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Governance challenges of small-scale gold mining in Ghana: Insights from a process net-map study

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Abstract

The small-scale mining (SSM) sector in developing countries is increasingly associated with the use of heavy earth moving machines and large volumes of hazardous chemicals for ore extraction, which can have negative implications on agricultural land use and the environment. Moreover, land reclamation, or the lack thereof, associated with SSM is a rising concern. Despite the potentially far-reaching effects of SSM on the environment and human health, the legal framework for SSM, particularly in sub-Saharan African countries, is not as well implemented as it is for its more formalized large-scale counterpart. Focusing on Ghana as a study case, this paper explores the factors that hinder the implementation of its legal framework for mining. A combination of qualitative explorative methods was applied, including an innovative tool called a “Process Net-Map”, a visual participatory mapping technique. The tool gave insight into the governance challenges of the SSM sector and enabled the identification of policy reform options to address them. The results exposed outdated legislature, which fails to capture the ever-growing complexities of the subsector’s operations, as a major bottleneck. This was with a bureaucratic, resource-consuming licensing process that serves as a disincentive to formal mine registration. Also, a lack of tenure security and documentation of land rights encouraged opportunistic behavior by license holders. Another challenge is the lack of active involvement of local-level stakeholders in ensuring the responsible management of community lands and the environment. In addition to well-known problems of limitations with strict monitoring and compliance, due to logistical, technological, and capacity constraints, the results also identified a lack of collaborative efforts among relevant stakeholders in public, private, and third sectors. Rather than using just the concession size, this paper suggests more focus on the technical and economic requirements in categorizing the subsector operations and its accompanying regulating policies. It also recommends the adoption of more collaborative governance systems, like co-management, which has been successfully implemented in other disciplines, in the SSM sector to ensure sustainable and beneficial environmental use.

Key Words

Small-scale mining, land degradation, remediation, process net-mapping, governance challenges, Ghana

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1. Introduction

There has been increasing global concern regarding the environmental impacts of mining (United Nations Environmental Programme, 2018; World Economic Forum Mining and Metals team, 2014), which has been fueled by a growing number of small-scale mining (SSM) activities in developing countries (Gavin Hilson & McQuilken, 2014; Hinton, 2005; Wall, 2013). SSM, which is increasingly linked to the use of heavy equipment for earthmoving and the use of chemicals, like mercury and cyanide (for on-site ore extraction), can lead to land degradation and contamination. This contributes to a loss of agricultural land which is a major source of livelihood for inhabitants of host rural mining communities (Gavin Hilson, 2002b; Gavin Hilson & Pardie, 2006; Shackleton, 2020; United Nations Environmental Programme, 2018). This is mostly a result of the lack of restoration of these degraded and contaminated mined lands which can be due to deficiencies in legislation regulating the sector, or an absence of political interest to ensure diligent implementation, among other reasons (Gavin Hilson, 2002b). While many scholars have identified the factors that lead to these environmental outcomes (Gavin Hilson, 2002b; Gavin Hilson & McQuilken, 2014; Owusu et al., 2019), the legal and political context within which environmental issues are addressed has received insufficient attention.

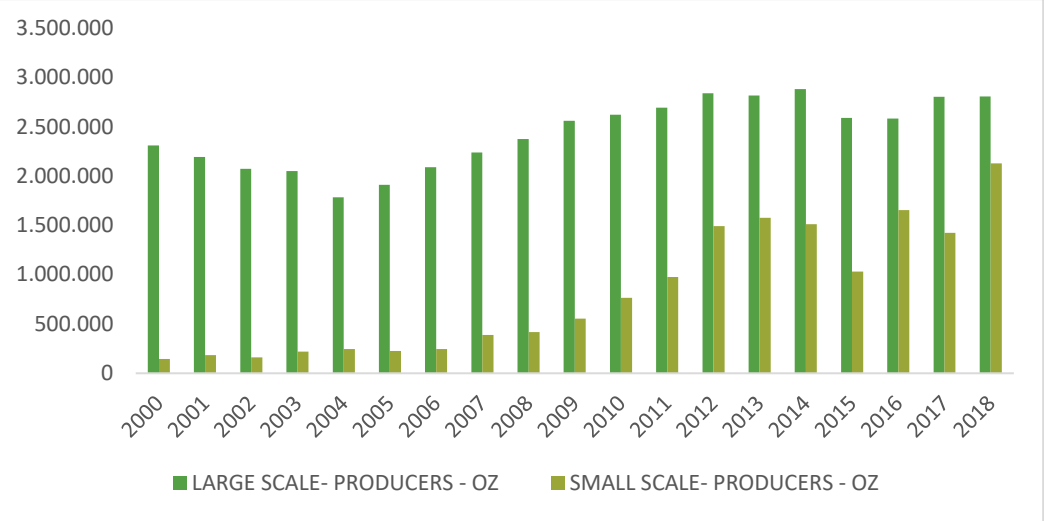
Focusing on Ghana as a case study, this paper addresses this knowledge gap by examining its legal mining framework from a governance perspective. It identifies and addresses the governance challenges of three basic types of governance structures (public sector, private sector, and third sector) within SSM, that hinder the effective implementation of this framework. Ghana provides an interesting case because it has over the years seen a steady evolution in SSM. An African country known for its good governance (Kaufmann et al., 2009), it has, since the 1980s, developed and adopted a legal and institutional framework that governs both its large and small-scale mining industries. The objectives of this framework were to promote, formalize, and regulate the mining sector (Government of Ghana, 2014; Teschner, 2012). Concurrently, large scale mining contributed close to 90% of the total gold produced (Government of Ghana, 2014).

Since then, SSM has grown steadily, however, with rapid spikes in growth over the past decade. In 2018, SSM contributed 43% of the total gold produced (Minerals Commission, 2019). The growth of SSM has been linked to the use of heavy earth moving equipment like excavators (Government of Ghana, 2017; Hinton, 2005), facilitated mostly by illegal foreign investors who introduce these sophisticated technologies (Crawford et al., 2015; Teschner, 2012). These developments have been directly linked to recent mounting tensions and violence in host mining communities just as much as they have to the degrading agricultural

landscapes, loss of forest reserves, and the pollution of major water bodies. Consequently, the central government has had to directly intervene on several occasions by putting in place stopgap measures to deal with these concerns.

Considering the above, this paper addresses the following questions: Why are mined lands reclaimed in some cases and abandoned in their degraded and contaminated state in other cases? Do existing regulatory regimes provide adequate and comprehensive coverage of mine rehabilitation and closure? Why are African mines operating on a small scale not as heavily regulated as their large scale counterparts (Gavin Hilson, 2002b)? Who are the relevant implementing stakeholders in the SSM value chain and what governance challenges do they face?

Figure 1: Trend of gold production in Ghana



Source: Minerals Commission, 2019

2. Research methods, areas, and analysis

2.2. Methods

A combination of extensive documentary reviews together with qualitative explorative research approaches were used in this study. These were complemented with observations from field visits. This section describes the research design as well as data collection and analysis methods used in the study.

2.2.1. Documentary review

The first step was to analyze the legal framework governing the country's mining sector. This was achieved through the review and synthesis of corresponding policy, legal and

regulatory documents, specialized reports, and literature relevant to the sector. This review not only informed the selection of experts within the sector who were then used as study participants, as further explained in subsequent subsections but also served as a triangulation tool to validate findings. To assess how well the legal framework is implemented on the ground for the SSM sector and to identify governance challenges associated with it, mapping and interviewing methods, explained below, were used.

