC and LC operate under the same ministry (the Ministry of Lands and Natural Resources) making it easier for them to correspond. However, relevant agencies do not have arrangements enabling regular meetings to find solutions to ASGM's licensing problems. Regional MC officer 1 confirmed that: "*We correspond to sectors like LC, EPA and WRC through letters … But we do not have a directive to require the different sectors including the agriculture to meet, discuss ideas and find solutions to challenges.*''

The EPA also confirmed that miners apply for environmental permits from them prior to ASGM commencement, but the EPA officer clarified that: *"As for EPA, it takes a lot of time before permits are granted. But if permits were processed within weeks, word of mouth would go out there that permits from EPA was easy, and this would encourage the illegal ones too to come to EPA for permits.*'' Currently, licenses and permits are only issued at national head offices in Ghana's capital, Accra.

4.1.3. Mine operation

The Inspectorate Division of the MC headed by the Chief Inspector of Mines, inspect the ASGM license, environmental permit and mining operating plan before issuing a mining operating permit. A mining operating plan includes mining and processing procedures; fuel and chemical handling processes; waste management processes; and site reclamation/restoration procedures. The operating permit is subject to annual renewal (Minerals and Mining (Health, Safety, and Technical) Regulations, 2012 (LI 2182) (Ghana Government, 2012b); (Minerals and Mining Regulations, Explosives (LI 2177)(Ghana Government, 2012c). The Inspectorate Division of the MC is to monitor the progress of mining and rehabilitation activities over the lifecycle of a mine based on the mining operations plan, and to enforce all mining regulations. Regional MC officer 1 in Koforidua explained that "*Every month we go round to check activity* [of the ASGM miners]. *We are very serious on them, if they violate, we can close them down.*''

Environmental permits for small-scale miners are valid for two years. Holders must submit annual environmental reports regarding ASGM operations (The Environmental Assessment Regulations, (LI 1652)) (Ghana Government, 1999). The EPA is required to monitor mining activities and be satisfied with operations before permits are renewed. However, monitoring operations by MC and EPA were restricted due to limited available resources: "*We have few personnel, cars, drivers etc. We need more people to do the job*'' (MC officer 2, regional level).

4.1.4. Gold trading

A person is presumed to be lawfully in possession of minerals until proven otherwise. Sale of a mineral acquired by a licensed ASGM miner is subject to rules and regulations prescribed by the Minister (i.e., currently licensed miners must sell to licensed dealers) (Section 97 of Act 703). Section 97-99 of Act 703, does not, however, explicitly prohibit licensed dealers buying gold from non-licensed ASGM miners. There are no laws or policies directing traders to undertake due diligence checks and keep specified records on miners/individuals from whom they buy gold. The MC licenses and registers prospective gold traders, but presently, regional and district MC officers are not authorised to supervise activities of gold traders and to keep them in check:

"Licenses are issued by the mincom [MC], *but all are done in Accra. So, if a new trader comes to the regional office, we do not accept the paper or receive any payments … For gold trading everything is done in Accra. You don't have to come here"* (MC officer 1, regional level).

A minerals and mining operations tax (a mineral royalty rate of 5%) used to be imposed on the total revenue earned by a person engaged in mineral operations (Minerals Commission, 2023b). However, ASGM operators' non-compliance prompted the government to replace it with a 3% withholding tax in 2019 on processed gold, at the point of export, through the government's Precious Minerals and Marketing Company (PMMC). ASGM operators, however, considered this rate too high so gold smuggling increased. In 2022, this caused the government to reduce the withholding tax to 1.5% on the sale of unprocessed gold, paid before gold gets to the Precious Minerals and Marketing Company, where no more tax is paid at the point of export (Minerals Commission, 2023b). Beyond the tax incentive, however, there is no clear government-led guidance relating to gold sourcing enterprises that could limit exploitative tendencies.

4.1.5. Mine closure and land reclamation

Licensed ASGM miners are expected to undertake concurrent reclamation during mining and complete reclamation and revegetation of abandoned mined land within one month of terminating activities, to prevent accumulation of stagnant waters, and allow for productive reuse of mined lands. After reclamation, the Chief Inspector of Mines and the EPA must inspect the site and if satisfied, issue a rehabilitation certificate (Minerals and Mining (Health, Safety, and Technical) Regulations, 2012 (LI 2182) (Ghana Government, 2012b)). Appendix A2 details legislation, offences, and associated penalties linked to ASGM activities in Ghana.

In a performance audit report submitted to Ghana's Parliament in 2021, however, the Auditor-General revealed that the MC and EPA had failed to ensure that small-scale miners reclaimed mined sites to return them to their maximum beneficial value (as required by LI 2182 and LI 1652). The Inspectorate Division of the MC did not enforce the submission of operating plans before issuing operating permits, while the EPA did not administer the posting of reclamation bonds and failed to collect due amounts. Regulation 23 of LI 1652 mandates the EPA to ensure that prospective small-scale miners post reclamation bonds in the form of cash into an escrow account based on approved reclamation plans before they are issued permits. The audit report also stressed that monitoring carried out by the MC and EPA did not guarantee that small–scale miners complied with reclamation conditions and that the institutions failed to verify or certify reclaimed small-scale mining sites.

4.2. Policy coherence across mining-sensitive sectors regarding sustainable ASGM

Review of the various mining-sensitive policies (Tables 3 and 4) broadly revealed 'partial coherence' between the minerals and mining policy of Ghana (hereafter referred to as mining policy) and the other policies (a score of 2 or above, but <3). The policies were characterised by differing timeframes and ages, alongside infrequent and delayed revisions. Some lack specific review dates and most are infrequently updated. This significantly hinders policy coherence. For formalization, this means that efforts to regulate and support ASGM activities are inconsistent and often outdated, leading to challenges in effectively integrating ASGM into the formal economy and ensuring sustainable practices.

Table 5 summarises the policy coherence between mining policy and other mining-sensitive policies, based on the QDA score versus experts' views.

4.2.1. Mining and land

There is 'limited coherence' between mining and land policies (score of 1.9). Generally, the two policies support inter-sector coherence regarding ASGM governance but plans and activities to achieve these are not comprehensive. This is perhaps due to how old the policies are (land policy, 1999; mining policy, 2014). The mining policy states that "*government will continuously examine land use options and make a choice between mining and other forms of activity …* ''(MLNR, 2014, p.43). To ensure efficient ASGM, the sector minister is tasked to "*Generate detailed geological information in designated areas for demarcation to artisanal and small-scale miners …"*(MLNR, 2014, p.15), but this is not supported with any detailed plans. The mining policy lists relevant land institutions to collaborate with, but without clear action plans on delivery of that collaboration. The land policy also generally acknowledges mining activities and the need to manage these alongside other land use activities, as reflected in one of its guiding principles: " … *the principle of optimum usage for all types of land uses, including human settlements, industry and commerce, agriculture, forestry and mining, the protection of water bodies and the environment in the long-term national interest*'' (MLNR, 1999, p.5). Aspects of the land policy objectives that reflect support for ASGM activities include: ensuring that socio-economic activities are consistent with sound land use through sustainable land use planning; and enabling equitable access to and security of tenure of land. However, detailed action plans on achieving these objectives are not provided. The mining policy requires miners to pay compensation to landholders, but this is not explicitly mentioned in the land policy. Neither policy has provisions to provide a platform for regular engagement between the two sectors to review and address the concerns of landholders, miners, and related stakeholders.

MC and LC interviewees considered coherence between land policy and mining policy to be 'partial' (Table 5) which is only slightly different from the 'limited' coherence obtained in our policy coherence score. Both assessments generally reflect that coherence between the two policies is weak. While creating designated areas for ASGM activities is mentioned in the mining policy, the government has struggled to

Table 5
Extent of coherence between minerals and mining policy and other mining-sensitive policies, based on score versus experts' views.

Policy areas	Level of policy coherence	
	Score	Experts' views
Mining vs Agriculture	Limited (1.2)	Limited
Mining vs Land	Limited (1.9)	Partial
Mining vs Water	Partial (2.3)	Partial
Mining vs Environment	Partial (2.0)	Partial
Mining vs National development	Partial (2.0)	Partial

Table 4
Coherence of policy documents based on QDA score (3 = high coherence; 2 = partial coherence; 1 = limited coherence; 0 = no coherence).

	Minerals and mining, policy	Agriculture Policy	Land Policy	Water Policy	Environmental Policy	Development Policy
Minerals and Mining Policy of Ghana, 2014)	**N/A**	1.2	1.9	2.3	2.0	2.0
Agriculture Policy, 2018	**1.2**	N/A	1.1	1.5	1.2	1.1
Land Policy, 1999	**1.9**	1.1	N/A	2.1	1.9	1.8
Water Policy, 2007	**2.3**	1.5	2.1	N/A	2.3	2.2
Environmental Policy, 2012	**2.0**	1.2	1.9	2.3	N/A	1.9
National development Policy, 2022	**2.0**	1.1	1.8	2.2	1.9	N/A

execute this, with many mining areas operating without government directive or knowledge. The Ministry of Lands and Natural Resources needs to engage with other ASGM-sensitive agencies, particularly the traditional council, so that land use conflicts are managed and strategies regarding the creation of ASGM designated areas are coherent with the plans of other ASGM-sensitive sectors and stakeholders.

4.2.2. Mining and agriculture

The agricultural policy was the least coherent with the mining policy (limited coherence, score of 1.2). The mining policy recognises the need to pay attention to agriculture stating that: "*Land use choices present several challenges in fostering a healthy coexistence between mining and other forms of economic activity, particularly agriculture and forestry. Mining operations are to be conducted in a manner that will restore mined-out lands to other viable socio-economic uses.*''(MLNR, 2014, p.43). Yet, there are no clear strategies specifying activities to engage with the agricultural sector for collaborative implementation. The agricultural policy makes no mention of ASGM governance and linking up with the mining sector to ensure ASGM complements rather than inhibits agricultural growth. Artisanal mining was only mentioned once as a practice that challenges the implementation of sustainable land management in agriculture. Neither the mining policy nor the agricultural policy specifies strategies to ensure the two sectors coordinate to provide beneficial ASGM-agriculture coexistence and support the sustainable development of ASGM.