2.2.2. Process net-map

To assess to which extent the legal framework is applied in practice, the Process Net-Map method was used to visualize and understand the roles of relevant stakeholders and details of the steps within the gold mining value chain, as well as to identify where potential bottlenecks within the chain are regarding the implementation of the framework. The Process Net-Map which is a variant of a net-map, includes, in addition to identifying the roles and interlinkages among different actors, the consecutive steps of the processes involved in influencing particular outcomes (Schiffer, 2007b; Raabe, Sekher, Schiffer, Birner, & Shilpi, 2010). The application of the Process Net-Map involved the following steps:

1. The respondents were asked to list all the actors involved in the gold mining value chain including land acquisition, license acquisition, gold extraction operation, ore processing, and gold trading.
2. The respondents were subsequently asked to describe the sequence of activities in each stage of the value chain and to identify the respective roles of all participating actors. Each step in the process was indicated by a numbered link between actors, mapped out on a large sheet of paper. A legend on the map was also developed to describe the meaning of each number.
3. The respondents were then asked to rank the level of influence of the different actors who ensure mined sites are reconstructed and made ready for other economic uses such as farming. An influence scale range of 0 to 8 (0 indicating no influence, 8 indicating maximum influence) was used for this. The influence levels were visualized with poker chips (pile up number depending on the influence level assigned by a respondent to the actor) that were mounted next to respective actors to form “influence towers”. The respondents were also asked to explain why they assigned such influence levels to respective actors.
4. In the fourth step, respondents were asked to identify possible bottlenecks that prevent mined sites from being reconstructed and made ready for economic use

post-mining. The visualization process facilitated the identification and discussion of these challenges and ways in which they could be overcome.

2.2.3. Stakeholder interviews

Guided by findings from the Process Net-Maps, in-depth interviews with selected respondents from all identified stakeholder categories were conducted based on prior purposive sampling. To ensure exhaustive data collection, the chain referral-sampling method was used to gain access to potential respondents who otherwise were hidden or were not originally considered in the preliminary sample population. The respondents included policy making, implementing and regulating institutions, those from civil societies and non-governmental organizations, individuals and companies involved in mining and mining associations, mining research and academic institutions, gold and mercury dealers, financial service as well as mining support service providers (see table 1).

2.2.4. Data collection

A total of 78 stakeholders in Accra, Takoradi, Kumasi, and in mining towns and communities in the Central, Western and Ashanti regions (within and around Tarkwa, Dunkwa, Bibiani, Bekwai, and Konongo) were involved in this study (see table 1). These mining towns were selected based on their history as major mining hubs in the country and because of the concentration of artisanal and small-scale mining as well as commercial mining activities. Data was collected between May 2019 and September 2019. The Process Net-Mapping technique was applied with 45 respondents, each of whom represented stakeholders involved in different activities within the gold mining value chain.

Given that different respondents had in-depth knowledge and experience in specific areas of the value chain, detailed individual Process Net-Maps were generated for each component of the chain. These were later aggregated and discussed with experts who mostly had a broader overview of the chain due to their functions and with actors who were active in most of the components within the value chain. Existing literature was also used to validate the resulting outcomes of the maps. The mapping and interview sessions were conducted by the authors, mostly with individual respondents but sometimes with groups. The sessions were audio-recorded with expressed permission from the respondents.

Table 1: Detailed overview of all interviews

Actor/Institution	Abbreviation	Number of interviews	Number of interviews with net-mapping	Number of participants
Ministry of Lands and Natural Resources	MLNR 1	1	1	1
Ministry of Environment, Science, Technology and Innovation	MESTI 1	1		1
Ministry of Trade and Industry	MoTI 1 – 2	1		2
Minerals Commission (head office)	MCHO 1 – 2	2	2	2
Minerals Commission District Offices	MCDO 1 – 4	4	4	4
Inspectorate Division of Minerals Commission (formerly Department of Mines)	MCID 1 – 3	3	1	3
Environmental Protection Agency head office	EPA-HO 1 – 3	3	2	3
Environmental Protection Agency Regional Offices	EPA-RO 1 – 4	3	3	4
Forestry Commission	FC 1 – 2	2		2
Water Resources Commission	WC 1	1		1
Metropolitan, Municipal and District Assemblies	MMDA 1 – 5	5		5
Office of the Administrator of Stool Lands	OASL 1 – 2	2		2
Ghana National Association of Small-Scale Miners (head office)	GNASSM-HO 1	1		1
Licensed Small-Scale Miners	SSML 1 – 16	5	4	16
Non-licensed (illegal) small-scale miners	SSMI 1 – 5	2	1	5
Ghana Chamber of Mines	GCM 1	1	1	1
Large scale miner (Mensin Gold Bibiani Limited)	LSM 1	1	1	1
University of Mines and Technology	UMaT 1 – 2	2	1	2
Lands Commission	LC 1	1		1
Ghana Revenue Authority	GRA 1 – 2	2		2
Precious Minerals and Marketing Company	PMMC 1 – 2	2		2
NGOs focused on sustainable mining, its environmental, health, and socio-economic issues	NGO-CSO 1 – 3	3	3	3
Gold buyers (middlemen, financiers, banks, local gold buyers)	GB 1 – 4	4		4
Minerals Development Fund Office	MDF 1	1		1
Inter-ministerial committee on illegal mining	IMCIM 1	1		1
Machinery Service Providers	MSP 1 – 2	2		2
Farmers and landowners	FL 1 – 2	2		2
Mercury dealers	MD 1 – 5	5		5
TOTAL		**62**	**24**	**78**

2.2.5. Data analysis

Relevant legal documents and specialized reports were analyzed to understand the legal framework of both the commercial and small-scale mining sectors in Ghana. Content analysis, a qualitative data analytical tool was also used to inductively analyze in-depth interviews most of which were recorded. Content analysis is considered a useful tool for explorative and descriptive studies particularly in collaborative studies where participating subjects are also stakeholders in a situation in need of change or action (Berg, 2001). The individual Net-Maps were aggregated into two comprehensive maps detailing successive steps, actor relations, influence levels using median average calculation, as well as bottlenecks within the small-scale gold mining value chain.

3. Results and analysis

This section begins by presenting the legal framework of Ghana's mining sector (section 3.2). In assessing its implementation, section 3.3 presents the roles of actors within the processes involved in the small-scale gold mining value chain, with section 3.4 addressing their perceived influence levels. Section 3.5 presents the bottlenecks that hinder the achievement of the stated desired environmental outcome on the ground.

3.2. Mining legislation

The review of the legislation indicated that a rather comprehensive legal framework has been adopted in Ghana. The mining sector in Ghana is governed primarily by the Minerals and Mining Act, 2006 (Act 703) (as amended in 2015 and recently in 2019) and the Minerals Commission Act. These serve as the principal enactments setting out the guidelines for the country's mining laws. These documents emphasize among other things the state ownerships of minerals in their natural states, various licensing schemes, and the powers of relevant regulating institutions within the sector. Sections 82 to 99 of Act 703, for example, solely cover SSM, addressing areas including licensing, composition and functions of district mining offices, obligations of a miner as well as mercury distribution and use. In addition to these are subordinate legal instruments, which add details in specific areas highlighted in the principal legislation. There are other relevant laws such as environmental legislations (including those related to forest protection, protection of water bodies and water use), tax legislation, customary law relating to land tenure, the law of corporations, contract law, and administrative law principles concerning the exercise of government powers.

3.2.1. Prospective mining land acquisition

Even though minerals in their raw states on or under the surface of the soil are the property of the state in the trust of its citizens, the lands on which such minerals are found could belong to other varying entities. The location and tenure of the land influence its transfer for use as a potential mining concession. There are 5 land ownership types in Ghana:

1. State lands: These are lands compulsorily acquired by the government under the State Lands Act, 1962 in the interest of the public.
2. Vested lands: These are stool lands vested in the state under the Administration Lands Act, 1962. The state in such cases acts as trustees for the appropriate stool.
3. Stool lands: These are lands vested in an appropriate stool or clan authority, represented by the chief or traditional leader, on behalf of its subjects, following customary law and usage. Such lands practically belong to a group of landholders who have freeholding rights on the use of these lands. The interests of these landholders are secure, inheritable, and generally alienable. The consent of the landholder regarding these interests is required before the alienation of such land by the stool or chief. The challenge with stool lands as far as investment is concerned is that a prospective investor may have to deal with a multiplicity of interests and rights on the land they want to acquire.
4. Family lands: These are lands vested in a family represented by a family head.
5. Privately owned lands: These are freehold interest lands that have been purchased by an individual or a group of persons.