MC officials confirmed their everyday activities do not involve formal working relationships with the agricultural sector at the national, regional nor district levels. However, considering the impacts of ASGM on agriculture, officials recognised the pressing need to coordinate mining governance processes with those in the agricultural sector. Efforts should include coordination during policy formulation and reviews to foster coherence and involvement of agricultural officers in mining issues. A regional MC officer noted:

> "*There are district agricultural extension officers who get this information about mining and report to the district agricultural director, who also report to the District Chief Executive (DCE)* … [But], *even if reports get to the DCE* [who chairs the district mining committee], *how do you know that he takes it seriously? So, it is good idea to have a technical agricultural person on the committee who can speak to issues.*'' (MC officer 2, regional level).

A regional agricultural officer at the Ministry of Food and Agriculture in Koforidua likewise echoed the lack of policy drive to involve agricultural officers in ASGM governance, stating that:

> "*The agricultural department is decentralized, and forms part of the district assembly structure. So, it can be expected that when mining is having an engagement with them* [district assembly] *and it has to do with agriculture, definitely the director of agriculture or programs of agriculture will be involved. However, what is lacking is clear mandates, in laws and in policies, defining roles and responsibilities of agricultural officers that can help deal with ASGM issues.*''

He added that the agricultural department does not formally engage with the mining sector, stressing that: " … *a very formal engagement between agriculture and maybe lands or those who are in charge of mining, I could speak for myself, I haven't really heard of something like that.*'' Similarly, an EPA officer shared: "*There is no agricultural department involved in the* [district mining] *committee meetings*". He also stated: "*We don't link with the agricultural department in carrying out our revegetation mandate.*" This lack of communication and linkages between the mining and agricultural sectors reflects weak policy coherence. He explained that the institutional structures exist but strong policy drive and political will is lacking. Mining and agricultural officers also considered there to be 'limited' coherence between mining and agricultural policies, emphasizing the general disjointedness in activities between the two sectors.

4.2.3. Mining and water

QDA findings also revealed 'partial coherence' between mining and water policies. The mining policy recognises illegal mining activity pollutes water bodies. Mining policy actions include the demand for small-scale miners to obtain a license from the Water Resources Commission to use water bodies for their activities. The water policy equally notes mining activities as a polluter of water sources and seeks adequate protection of water sources in mining areas and to balance competing demands for water between mining and communities. The water policy has ten 'focus areas', with some considering mining issues. Under Focus Area 4 - Water for Non-consumptive and Other Uses – objectives include ensuring water availability for mining operations and various industrial purposes (MSWR, 2007). Water policy measures include requirements for industries, including mining operations, to develop and implement environmental management systems that account for the impact of their activities on water resources; and fully implement requirements relating to licensing of water uses (permits) and issuance of wastewater discharge permits. However, an EPA officer pointed out lapses in implementation efforts, stating: "*Discharge of waste into water bodies, we have numerous complaints and do follow up for emergency meetings to solve conflicts and bring peace among affected communities …. So, when we go monitoring, it is not just to find fault but to also teach them how to do the right things.*" The water policy mentions the promotion of public-private partnerships to protect and conserve water resources but does not specifically mention the MC or any of the mining agencies. Both policies lack deliberate provisions regarding policy actions to ensure continuous inter-sectoral collaboration for regular review and upgrade in a collective approach to water resource management. Interviewees from MC and EPA also considered coherence between mining and water policies to be 'partial'. It can be argued that the wanton pollution of water bodies, as witnessed in Atiwa West, reflects a lack of policy coherence that would otherwise coordinate activities of the MC, EPA and WRC to govern the ASGM sector more effectively.

4.2.4. Mining and development

Coherence between the national development policy and mining policy is classed as 'partial'. The national development policy acknowledges the importance of the mining sector, emphasizing that between 2017 and 2020, gold production increased by 10.2 % and those employed in large- and small-scale mining by 10.5 %. It also recognises challenges facing the sector including degradation, poor management of royalties and compensation, illegal mining, weak enforcement of laws and regulations, inadequate mineral revenue, and unaccounted flows of mineral revenues. The policy is detailed perhaps because it is more recent (2022), providing objectives and strategies that cover key areas, including mineral extraction, water resources management, environmental pollution, and land administration. Objectives include promoting sustainable extraction of mineral resources and ensuring effective linkages between the extractive industries and the rest of the economy. For each strategy, it also lists the relevant institutions that must collaborate to implement actions.

Provisions for key institutional reforms are nevertheless missing in both policies, including full decentralization of the MC and collaboration with regional and district councils for the effective enforcement of the legal framework governing mining (including prevention of smuggling of minerals). The national development policy seeks to link mining (including ASGM) to relevant sectors for coordination, but there remains a lack of clear district, regional and national level targets regarding ASGM growth and its impact on development. The mining policy lists measures intended to enhance growth and opportunities in the small-scale mining sector such as: "*improving access to finance for small-scale miners, and assistance to obtain fair market prices for their minerals by the control of illicit dealings.*'' (MLNR, 2014, p.34-35). However, detailed directives on ways to achieve these measures are lacking. These measures are also not corroborated in the national development policy.

Both policies provide insufficient details on approaches to enhance

the skills of ASGM miners and give no detailed strategies on the development of mining communities and districts based on revenue inflows from small-scale mining. Furthermore, there is a lack of coherence regarding sourcing of gold. While the mining policy acknowledges gold sourcing as a segment of the mining enterprise, the national development policy does not mention it. In both policies, there are no specific strategies on gold sourcing businesses, and no strategies on drastic reduction of financial leakages and illicit financial flows from ASGM revenue sources. The national development policy does not include suggestions on how to integrate ASGM into district level development plans.

According to the Atiwa West district officer: "*there is no national policy drive directing district assemblies endowed with mineral resources on specific plans and programmes to implement to* support *sustainable ASGM practices that would contribute significantly to the development of the districts.*'' Interviews revealed there were no MC, EPA, or LC offices in the district for miners to access. Inadequate presence of these state agencies at district level is common. Prospective miners interested in obtaining licenses must travel to regional/national centres. Miners who consider the travelling and associated costs as disincentives then easily drift into illegal, informal operation. The institutional framework for development at the regional level is the regional coordinating council, made up of all DCEs in a region, presiding members, and heads of government departments/agencies. Yet, MC officials confirmed that no policy directives require linkages and coordination between them and the regional coordinating councils on a regular basis to ensure that ASGM is properly integrated in regional development programmes, nor is there any requirement to ensure that ASGM plans are coherent with other development plans for the region. The district official at Atiwa West and MC officials considered there was 'partial coherence' between the national development policy and the mining policy. This viewpoint corresponds with the 'partial coherence' obtained from the QDA score.

4.2.5. Mining and environment

'Partial coherence' was found between the mining policy and environmental policy in relation to land and water degradation due to mining. The mining policy recognises the importance of linking with the environmental sector to deal with land and water degradation, noting that: "*Mineral activities can only commence after environmental and other permits have been obtained* [from the EPA]'' (MLNR, 2014, p.25). The environmental policy recognises ASGM as an important industrial activity but also notes the environmental challenges posed by mining, including land degradation, and water and air quality deterioration. The environmental policy's objectives concerning mineral resources include: safeguarding the long-term use of land in mining areas through implementation of environmental management plans; educating mining communities in environmental protection methods and use of abandoned mining areas; ensuring miners undertake appropriate mitigation and reclamation measures; and regularly reviewing mining laws to reflect emerging issues regarding restoration of mined land to the best improved level (MESTI, 2012, pg. 22).

Management activities include linkages with the mining policy and fiscal regime, Environmental Impact Assessment guidelines and procedures, reclamation bonds, and the performance disclosure rating system. The environmental policy, however, does not mention the need to ensure the adequate presence of EPA district offices, nor does it set out how the offices would link with district offices of the MC and other relevant institutions for effective enforcement. Aside from provisions in both policies requiring prospective miners to engage with both the MC and the EPA to secure licenses and permits, there are no specific directives that require regular cross-sectoral engagement at district, regional or national levels. Thus, there is no clear pathway to foster effective connections between them and coordinate regular reviews of policies, procedures, and to air general concerns.

Similarly, interviewees from MC and EPA considered coherence between environment and mining policies to be 'partial', noting little deliberate inter-sectoral engagement on ASGM and existing policies not being implemented effectively. An EPA officer shared: *"There is lack of coordination among agencies"* acknowledging further that: "*Monitoring is key, because there are even permit holders who are mining wrongly and need checking routinely"*.

4.3. Experts' insights on cross-sectoral challenges regarding policy implementation, coherence and informality

Interviewees identified various political, institutional, financial, regulatory, and sociocultural challenges in their respective sectors regarding policy implementation concerning ASGM governance, as are presented below.

4.3.1. Political influence

Interviewees stated that due to high interest in ASGM across the country, sometimes people visit them claiming to be associates of politicians and attempt to use those politicians' names to fast-track acquisition of licenses/permits or to be lenient on a licensed miner who has been non-compliant. An EPA official said that:

> *" … per our law, you have to work for 18 months and come for renewal* [of the permit]. *But after getting the first permit, they* [some miners] *don't care of renewing it because they have political power. So basically, that is what we are facing in terms of political affiliation.''*

Interviewees were clear on their employment terms of reference and aware that corrupt practices are not countenanced. An EPA officer stated that: "*If a staff takes bribe and it's found out, it is summary dismissal. You don't even face the disciplinary committee.*'' Thus, any potential political interference can be linked to weakness in regulatory enforcement and lack of effective supervision. Findings indicate that while some politicians can influence processes and outcomes, sufficient regulations guide the conduct of public workers within the ASGM space such that if institutions are strengthened, they could limit political interference. Additionally, lack of political will is a major contributing factor to policy incoherence and a key challenge to ensuring sustainable ASGM implementation. Political actors in charge of sectors must deliberately initiate reforms that ensure policy coherence across the various mining-sensitive sectors.