Most lands in Ghana, particularly those found in rural settings where mining concessions are commonly located, are owned by individuals, extended families, or by traditional leaders in the trust of members of the communities they head. According to the Ministry of Land and Natural Resources, about 78% of the total land in Ghana, including forest reserves, is owned by customary landowners or allodial titleholders (clans, stools, families). Customary law allows these landowners to exercise surface rights and appropriate portions of these lands in the interest of their welfare.

Act 703, permits a holder of mineral rights to enter onto land for the conduct of mineral operations, subject to limitations due to the surface rights of the owner or occupier of the land. For a piece of land assigned to a mineral right, the lawful occupier retains the right to graze livestock or cultivate the land surface if such activities do not interfere with mineral operations within the area. The landowner or lawful occupier is however not permitted by law to erect buildings or structures without the consent of the mineral rights holder.

The holder of mineral rights is also required, as stated in Act 703, to compensate the landowner for the deprived use of the natural surface, loss of or damage to immovable property, loss of potential earnings from alternative land use and crop life expectancy benefits in the case of cultivated land. Compensation type (monetary or resettlement) and value, is determined after negotiations between both parties. The Land Valuation Division of the Lands Commission is involved in the case that negotiating parties are unable to reach an agreement on compensation settlements. Its role is to intervene using prescribed public property valuation estimates as a basis to inform negotiating parties. Minerals and Mining Legislative Instrument for Compensations and Resettlement has details of regulations governing compensation and resettlement in the mining sector.

3.2.2. License acquisition

Prospective miners require authorization in the form of licenses and permits from various institutions before commencing their operations. These authorizations, which commit them to strict requirements, legitimatizes their activities, and regularizes mining operations. The different types of licenses that miners can obtain include:

3.2.2.1. Rights for mineral reconnaissance, exploration, and mining

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. Commercial or large-scale mining entities require unique rights for mineral exploration (reconnaissance license), mineral search and evaluation (prospecting license), and for mineral extraction (mining lease). Small-scale miners require a small-scale mining license to undertake small-scale mining activities on a concession area up to 25-acres. This license also allows the license holder to engage in reconnaissance and prospecting.

Non-Ghanaians are prohibited by law from engaging in small-scale mining, which is exclusively meant for Ghanaian citizens above 18 years who have been duly licensed to operate. However, entities incorporated by foreigners can hold mineral rights to operate commercial mines under certain conditions (see Ghana Investment Promotion Center Act, 2013 for details).

Table 2: Summary of types of mineral rights

License type	Reconnaissance license	Prospecting license	Mining lease	Small-scale mining license (reserved for Ghanaians only)
Purpose	Regional exploration now including drilling and excavation	Search for minerals and evaluation	Extraction of minerals	Extraction of minerals
Area	Block of 21 hectares, not exceeding 5,000 contiguous blocks	Not exceeding 750 contiguous blocks	Not exceeding 300 contiguous blocks	Maximum 25 acres
Maximum duration	12 months renewable	3 years, renewable with reduction of the area to not more than half	30 years or less depending on mine life. Renewable	5 years. Renewable

Source: Minerals commission

3.2.2.2. Environmental permit

The Environmental Assessment Regulations, (LI 1652) prohibits a person from commencing activities (such as mineral extraction) which have possible adverse environmental and public health impacts without first registering with the Environmental Protection Agency (EPA) and obtaining an environmental permit from the Agency in respect to the undertaking. The EPA issues an environmental permit after the screening, reviewing, and approving a proposed project through an environmental assessment (EA) process with the applicant. The EA could be in a simple form of a preliminary environmental assessment (PEA) process, usually for small-scale mines or a more detailed environmental impact assessment (EIA) study, for larger-scale mines. Notable requirements of an EA include relevant information such as the location, size, and likely output of an undertaking; technology intended to be used; a report of consents of the general public and those directly impacted by the undertaking; evidence of compensation payments to land and property owners; and a plan detailing proposed steps to mitigate unavoidable environmental and health impacts of the undertaking.

The process of acquiring an environmental permit also requires an applicant to develop a management and/or financial plan for reclamation and abandonment. The applicant (only in the case of a large-scale mining undertaking) must post a financial bond to the Agency to that effect. This amount is to be returned to the applicant at the end of the project after meeting permit requirements regarding land reclamation. If these requirements are not met, the bond is to be used by the state for reconstructing the degraded and abandoned mined area. A person granted an environmental permit under the Environmental Assessment Regulations, must submit annual environmental reports regarding the mining undertakings

from the date of commencement of operations. A permit for large-scale mining operations is valid for a year whereas that for small-scale mines is valid for two years until renewal.

3.2.2.3. Operating permit

The inspectorate division of the minerals commission is the sole operation permitting institution with the Chief Inspector of Mines as its head and permitting authority. An operating permit allows one to practically exploit the land for minerals (see Minerals and Mining Regulations, Health, Safety and Technical, LI 2182). The Chief Inspector of Mines and the team of inspectors at the division are also responsible for administering and enforcing all mining regulations including transportation, management, storage, and use of explosives in the mines under Minerals and Mining Regulations, Explosives (LI 2177). The division is widely considered as the police of the mines (for both small-scale and large-scale mines).

A holder of either a reconnaissance or prospecting license or a mining lease (small-scale mining license for small-scale miners) can only commence operations after receiving an exploration operating permit or a mining operation permit, respectively. In addition to submitting the relevant mineral right and environmental permit, an applicant must submit a detailed exploration or mining operation plan (depending on the type of operation permit sought) which must be approved by the Chief Inspector of Mines before being issued an operating permit. An operating permit is valid for one year before renewal. Some requirements of a mining operating plan include details on the mining methods; processing procedures; manner of handling of reagents, chemicals, fuel, and explosives; processes of waste management, reclamation, restoration, and abandonment procedure.

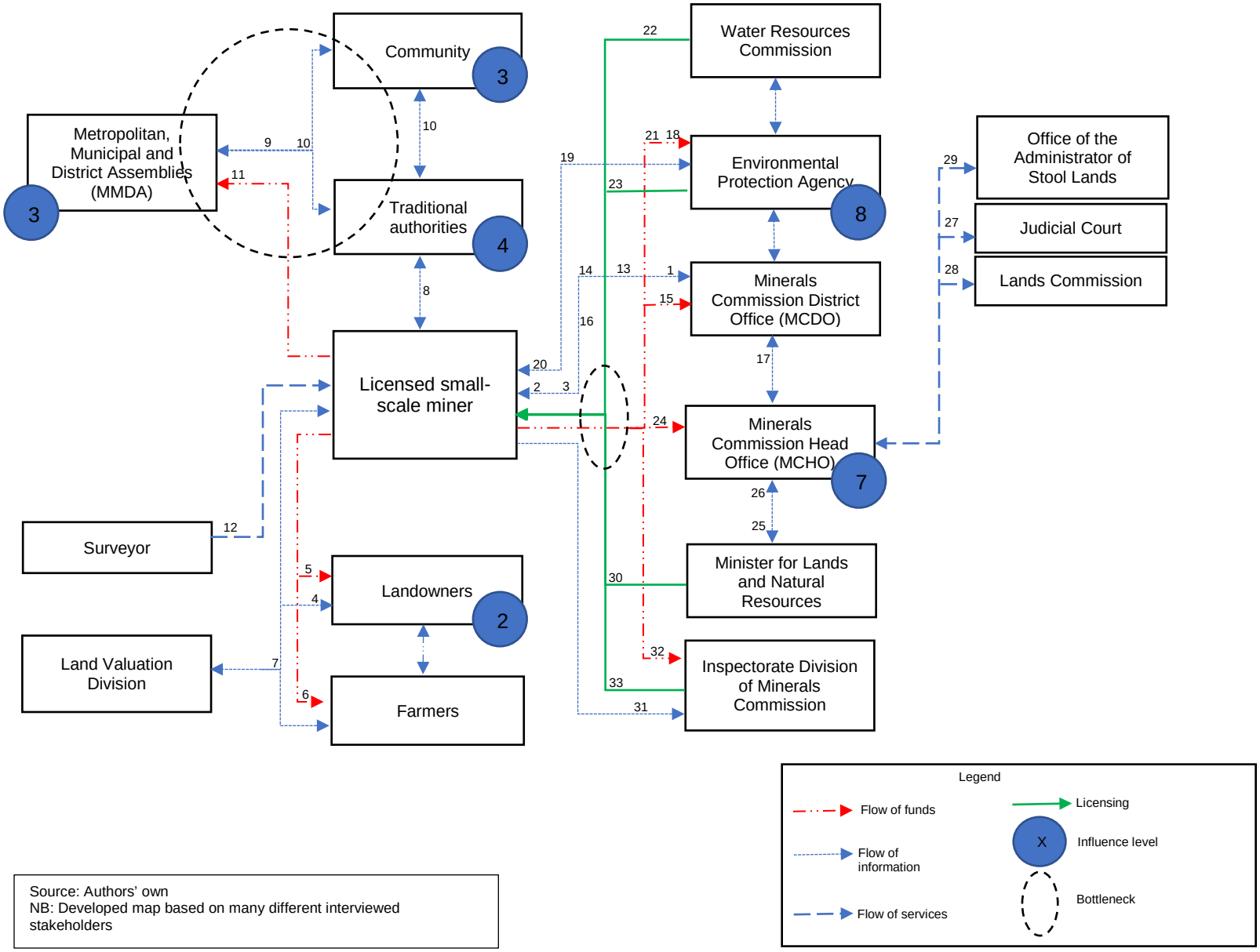
3.2.2.4. Mine closure obligations of a license holder

Licensing conditions compel license holders to practice concurrent reclamation during mining and adopt an effective abandonment plan, which allows for productive reuse of mined areas post-mining. A holder of a small-scale mining license is required to reclaim and revegetate land that is no longer used for mining within one month of terminating activities on the land (LI 2182). Within this period, disused trenches, excavations, and pits must be backfilled to prevent the accumulation of stagnant waters. After these restoration undertakings are completed, the Chief Inspector of Mines and the EPA conduct an inspection and issue the miner with a rehabilitation certificate if results are satisfactory. A mining leaseholder (in the case of a large-scale mine) is required to rehabilitate mining areas that are no longer fit for mining operations within twelve months after the closure of the mine.

3.3. Implementation of the legal framework

This section explores governance problems faced in SSM by analyzing the implementation of the legal framework on the ground. The analysis focuses on the steps that are relevant for implementation based on the aggregation of different individual Process Net-Maps into two comprehensive maps showing the successive steps of the processes within the small-scale gold mining value chain. The average influence levels of actors (see Table 3) who appeared in more than one map were computed and rounded off in the final versions of the maps. Figure 1 shows the details of land acquisition and licensing. Figure 3 shows the details of ore extraction, processing, land rehabilitation, trading, and revenue distribution.

Figure 2: Process Net-map of the small-scale mining value chain (land acquisition and licensing)



Source: Authors' own
NB: Developed map based on many different interviewed stakeholders

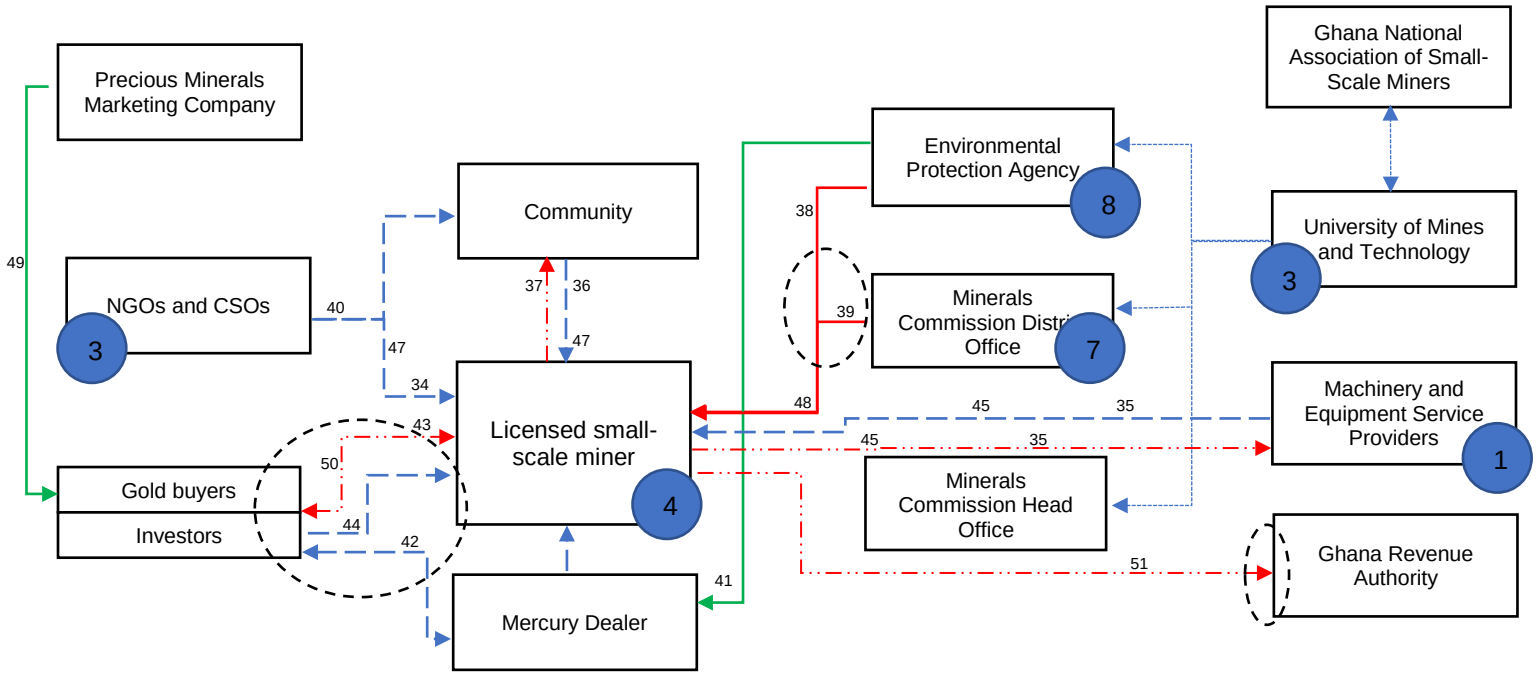
Land acquisition

1. Prospective miner identifies a potential mining area of interest
2. MCDO confirms if the area falls within blocked out zones earmarked for small scale mining
3. MCDO confirms the area is available or has not already been secured by another miner
4. Prospective miner seeks approval of landowner
5. Prospective miner negotiates and makes compensation payments
6. Prospective miner compensates farmer in the case of loss of crop and farmland
7. Land valuation division advises in cases where negotiating parties do not agree on compensation
8. Prospective miner seeks the consent of chief or traditional head of the host mining community