4.3.2. Institutional challenges

Interviewees across sectors confirmed that licenses and permits are issued only at national head offices in Accra, lamenting the time taken. An EPA officer stated that:

> *"…a challenge we have is* [if] *someone trying to venture into ASGM, the person will get his permit signed at the head office, and that delays the processes….And head office too, we are all aware the place is very choked. They are working very tirelessly but they can't meet the timelines because of the job pile up…''*

Breaking away from this customary practice and opening more branches, decentralizing application processes across sectors so applicants can apply and secure licenses/permits at district offices, is critical to promoting regulated ASGM, improving ASGM monitoring and checking the rise of illegal mining activities. Interviews also highlighted that the lack of coordination between sectors is due to a tradition of sectoral working, exacerbated by tight sectoral budgets and lack of clarity in policies on intersectoral working. Policy analyses also focus chiefly on sectoral goals, with little emphasis on cross-sectoral working dynamics, while policies lack information on intersectoral roles and responsibilities with clear pathways that would warrant functioning linkages across institutions in different sectors.

4.3.3. Financial challenges

Interviewees acknowledged that they have structured monitoring and evaluation procedures within their organizations. Routine

monitoring to check that legal miners operate responsibly is vital, but monitoring is ineffective due to inadequate budget allocation. An EPA official stated: *" … the main challenge is we do not have the required resources to handle enforcement and monitoring. We lack logistics – the cars and* funds *needed to do the work. We have structured monitoring and evaluation plans but lack the resources to implement them."* Lack of resources was also noted by MC officers.

Budgetary deficits impact how many offices serve the mining-sensitive institutions. Ghana has 16 administrative regions, divided into 261 districts. ASGM is happening in 13/16 regions, yet the MC only has 9 district offices. The EPA has regional and zonal offices and is not present in all mining districts. An effective coordinated system of ASGM governance requires adequate financial injection to retool institutions at multiple governance levels, and to recruit and train more personnel across all the mining-sensitive sectors.

4.3.4. Regulatory challenges

Across the different sectors, officials revealed that policy directives and regulations regarding their roles and responsibilities were clear, and staff were confident of their operational duties. Reforms have led to some institutions adjusting their regulatory requirements to improve ASGM governance. An EPA officer said:

> "*There is a reform in our permit conditions. At first the requirement for EPA permit was: mining lease, site plan, abandonment reclamation proposal. But about 2 years ago, due to conflict incidents witnessed in the past, we have added a compensational agreement. If there is a crop on the land, we require a full compensational agreement or proposal.*"

A major challenge revealed by MC and EPA officers was that most licensed miners usually have illegal miners operating next to their sites, which discourages licensed miners to return for permit renewals. Officials also stated that stakeholder meetings to discuss strategies to deal with evolving ASGM challenges only occur occasionally, often based on a political call, or through an operation organised by one of the sectors. These arrangements are not planned in policy for regular implementation, so, there are inconsistencies and that can be challenging.

Regulatory and policy reforms regarding ASGM governance are necessary but need to be undertaken across all mining-sensitive sectors in a synchronised manner to ensure meaningful improvement in ASGM governance. Irregular sector-specific adjustments are insufficient to meet expectations. More structured, regular coordination across sectors concerning reviews of regulations, policies, operations, and procedures is necessary. Meetings to deliberate on matters should be organised at national, regional and district levels so that lessons from these meetings can help inform policy reviews and reform institutional coordination.

4.3.5. Socio-cultural settings

Officials indicated that every institution desires a certain level of autonomy and does not entertain being told what to do by other institutions. But, where there are clear national policy directives seeking coordination among institutions for good governance practices and backed with strong political will, officials were open to them and willing to comply. There was no mention of ideological stands or institutional interests that were inimical to institutional collaboration for ASGM governance. A regional agricultural officer said:

> "We don't work in isolation. Through the structures of the local governance system, it ensures that. We go to the regional level, there is the regional coordinating council. So, all the various platforms are there. So, we just need a strong policy drive towards curbing this bane or stopping the issue of illegal mining. There shouldn't be a problem at all."

Provision of satisfactory salaries, transparent and traceable working processes, together with more effective supervision channels across the various mining-sensitive sectors would significantly improve working conditions.