License acquisition

9. MMDA publicizes prospective mining activity throughout the community
10. Concerns raised and conflicts resolved
11. Prospective miner pays levies to MMDA
12. Demarcation of the approved mining area of interest
13. Submission of the site plan to MCDO
14. MCDO officer goes on the ground to validate the work of the surveyor
15. Prospective miner acquires and fills application forms
16. The applicant applies with relevant documents to the MCDO
17. MCDO forwards endorsed application, supporting documents and field reports to the MC head office in Accra
18. Applicant purchases an EPA form
19. The applicant applies and supporting documents to EPA
20. EPA screens application and conducts field visits to confirm the suitability of the area
21. Applicant pays processing and permitting fees
22. Applicant issued a water use permit
23. EPA issues the applicant with an EPA permit
24. Applicant pays consideration fee
25. MCHO develops and submits mining agreement to MLNR minister
26. MLNR minister approves and signs mining agreement
27. Mining agreement acknowledged as a legal tender
28. Mining agreement registered by Lands Commission
29. Mining agreement registered by OASL
30. Applicant issued a mining permit
31. Prospective miner submits mines operating plan to IDMC
32. Payment of operating permit fees
33. Applicant issued an operating permit

Figure 3: Process Net-map of the small-scale mining value chain (ore extraction, processing, land rehabilitation, trading, and revenue distribution)



Source: Authors' own
NB: Developed map based on many different interviewed stakeholders

Mining operation

34. Investors contribute capital for operations
35. Miner hires machinery
36. Miners employ unskilled labor from the community
37. Laborers and support service providers from the host community earn daily income
38. EPA monitors mining activities on site
39. Minerals commission monitors mining activities on site
40. Training and sensitization

Ore processing

41. EPA authorizes mercury clearance and distribution permits
42. Dealers distribute mercury to miners and other suppliers
43. Investors and gold buyers distribute mercury to miners and other suppliers
44. Trading of mercury and other resources for gold

Land rehabilitation

45. Miner hires earth moving machines to refill dug out pits
46. Community members provide labor
47. NGOs and CSOs provide technical and financial support
48. EPA and MCDO monitor rehabilitation activities

Mineral trading, revenue generation, and distribution

49. Gold traders licensed by the PMMC
50. Gold sold to authorized buyers and gold dealers
51. SSGM pay taxes and royalties to the GRA

3.3.1. Mine land acquisitions

For a prospective miner to gain access to land for mining operations, the approval of the landowner is required, after which both parties negotiate on compensation payment for the affected landowner. In the case where an identified area has been cropped, the farmer must be compensated for the lifetime value of the crop as well as lost benefits from farming operations due to loss of farmland. The Lands Valuation Division intervenes using state-approved estimates to determine compensation payments in the case where negotiating parties are unable to reach mutual agreements (see steps 1 to 8).

3.3.2. License acquisition

The minerals commission has blocked-out areas earmarked for small-scale mining in active mining communities across the country. These areas are officially published in major news and communication media nationwide. Through the metropolitan, municipal and district assembly (MMDA) offices, information of these blocked out zones are posted at public locations within mining host communities (steps 9 to 12). A surveyor is engaged to demarcate and develop site plans for the intended mining area (step 13). The Minerals Commission and the Environmental Protection Agencies are the core permitting institutions. The EPA works with the Water Resources Commission to approve an environmental permit (which includes a water use permit) for the miner (steps 22 and 23). The Minister of Lands and Natural Resources on behalf of the government, and with the recommendation of the Minerals Commission approves the mineral rights for the prospective miner (step 26). The Office of Administration of Stool Lands, the Judicial Court, and the Lands Commission formally acknowledge the contract between the state and the prospective miner (steps 27, 28, and 29). The inspectorate division of the minerals commission finally issues an operating permit (step 33).

3.3.3. Mining operation

Miners mostly rent excavators from machinery service providers for their operations (step 35). Excavators are usually hired for 8 hours at a Ghana cedi equivalent fee of between $460 and $840 depending on its workload capacity, availability, and location[1]. Regulators from the Minerals Commission District Offices and the EPA conduct on-field monitoring visits (steps 38 and 39). The purpose of such visits (which could be formally arranged or unannounced) is to ensure compliance by licensed miners regarding responsible mining and environmental practices, where concurrent

[1] [MCDO 1 – 4, SSML 1 – 16, SSMI 1 – 5, MSP 1 – 2]

land reclamation is encouraged. It also allows the field monitoring teams to provide technical support to these miners. In this regard, the Minerals Commission has set up nine district offices in active small-scale mining areas across the country[2]. The EPA monitoring teams, on the other hand, operate mostly from their regional and zonal offices, with some offices set up in strategic active mining areas.

As third sector organizations, CSOs and NGOs can play an important role in addressing the governance problems caused by market and state failures. The Process Net-Map showed that CSOs and NGOs, such as SOLIDARIDAD, A Rocha Ghana, Wassa Communities Affected by Mining (WACAM), Tropenbos and Friends of the Nation are indeed active at the mine operation level, sensitizing miners and mining host communities towards dealing with the potential impacts and opportunities of mining (step 40).

3.3.4. Mined land rehabilitation

Hired machinery, usually excavators, together with manual labor sourced mostly from the host mining communities are used for post-mining rehabilitation (steps 45 and 46). Mine regulators promote concurrent reclamation as highlighted in 3.3.3 and ensure compliance through field monitoring and providing technical assistance and training (step 48). NGOs and CSOs, mostly those focusing on the environment, are heavily involved at this stage too (step 47). Their roles range from providing funding for rehabilitating abandoned mined lands to providing technical support and training on the rehabilitation processes.

3.4. Level of influence of actors

Analyzing the role of different actors can shed further light on the nature of the governance problems observed in implementing government regulations. As described in section 2.2.2, respondents were asked to rank their perceived influence levels for actors who ensure the reconstruction of mined sites. Table shows the two key regulators, the EPA and the Minerals Commission, as being perceived by respondents as having the highest influence (influence levels of 8 and 7 respectively). Their high scores are based on their core functions as permitting authorities and chief regulators[3]. The range between the highest and lowest influence scores given by respondents for these actors was also quite high (see Table).

[2] Small-scale mining district offices are in Assin Fosu, Akim Oda, Asankra Ogua, Tarkwa, Bibiani, Dunkwa, Konongo, Wa and Bolgatanga

[3] [MLNR 1, MESTI 1, MCHO 1 – 2, MCDO 1 – 4, MCID 1 – 3, EPA-HO 1 – 3, EPA-RO 1 – 4, WC 1, MMDA 1 – 5, GNASSM-HO 1, SSML 1 – 16, IMCIM 1]

Table 3: Average and range of influence scores of actors

Actors	Median average influence level	Highest influence level reported	Lowest influence level reported	Range
EPA	8	8	3	5
Minerals Commission	7	8	4	4
Artisanal and small-scale miners	4	4	3	1
Traditional authority	4	7	1	6
CSOs and NGOs	3	7	3	4
University of Mines and Technology (UMaT)	3	5	3	2
Metropolitan Municipal and District Assembly (MMDA)	3	6	2	4
Community	3	4	2	2
Landowners	2	6	0	6
Machinery service providers	1	1	1	0

The range is the difference between the highest and lowest reported influence levels of an actor. A total of 46 respondents participated in the mapping exercises.

While some respondents gave a perfect score of 8 for these regulators, others argued that their presences were barely felt on the ground[4], hence allocating them with scores as low as 3. This reaction from a regional EPA officer was echoed by most regulating officers:

> *"I am the only trained officer in charge of overseeing all activities in 4 major mining districts in this region… I only have one pick-up truck, one driver and one assistant which is very inadequate" –17/07/2019*.

With hardly any range variations, artisanal and small-scale miners were perceived as having an influence level of 4 on the outcome. Respondents indicated that factors such as the economic value of the amount of ore extracted, pressure from regulators and landowners, availability and affordability of hired excavators (machinery service providers, for this reason, were perceived to have an influence level of 1), and the market price of gold influenced their decision to reclaim and reconstruct mined out concession areas for other users. This was captured from an interview with a regulator:

> *"A miner, desperately looking for gold, is very unpredictable and difficult to manage. Before you get him to do one right thing, you must visit an area for more than 5 times" – 26/06/2019*

Other actors with perceived average influence scores of 4 but with a higher range were the traditional authorities (range = 6). As custodians of all lands within their assigned traditional areas,

[4] [SSML 1 – 16, SSMI 1 – 5, NGO-CSO 1 – 3, UMaT 1 – 2]

chiefs and traditional heads must give their consent before mining operations can begin in their communities. As leaders of local communities, they are the voice of the people and seek their interest/welfare. Under customary law, traditional authorities have the power to prevent, stop, or approve all activities (including mining) that impact on the welfare of their subjects. Traditional authorities are also members of district mining committees, set up to support the regulating bodies in monitoring and developing sustainable mining operations in designated areas[5]. Some respondents however mentioned that some corrupt chiefs allow for illegal, and irresponsible mining within their communities[6]. An officer at the district assembly in an interview mentioned:

"In most of these rural mining areas in the south, the lands are stool lands given to community members who hold allegiance to the stool, mostly to farm or settle on. Before miners start operating, they visit the traditional leader with a token to receive his approval or blessings as a customary but necessary gesture" – 29/06/2019

NGOs and CSOs were given an influence level of 3 (range = 4). NGOs and CSOs such as SOLIDARIDAD, A Rocha Ghana, and Friends of the Nation, also work actively in the mining space, influencing policy, providing technical, educational, and in some cases financial support to selected actors (miners, regulators, communities, and landowners) within the chain. SOLIDARIDAD for example has introduced an innovative model known as the Accelerator for Responsible Gold that aims at rapidly scaling up best practices in the small-scale mining sector by improving the quality and availability of services that miners need to operate responsibly. They proceed to offer premium prices to miners who excel at implementing the organization's criteria for best mining practices.

A Rocha Ghana, an environmental NGO, as another example, provides practical conservation intervention support services to miners to contribute to sustainable ecological management. Friends of the Nation, a socio-environmental NGO is heavily involved in developing a national mercury action plan to limit, and ultimately, eradicate the use of mercury within the SSM sector. Wassa Communities Affected by Mining (WACAM) is an active local pressure group in the Wassa districts of the Western region, serving as whistleblowers to irresponsible mining practices and influencing mining-related policy processes. Some respondents however indicated that the impact on the ground of these third sector actors is not easily recognizable, especially at the local level[7].

[5] See (Minerals and Mining Act, 2006)
[6] [MLNR 1, MESTI 1, MCHO 1 – 2, MCDO 1 – 4, MCID 1 – 3, EPA-HO 1 – 3, EPA-RO 1 – 4, SSML 1 – 16, SSMI 1 – 5, NGO-CSO 1 – 3] and https://www.myjoyonline.com/business/mining/chiefs-engaged-in-illegal-mining-must-be-jailed-minerals-commission/
[7] [MCDO 1 – 4, EPA-RO 1 – 4, SSML 1 – 16, SSMI 1 – 5]

The University of Mines and Technology was assigned a score of 3 because of its role as the primary research and development institution within the country's mining value chain. The university works closely with the Minerals Commission, EPA, Chamber of Mines (an association of commercial miners), and the Ghana Association of Small-Scale Miners to develop and adopt safe and sustainable mining methods. The university also develops appropriate technologies, useful for the sector. As an example, the university has developed the 'sika bukyia'[8], a technology for the direct smelting of gold concentrates as an alternative to mercury amalgamation. This technology has been piloted in selected mining communities nationwide to improve on it for commercial distribution – a process that has stalled since the exit of a European Union funding agency which helped to promote it.

MMDAs were assigned an influence score of 3. At the local governance level of all designated SSM areas, district mining committees have been formed to assist district mining offices to effectively promote, monitor, and develop the mining sector. The MMDA's role with regards to mining is to collaborate with relevant institutions, agencies, and stakeholders directly and indirectly involved in the sector to promote sustainable mining. MMDA also organizes sensitization and educational programs through stakeholder meetings. It also intervenes and addresses grievances between miners and their host communities. The relatively high range for the perceived influence of MMDA (range = 4) was attributed, by most respondents[9], to the limited presence of the MMDA in ensuring that proper mining practices are adopted on the ground.

Residents of host mining communities were also assigned an influence score of 3 (range = 2). These actors bear the brunt of most of the direct negative impacts of mining operations, which usually happen in the form of noise, dust, water, and environmental pollution, loss of farmlands and other employment avenues, and in some cases loss of original settlements due to the development and activities of mines. When able to organize themselves, they act as whistleblowers (like in the case of WACAM) to identify activities of miners that are considered harmful to their welfare. These complaints reach relevant authorities at the traditional and local governance levels for action to be taken.

Landowners were perceived to have an influence level of 2 since their approval is needed before a miner can extract ore from lands they own. In giving out mining lands, they could also demand that these lands are restored to their original forms after ore has been extracted or seek compensation which factors the cost of land reclamation and revegetation if miners do not restore

[8] See (Amankwah et al., 2010)
[9] [MLNR 1, MESTI 1, MCHO 1 – 2, MCDO 1 – 4, MCID 1 – 3, EPA-HO 1 – 3, EPA-RO 1 – 4, WC 1, MMDA 1 – 5, GNASSM-HO 1, SSML 1 – 16, IMCIM 1, SSML 1 – 16, SSMI 1 – 5, NGO-CSO 1 – 3]

the land appropriately. This however is commonly not the case, hence the high range 6[10]. A Minerals Commission District Officer, during an interview, had this to say:

"After receiving compensation payments for giving out their lands to mineral right holders, landowners usually do not follow up to ensure that these lands are managed responsibly during mining or put back in good conditions after mining." – 19/07/2019

3.5. Identified governance challenges along the SSGM value chain

The participatory net-mapping exercise allowed respondents to identify bottlenecks that hinder the successful implementation of the regulatory and institutional mining framework within the SSGM value chain, with emphasis on land use and the environment. In this section, findings for these bottlenecks are presented.

3.5.1. Mined land rehabilitation and the involvement of actors at the local level

At the local level, direct ecological, health, and socio-economic impacts resulting from mining activities are experienced the most. This study, however, found minimum involvement of local-level actors (local authorities, traditional authorities, landowners, and community members) in the activities of miners, especially in ensuring that degraded and contaminated mined sites are appropriately reconstructed after mining (as shown in section 3.4).

Both family land and stool land, which are common among rural active mining areas, have allodial interests from the family or the clan over the land. Such collective rights overrule individual land use rights. Bound to allodial interests, family heads (or elders) or community chiefs can grant land-use rights to certain persons for a certain period. If granted at a lower level, it can be overruled at a higher level (e.g. by a paramount chief)[11]. The challenge with such granted land use rights is that they are not documented or registered with the Lands Commission, with some lands used even though they have not been granted to the miner by authorities.[12]

The district assemblies, with their close association and knowledge of communities at the local level, are generally regarded as a powerful rural governing institution (see section 3.4). Their involvement in mining activities especially on the ground was shown from the results to be minimal,

[10] [MLNR 1, MCHO 1 – 2, MCDO 1 – 4, MCID 1 – 3, EPA-HO 1 – 3, EPA-RO 1 – 4, MMDA 1 – 5, GNASSM-HO 1, SSML 1 – 16, IMCIM 1, NGO-CSO 1 – 3]

[11] In a restoration study report on abandoned artisanal mining areas in Atewa range by IUCN NL & A Rocha Ghana, (2018) p. 23, it is recorded, "Once a farmer or chief grants permission to a miner to conduct mining on its farm land, this might contradict with the initial customary land right granted by the paramount chief, as the land use right granted was e.g. farming. Once the miner has left, the current decision of the traditional council is as follows: If the farmer does not rehabilitate the abandoned mining area within a couple of years, the Community Assembly might decide to reclaim the land. The Community Assembly will than receive the customary land use right for the piece of land. The previous farmer will lose its rights."