5. Discussion

5.1. ASGM formalization challenges across its value chain

Our research revealed a broad legal framework governing Ghana's ASGM sector across its value chain, covering aspects such as establishing designated mining areas, land acquisition, licensing procedures, mine operations, gold trading, and mine closure/rehabilitation. However, significant gaps and governance challenges exist. For instance, strategies for designating ASGM areas are not comprehensive, licensing procedures are complex and not decentralised to meet miners' needs, and a clearly defined framework for responsible gold sourcing is almost non-existent. These issues result in delays in licensing (also see Kumah, 2022), inadequate gold sourcing mechanisms, and ineffective monitoring. Consequently, many miners resort to informal operations, negotiating with landowners and mining illegally. The lack of capacity among regulators to effectively monitor mine operations and land reclamations, coupled with the increasing involvement of landholders and customary authorities in informal land transactions, further exacerbates formalization challenges. Similar difficulties are found in Sierra Leone (Maconachie and Conteh, 2021). Licensed gold traders in Ghana can potentially legally buy gold from both legal and illegal miners, compounding illicit financial flow risks (also see: Hunter (2020). Laws ensuring rigorous due diligence in gold trading and effective monitoring are lacking. The current legal framework is inadequate for supporting a formalized ASGM sector and needs reform.

These findings align with broader formalization challenges in SSA. ASGM formalization in SSA faces numerous barriers, including complex bureaucracies, high costs for securing permits, and insufficient designated mineralized areas for prospective licensees (Hilson et al., 2021), as evident in countries like Zimbabwe (Spiegel, 2015), Liberia (Van Bockstael, 2014), Niger (Hilson et al., 2019), and Senegal (Persaud et al., 2017). The process of acquiring ASGM licenses involves navigating multiple government agencies, often requiring national office approval, with associated travel, fees, and personal expenses exceeding the capacity of most rural artisanal miners (Hilson et al., 2022).

5.2. Links between ASGM formalization and policy coherence challenges

ASGM is a significant income source for many mining communities in SSA, but its integration into formal economic and policy structures faces considerable challenges, particularly regarding policy coherence. While formalization is essential for improved livelihoods and environmental sustainability, inconsistent and fragmented policies across different sectors create substantial obstacles. Our analysis reveals that coherence between mining policy and other mining-sensitive sector policies is largely partial and weak. Conflicts between mining policy and other sectoral policies, such as land, agricultural, environmental, and development policies, lead to inefficiencies. For instance, the mining policy may support ASGM activities, but agricultural policies often fail to support farmers affected by mining, resulting in environmental degradation and reduced agricultural productivity. In Ghana, ASGM activities have polluted water bodies and degraded farmlands, leaving farmers without support (Forkuor et al., 2020).

Weak institutional coordination further complicates effective ASGM governance. Collaboration between various governmental agencies at national, regional, and district levels is essential but often lacking. In Ghana, Act 703 mandates that local District Assemblies be notified of any ASGM licensing processes within their jurisdictions, yet their roles and capabilities towards ASGM formalization are not well-defined or supported. This inconsistency hampers the ability of district council officers to support licensed ASGM operations, leading to informal practices that evade regulation and oversight.

The literature highlights that ASGM is not fully incorporated into national development and poverty alleviation strategies in many SSA countries (Hilson and Maconachie, 2017; Hilson and McQuilken, 2014).

This lack of integration means the potential of ASGM to contribute to economic development and poverty reduction is not fully realized. ASGM can provide crucial income for rural households, which can be reinvested into agriculture and other productive activities. However, without coherent policies supporting such synergies, the benefits of ASGM remain limited and unevenly distributed.

Customary land tenure and local governance structures further complexify ASGM formalization. Customary landowners often engage in informal ASGM or negotiate land sales with miners, bypassing official regulatory frameworks due to unfavourable small-scale and large-scale mining policies (Hilson et al., 2020; Nyame and Blocher, 2010). This informal engagement leads to land grabbing, conflicts over land use, and environmental degradation, undermining formal governance efforts. Policies that do not consider customary land rights and local power dynamics are likely to face resistance and non-compliance, exacerbating the challenges of ASGM formalization.

To address these issues, comprehensive and coherent policies that integrate ASGM into broader national development plans are needed. These policies should promote the sustainable coexistence of ASGM with other land-based livelihoods, such as agriculture and supply of clean potable water. Designating specific areas for ASGM, supported by detailed geological surveys, could help tackle land use conflicts, manage environmental impacts, and improve mining efficiency. In 2019, the Ghanaian government introduced the Community Mining Scheme to help communities form cooperatives and engage in local mining, but this revealed a disconnect between the mining sector and local development institutions. District Assemblies with mineral-rich lands recognizing the potential benefits of the scheme, have taken the initiative and proactively led their communities in applying for ASGM licenses from the Minerals Commission (Hilson et al., 2022). Enhancing local governance structures and involving District Assemblies, agricultural officers, chiefs, and landholders in the formalization process can strengthen the link between the mining sector and local development initiatives and thereby support decentralization efforts towards ASGM formalization.

Effective governance pathways are crucial for achieving policy coherence. This requires strong political will and coordinated efforts across multiple levels of government. Policies should facilitate permit acquisition at the district level, promote responsible environmental practices, and support the livelihoods of local communities. Governments can create a more enabling environment for ASGM formalization if they collaborate to designate ASGM areas, regularly update geological maps, and improve institutional coordination. Addressing the challenge of policy coherence requires integrated and coordinated policies that consider the diverse impacts of ASGM on local economies, environments, and communities. Collaboration between different sectors and levels of government, and recognition of the importance of critical non-state interests such as customary land rights, can create a more effective framework for ASGM formalization.