[12] [FL 1 – 2, NGO-CSO 1 – 3, MMDA 1 – 5, MCDO 1 – 4, EPA-RO 1 – 4, MESTI 1, LC 1, OASL 1 – 2]

most likely because of their general role as the overall administrative body at the local level. They are mostly overwhelmed with other pressing responsibilities like sanitation, maintaining security, law, and order, among other things. Their current obvious roles in SSM are the collection of levies and publicizing mining concessions[13].

3.5.2. Impact of the licensing process on illegal mining activities and land use

Most mining operators (both licensed and unlicensed miners) interviewed confirmed that the process of acquiring a license (mineral rights, environmental permits, and operating permits) takes a long time and requires having to chase after one's application which goes through a chain of bureaucratic channels in Accra. These long bureaucratic processes make it difficult for local entrepreneurs with low levels of education, for example, to comply. This together with its associated costs, making compensation payments to landholders, and informal payments made to various actors along the chain, provides a disincentive for prospective miners to follow the legal route. There are also cases where foreign investors, with enough capital use locals (who lack such capital) to acquire formal licenses, which these foreigners use to operate illegally[14].

According to the Minerals Commission, acquiring a mining license takes around 3 months if all requirements are duly met. They confirmed that most delays beyond this time may be due to inappropriately filled forms or non-availability of the Minister who is required to sign the mineral right agreement. One of the primary functions of each of the 9 established minerals commission district offices is to help prospective miners expedite the licensing processes. They do not have the power to issue licenses, however – an authority that is held only by the head office in Accra.

The process of acquiring an environmental permit could also take a month or more depending on the anticipated level of the environmental and social impact of the project by the EPA as well as permitting requirements. Just as with mineral rights, environmental permits can only be issued at the EPA head office in Accra even though the processes begin at either the regional or zonal offices.

After securing both mineral rights and environmental permits (which comes with water use rights) an applicant must then apply for an operating permit to begin operating. This involves submitting a mining operating plan, together with all other permits acquired and the payment of permit fees. Overall, the inferences made from the process net-mapping exercise and from interviewing

[13] [MMDA 1 – 5, MCDO 1 – 4, EPA-RO 1 – 4, NGO-CSO 1 – 3]
[14] [MCHO 1 – 2, MCDO 1 – 4, MCID 1 – 3, EPA-HO 1 – 3, EPA-RO 1 – 4, MMDA 1 – 5, GNASSM-HO 1, SSML 1 – 16, SSMI 1 – 5, IMCIM 1]

respondents indicate that, if all conditions are met accordingly, an applicant requires between 4 to 6 months and around US$ 3,600 (or more after considering payment to landowners) between the period of identifying the prospective mining area of 25 acres and operating as a licensed miner.

Unlike with large-scale miners who are required to post reclamation bonds before being issued with relevant permits to begin operations, the law exempts small-scale miners from posting such reclamation bonds. Instead, regulators request for a detailed environmental assessment report and operation plans to be submitted as a requirement for license acquisition. Applicants who are permitted or licensed to operate are expected to strictly stick to these submitted operating programs and post mined land rehabilitation plans. In many cases, however, compliance with such proposed plans are not followed in practice without strict and regular monitoring.

3.5.3. Monitoring compliance with proper mining and post-mining environmental management

On paper, Ghana is considered as having among the most decentralized systems of small-scale mining governance in the world with its 9 Minerals Commission District Offices being complemented by regional and zonal EPA offices (Corbett et al., 2017; Mcquilken & Hilson, 2016). This decentralized structure could be expected to reduce the governance challenges of implementation of government regulations by improving on-site monitoring of mining operations and the provision of technical support to miners. As required by law (see Act 703), mining district offices, aside from promoting mining in the country, are also responsible for ensuring compliance with responsible mining practices by miners.

Mining licenses and permits are accompanied by permitting conditions to which these regulators ensure compliance through periodic on-site monitoring visits. These visits are made to keep miners conscious of their environment, their health and safety, and that of their workers while operating. Field officers are authorized to provide technical support services and/or impose sanctions to operators who deviate from recommended operating protocols. The evidence collected however identified constraints with regards to staff, technological and logistical capacity in most of these districts, regional and zonal public regulating offices that affect effective monitoring operations.

For lack of adequate logistical and technological resources and due to security concerns (with reported cases of illegal miners keeping and using firearms in self-defense), district Minerals Commission officers have been instructed not to visit active illegal mining sites. Rather, they are to report them to the nearest law enforcement agencies. These illegally operating mines are

occasionally backed by powerful individuals within the government however and continue to operate even after police (and sometimes military) intervention. This sentiment was expressed by an environmental NGO as:

"When you really go down to the mining issue, you will realize that, there are always these small group of people, backed by powerful individuals, and even though the particular mining that they want to do is not the priority land use option preferred by the majority of people, they get their way because they are backed by these powerful people" 23/08/2019

4. Discussion

Using Ghana as a study case, this study reviewed governance challenges of SSM by analyzing the government regulations in place to address the externalities of gold mining and by exploring the factors hindering its successful implementation within the SSM sector, with a focus on land use and the environment. The paper identified implementation barriers associated with an outdated legislature, minimal active involvement of local-level stakeholders, bureaucratic and resource-consuming licensing processes, and limitations regarding monitoring and compliance. This section discusses the findings with comparison to identified best practices from the Australian and German mining industries, which are considered among the leaders in practicing sustainable mining and land rehabilitation.

4.2. The mining policy, legal and regulatory framework

Barriers, such as the ones highlighted above, significantly contribute to an uneven pattern of environmental behavior, with some mines operating in line with governmental regulations, while others ignore environmental issues entirely (Hilson, 2000). For the SSM value chain to run sustainably, producing desirable ore quantities at limited environmental, health, and safety costs, there is a need for interactive roles to be played by relevant actors in public, private and third sector institutions under an effective regulatory environment.

Mining legislation must be periodically and actively amended to address in detail the ever-growing complexities of natural resource extraction and its accompanying socioeconomic and environmental concerns (Kuter, 2016). The artisanal small-scale mining subsector in Ghana now uses heavy earthmoving machinery and handles increasing volumes of hazardous chemicals in its operations. Without conducting appropriate geological studies to assess ore economic quantity and quality before operating (Teschner, 2012), "trial and error" mining approaches increase the cost of environmental repair (Hilson, 2002b). These developments call for a review of the current

definition of the subsector which, as it stands, emphasizes the size of the concessions, more than the technical and economic conditions under which its mines operate. Accurately categorizing subsector operations and consequently, its accompanying legal and regulatory requirements should also contribute to reducing the long, bureaucratic and resource consuming license acquisition process which could explain the share of illegal mining operations.

Current mining laws in Germany for example, apply equally to small, medium, and large-scale mines. Provisions could be made within the Ghanaian mining legislature to ensure that small-scale operators, just as it is with large-scale mines, mandatorily commit to bearing the environmental repair cost burden. This should induce the practice of conducting detailed geological assessments before mining operations begin. The results from this assessment could contribute to serving as relevant bankable collateral to access formal finance and investments. In implementing such a policy reform, authorities should consider making strategic adjustments in order not to further increase mining land and license acquisition costs. Also, incentive packages, which promote safe and environmentally sound mining, like the payment of premium prices for sustainably mined gold could be promoted. Third sectors may play an important role in this regard. An example is, the premium payments initiated by SOLIDARIDAD, and Fairtrade, which also encourage small-scale producers to organize themselves into cooperatives. Policy considerations regarding costs and financing are necessary since the SSM industry struggles to obtain investment finance, and therefore faces resource limitations, but still must front the costs for land reclamation. Additional policy and regulatory considerations could include;

- Ensuring that a thorough pre-mining environmental investigation, which details an assessment of the landscape and soil characteristics as well as existing vegetation cover of the potential mining concession area, is done before mining operations begin. This will provide baseline information on the area for post-mining land rehabilitation
- Establishing a post-mining land use planning process before granting concessions, which balances the needs of the government and the host mining communities. This process could allow the prospective miner, local and traditional government representatives, landowners, and communities to meet and agree on a plan for the use of the land after mining.

4.3. Land tenure

The findings confirmed that there is usually no signing of legal land transfer documents during the land acquisition stage of the mining value chain. The mining legal framework only mandates the mineral rights holder to compensate the landholder after negotiations before ore extraction

operations commence. These negotiations and compensations however do not consider the cost of land degradation and pollution (an inevitable outcome of the extraction process) or include what land reconstruction strategies the surface rights holder must adopt post-mining. Landholders, after transferring lands and receiving compensation payments, do not make follow up monitoring visits on their property to ensure its proper management. The study findings confirmed that lands in rural mining communities do not have higher levels of tenure security and formal documentation of land rights.

Deininger et al. (2008) argue that having private contracts, even for rural lands, which have been sanctioned publicly does not only increase the value of the land but also protects against opportunistic behavior by the other party if this party submits to the same authority. Formally registering lands found in such ore endowed regions will not only increase the value of these assets, which could contribute as relevant bankable collateral to access formal finance and investments but can also protect against irresponsible behavior of mineral right holders on the land while extracting ore. Increasing the value of such lands could also serve as an incentive for these landholders at the community level to involve themselves more and directly in mining activities. This suggestion is in line with Mcquilken & Hilson, (2016) who argue that those who mine their lands may be more inclined to reclaim and protect it for future agricultural use.

4.4. Local-level actor involvement

The authority and influence of traditional leaders at local level governance in Ghana, just as in many parts of Africa, cannot be overemphasized. Customary land tenure structures, which see the distribution of rural lands managed by these actors, and the inclusion of traditional leaders in district mining committees, underscores their importance further. Traditional leaders play an active role as agents of rural community development. Their lack of initiative, however, embeds existing poor environmental management practices and dooms sustainable development schemes, even before they begin. Specific to SSM and land reclamation, Mcquilken & Hilson, (2016) identifies traditional authorities as the best voice for policy dialogue. Their influence level in this study exemplifies their position as important implementing agents.

As the governing arm of the central government at the local community levels, local authorities (including law enforcement groups), are a powerful governance institution (Hilson, 2000; Mineral Council of Australia, 2017). Their expanded active presence on the ground, complementing efforts of traditional mine regulating institutions to enforce strict compliance to regulations by miners at the rural community level can contribute significantly to safeguarding the environment.

In addition to such collaborative strategies of intensifying strict compliance monitoring exercises, solutions involving actors of the third sector could be promoted. Examples include community-based natural resource management groups, like “Landcare” in Australia (Prager & Vanclay, 2010), and already in Ghana’s case, local pressure groups like WACAM. In collaboration with the local government and non-governmental organizations, inhabitants within host-mining communities could work together in local groups to ensure responsible mining and environmental protection is practiced within their communities.

4.5. Intensifying compliance with strict environmental regulations

Lack of technological, logistical and staffing capacity, a typical governance problem of implementing state regulations has been confirmed by this study as among the primary causes of the poor state of the environment that results from mining operations (Crawford & Botchwey, 2016; Gavin Hilson, 2002b; Mcquilken & Hilson, 2016). Even with its fairly well decentralized small-scale mining governance system (Mcquilken & Hilson, 2016), the subsector still faces major capacity and logistical problems that hinder effective compliance in monitoring efforts. This is a major concern because between 60% to 80% of its miners operate informally without the security of licenses (Mcquilken & Hilson, 2016). Some researchers have linked a lack of effective law enforcement capacity to the growing scale of illegal mining activities (Hilson, 2002a; Hilson & Potter, 2003). Research findings confirmed that state regulators are prohibited from accessing illegal mining concessions to offer technical support and training. Some of these illegal operators were identified as having the backing of certain powerful government officials.

The success of the mining industries in Australia and Germany and even that of local large-scale mines has been largely attributed to strict compliance to mining and environmental regulations due to well resourced, modern, and active monitoring structures (Kuter, 2016; Mineral Council of Australia, 2017). Pressure from actors of the third sector, e.g., strong farmers groups and the environmental movement in Germany, may have contributed to this result by strengthening the political will for proper implementation. A more active presence of field monitoring staff, with support from other relevant stakeholders at the local level, with security forces, such as Operation Vanguard, would also be a promising strategy. To ensure that security forces and regulators perform their roles without interference from corrupt but powerful authorities, hidden actors, like the media, should be empowered to report such illegal activities and those responsible to the public. To ensure the safeguarding of the environment, investments by central governments into developing the logistical and staffing capacity of local small-scale mining and EPA offices are required.

4.6. Investment in the promotion of cleaner production practices

Promoting the use of research-driven and collaborative mining and rehabilitation methods throughout the life of a mine has been key to the success of the industry and the protection of the environment in many developed countries (Hilson, 2000). In the Ghanaian context, the University of Mines and Technology has been the primary research and development institution within the mining area, contributing knowledge and appropriate technologies (like concurrent land reclamation strategies and cleaner production technologies) to both the small-scale and large-scale mining sectors. The development and dissemination of promising innovations, like retorts and 'sika bukyia', which are in most cases supported by foreign development projects, are stymied when such projects end. Direct government and other local stakeholder investments in technologies like the 'sika bukyia', will not only provide a more eco-friendly and safer alternative to mercury use but will also help control the influx of the toxic chemical through unapproved routes into the country (Lassen et al., 2016; Ministry of Environment Science Technology and Innovation, 2018).

5. Conclusion

This paper analyzed the legal and political framework governing Ghana's small-scale gold mining sector, with a focus on land rehabilitation for use post-mining and explored the governance challenges related to its implementation on the ground. The research findings highlighted that a comprehensive legal framework was in place to address the market failure associated with gold mining, but the framework was outdated and hence failed to capture the ever-growing complexities associated with the sector's operational methods. A strategic review of the legal framework seems necessary, which should focus on operational and economic requirements of a small-scale mine and not just on the concession size when defining subsector related policies and regulations. This could also help to address the long bureaucratic and resource-consuming licensing problem which was found to be a disincentive to formal mine registration. Lack of higher levels of tenure security and formal documentation of land rights was also identified as a factor that encouraged opportunistic behavior by the license holder. Formalizing ore-rich rural lands, thereby increasing their value, was recognized as a possible incentive for their responsible management. The study also showed that the potential of third-sector actors to address governance problems of state regulation was not utilized as there was the minimal active involvement of local-level stakeholders on the ground, which limited efforts in ensuring responsible management of community lands and environment. Given their knowledge of the local terrain and their influence levels, their active involvement in SSM should be encouraged. There were also limitations with strict monitoring and

compliance due to logistical, technological, and capacity constraints as well as lack of collaborative efforts among relevant stakeholders from the public, private, and third sectors. The concept of co-management, a collaborative governance system, which has been successfully implemented in other areas of natural resource management, is a promising option for the SSM sector to ensure sustainable and beneficial environmental use.

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