5.3. *Policy implementation structures and institutional coordination mechanisms*

Our research demonstrates that Political, institutional, financial, and sociocultural barriers constrain regulatory and policy implementation efforts in ASGM. Although the literature advocates decentralizing ASGM license applications to district levels (e.g., Dondeyne and Ndunguru, 2014; Kumah, 2022). This approach remains insufficient as miners still need to visit national offices for additional permits. Effective ASGM formalization requires a coordinated effort among government institutions at national, regional, and district levels. The OECD's framework for policy coherence emphasizes cross-sectoral and whole-of-government approaches, leveraging existing structures for better coordination (Zeigermann, 2018).

Integrating ASGM into national development programs is essential (Nilsson and Persson, 2017), yet often hindered by a lack of political will and challenges in implementation, such as inadequate funding for agencies like the Minerals Commission and EPA. Despite the creation of numerous institutions for mineral resource governance, there is a lack of capacity to implement coherent policies across sectors and levels of governance. Ministries and government departments operate in silos, resulting in poor coordination, especially post-licensing. This issue is widespread in SSA, as noted by Fold et al. (2014), who suggested mechanisms to incentivize ASGM formalization in Tanzania and Ghana. Our findings indicate that beyond enacting laws, policies must address the entire ASGM value chain and be supported by sufficient resources.

Achieving policy coherence and effective policy implementation requires strengthening institutions and providing mechanisms for improved vertical and horizontal coordination and collaboration among mining-sensitive sectors (Ranabhat et al., 2018). Less economically developed countries, particularly in SSA, face significant challenges due to weak and limited-capacity agencies. Our study identifies new strategies to address these barriers, emphasizing the need to integrate ASGM with other sectors such as agriculture and development, establish and coordinate institutions for a more formalized and sustainable ASGM, and develop inter-agency and inter-ministerial approaches, building partnerships with non-state stakeholders to create formal platforms for knowledge sharing related to ASGM. Addressing institutional and capacity challenges is crucial for sustainable ASGM practices. While this study focused on state institutions, future research should include non-state stakeholders to enhance policy coherence.

Our findings revealed that barriers to policy coherence are primarily due to internal circumstances such as poor coordination of policy development and implementation processes between ministries and agencies, rather than entrenched factors linked to ideas or interests (Shawoo et al., 2023). Strong political will is essential, requiring a re-examination of how governmental goals are conceptualized. Social norms, and other political factors influencing policy processes and outcomes also need to be re-examined. Mapping stakeholder preferences and power distributions, along with frequently revising sectoral policies to address emerging ASGM challenges, are critical steps. These insights are applicable across SSA. For example, in Zambia, ASGM formalization allowed state control but did not benefit operators, highlighting the need for more support and strong political will (Siwale and Siwale, 2017). Political leadership commitment is essential for policy coherence (OECD, 2018).

6. Conclusion

Existing studies have reviewed regulations and policies within the mining sector. The novelty of our study lies in exploring policy coherence across sectors predominantly impacted by ASGM activities. This paper examined Ghana's laws and regulations concerning the ASGM value chain and assessed the coherence of policies in mining-sensitive sectors. These analyses provided a useful backdrop to better understand the challenges to ASGM formalization. The findings revealed a broad legal framework governing various aspects of the ASGM value chain. However, the laws are insufficiently detailed in certain areas, such as gold sourcing, and overly complex and unsuited to miners' needs in others, such as licensing processes. Additionally, a significant challenge is the effective and consistent implementation of laws and regulations. Findings also indicated that coherence between Ghana's mining policy and sectoral policies for agriculture, water, land, environment, and development is generally 'partial'. Weak policy coherence is reflected in a lack of effective inter-sectoral coordination in ensuring sustainable practices along the ASGM value chain. The current legal framework and degree of policy coherence are inadequate for ensuring effective ASGM formalization and requiring reform. Moreover, ASGM governance is not truly decentralised across the different sectors. Barriers such as lack of political will to push ASGM integration and policy coherence, lack of resources to run institutions, and limited office networks to efficiently implement laws and policies, mean there is incoherent policy implementation across the mining-sensitive sectors. There

are few incentives to motivate miners to enter mining through formal channels to advance their livelihoods. Connected financial leakages and illicit financial flows are not vigorously tackled due to ineffective due diligence checks and monitoring mechanisms. The study overall contributes to our broad understanding of ASGM formalization by emphasizing that legal reforms and policy coherence across ASGM-sensitive sectors are critical to achieving sustainable ASGM, and to ensure that ASGM governance is integrated across all relevant sectors and institutional structures.

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CRediT authorship contribution statement

Enoch Adranyi: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Lindsay C. Stringer:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Henrice Altink:** Writing – review & editing, Supervision, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendices.

Appendix A1. Laws and regulations for artisanal and small-scale mining governance in Ghana

Period of establishment	Laws and regulations
Established in the 1980s	• Mercury Act (PNDCL 217) – replaced with Act 703, 2006 • Small-scale Mining Act (PNDCL 218) – replaced with Act 703 • Precious Minerals Marketing Company Act, 1989 (PNDCL 219)
Established in the 1990s	• The Constitution, 1992 • *Minerals Commission Act, 1993 (Act 450)* • Environmental Protection Agency Act, 1994 (Act 490) • Water Resources Commission Act, 1996 (Act 522) • Local Government Act, 1993 (Act 462) • Office of the Administrator of Stool Lands Act (1994) (Act 481) • *Environmental Assessment Regulations, 1999 (LI 1652) ('Environmental Regulations')*
Established in the 2000s	• Minerals and Mining Act, 2006 (Act 703) as amended by the Minerals and Mining (Amendment) Act, 2015 (Act 900) and the Minerals and Mining (Amendment) Act, 2019 (Act 995), • Internal Revenue Act, 2000 (Act 592) as amended and associated regulations • Lands Commission Act, 2008 (Act 767) • Ghana Revenue Authority Act, 2009 (Act 791)
Established in the 2010s	• *Minerals (Royalties) Amendment Act, 2010 (Act 794)* • Minerals and Mining (General) Regulations, 2012 (LI 2173) Minerals and Mining (Support Services) Regulations, 2012 (LI 2174) • *Minerals and Mining (Compensation and Resettlement) Regulations, 2012 (LI 2175)* • *Minerals and Mining (Licensing) Regulations, 2012 (LI 2176)* • *Minerals and Mining (Health, Safety, and Technical) Regulations, 2012 (LI 2182)* • *(Minerals and Mining Regulations, Explosives, 2012 (LI 2177)* • Minerals Development Fund Act 2016 (Act 912) • Minerals and Mining (Ground Rent) Regulations, 2018 (L.I 2357) • Minerals Income Investment Fund Act, 2018 (Act 978) as amended by the Minerals Income Investment Fund (Amendment) Act, 2020 (Act 1024).
Established in the 2020s	• Minerals and Mining (Mineral Operations – Tracking of Earth Moving and Mining Equipment) Regulations, 2020 (L.I 2404)

Appendix A2. Legislative instruments covering ASGM activities in Ghana

Offences	Penalty	Legislation
Undertaking small-scale mining operation without a licence	Summary conviction to a fine of not less than ten thousand penalty units and not more than fifteen thousand penalty units, and to a term of imprisonment of not less than fifteen years and not more than twenty-five years.	Section 99 of Act 703 as amended by Section 2a of Act 995. New Section 99 (2)(a)
Use of explosives without the written permission of the Minister.	Summary Conviction to a fine of not more than the cedi equivalent of US $5000.00 (at first instance). The cedi equivalent of US$500.00 for each day the offence is continued (after first conviction).	Section 95 of Act 703
Use/purchase of mercury from an unauthorised dealer.	Summary Conviction to a fine of not more than the cedi equivalent of US $5000.00 (at first instance). The cedi equivalent of US$500.00 for each day the offence is continued (after first conviction).	Section 96 of Act 703
Buying or selling minerals without a licence or valid authority by the Minister.	Summary Conviction to a fine of not less than ten thousand penalty units and not more than fifteen thousand penalty units, and to a term of imprisonment of not less than fifteen years and not more than twenty-five years.	Section 99 of Act 703 as amended by Section 3 (1) of Act 995. New Section 99 (1).

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(*continued*)

Offences	Penalty	Legislation
Manufacture/use any mining equipment to obtain minerals in or along the banks of natural water bodies.	Summary conviction to a fine of not less than fifty thousand penalty units or to a term of imprisonment of not less than fifteen years and not more than twenty-five years or to both	Section 99 of Act 703 as amended by Section 6 of Act 995. New Section 99 (6).
Provides or involved in provision of excavator or any other equipment for mining operations contrary to a provision of the Act 703.	Summary conviction to a fine of not less than fifty thousand penalty units and not more than one hundred thousand penalty units or to a term of imprisonment of not less than fifteen years and not more than twenty-five years or to both	Section 99 of Act 703 as amended by Section 7 of Act 995. New Section 99 (7).
Undertaking or facilitating small-scale mining as a foreigner.	Liable on a conviction to a fine of not less than one hundred thousand penalty units and not more than three hundred and fifty thousand penalty units or a term of imprisonment of not less than twenty years and not more than twenty-five years; or to both.	Section 99 of Act 703 as amended by Section 3 of Act 995. New Section 99 (3).
A Ghanaian employing or engaging a foreigner to undertake or participate in small-scale mining	Summary conviction to a fine of not less than thirty thousand penalty units and not more than one hundred thousand penalty units and to a term of imprisonment of not less than fifteen years and not more than twenty-five years.	Section 99 of Act 703 as amended by Section 5 of Act 995. New Section 99 (5)
Contracting a non-Ghanaian to provide mining support services in small-scale mining	Summary conviction to a fine of not less than ten thousand penalty units and not more than fifteen thousand penalty units and to a term of imprisonment of not less than fifteen years and not more than twenty-five years.	Section 99 of Act 703 as amended by Section 1c of Act 995. New Section 99 (1)(c)

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