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COLLEGE OF BASIC AND APPLIED SCIENCES

POLICIES AND LEGAL CHALLENGES IN SMALL-SCALE GOLD MINING IN GHANA THAT HINDERS ITS FORMALISATION; STAKEHOLDERS' PERSPECTIVE.

HENRY KWABENA KOKOFU

INSTITUTE FOR ENVIRONMENT AND SANITATION STUDIES

(IESS)

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BY

HENRY KWABENA KOKOFU

10442751

THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON, IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF DOCTOR OF PHILOSOPHY ENVIRONMENTAL SCIENCE DEGREE

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DECLARATION

I, Henry Kwabena Kokofu Esq, hereby declare that this thesis is the result of my research work carried out in Tarkwa Nsuaem, Amenfi East, Prestea/Huni Valley, Atwima Mponua, Amansie West, Atiwa and Talensi Districts of Ghana. The thesis was solely composed by myself and has not been submitted in whole or part in any previous application for a degree. Prof. Chris Gordon, Dr. Jesse Sey Ayivor, and Dr. Benedicta Fosu-Mensah supervised the study.

Henry Kwabena Kokofu Esq, Doctoral Candidate

..... Date 03/02/2023

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..... Date 03/03/2023

Dr. Jesse Sey Ayivor, Supervisor

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..... Date 3/3/2023

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ABSTRACT

The mining industry in Ghana is divided into two primary forms: large-scale and small-scale mining. About 20 per cent of the country's mining industry is formalised, while over 80 per cent remain informal and unregulated. The rampant illegal activities associated with the small-scale mining industry has resulted in the degradation of the biophysical environment, posing severe developmental challenges. The country, through successive governments, has initiated moves to stop illegal mining activities all to no avail. This thesis sought to examine policies and legal challenges that hinder the formalisation of the small-scale gold mining sub-sector. The study employed a cross-sectional mixed approach and a systematic documentary review to attain its aims. Data gathering and analysis included both quantitative and qualitative methodologies, with 485 respondents. Focus Group Discussions were conducted at the District/Community levels and Key Informant Interviews with mining-related Institutions. The study collected quantitative data from the seven mining study districts. The study brought out many policies and laws that purport to govern small-scale mining in Ghana. It is important to note that the 1992 Constitution of Ghana is the primary source of law.However, several Acts of Parliaments and Policy statements are meant to regulate the mining sector. The results demonstrated a lack of institutional cooperation and collaboration, for instance, the mode of operation within the Minerals Commission (MC) and that of the Environmental Protection Agency (EPA). The results also suggested that budget allocations and staff strength are insufficient to enable effective monitoring. Moreover, some officers tasked with regulating small-scale miners' operations are found to be corrupt or compromised. A significant level of favouritism and nepotism were also detected. The lack of employment opportunities in mining communities

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influenced many people, mostly the youth, to engage in illegal activities. Furthermore, education and knowledge gaps contribute immensely to the indiscipline in the sub-sector. It was detected that the licensing regime is cumbersome and tedious; hence prospective miners are demotivated from acquiring permits before mining. The appreciation of illegal mining activities is also an issue. Whiles regulators (officialdom) are concerned with environmental degradation and its effects, the operator perceives the activities as a source of income and livelihood. Thus, socioeconomic considerations are powerful among the operators and members of the host communities. That leads to the question of 'political will' to genuinely fight the menace. The study recommends that regulatory agencies are resourced with adequate finances and logistics. Their human resource capacities must also be beefed up in numbers and efficiency. Critical regulators like the EPA should implement the provision in Section 23 of L.I. 1652 (1999) (Environmental Assessment Regulations), which requires the posting of reclamation bonds before the commencement of any mining activities. Furthermore, the coordination mechanisms among state and parastatals agencies such as the Minerals Commission, Land Commission, Forestry Commission, EPA, and the Water Resource Commission should be strengthened with enhanced transparency and efficiency. Policy and legislative formations and implementations are recommended to involve all industry stakeholders. Of particular interest are the traditional local authorities and community members. It is also necessary to upgrade the knowledge base of the direct operators through skills training and awareness creation.

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DEDICATION

I dedicate this piece of work to my father, J. C. Kokofu and Mother, Augustina Oparebea (all of blessed memory) and to all my children and loved ones.

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My special thanks to God Almighty for his continuous blessings and grace unto my life. Special mention is made of my team of supervisors; Professor Chris Gordon (founding Director of IESS), Dr. Jesse Sey Ayivor (Senior Resaerch Fellow IESS) and Dr. Benedicta Fosu-Mensah (Senior Resaerch Fellow IESS). Professor Kwasi Appeaning-Addo, the current Director of IESS, also deserves gratitude for his brotherly advice and encouragement.

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I also acknowledge the support of my children and other family members, friends and colleagues.

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List of Abbreviations

AGC	Ashanti Goldfields Corporation
ASM	Artisanal and Small-scale Mining
CAST	Consolidated African Selection Trust
CSOs	Civil Society Organisations
CSR	Corporate Social Responsibility
CSV	Comma-Separated Values
EIR	Extractive Industries Review
EPA	Environmental Protection Agency
ERP	Economic Recovery Programme
FAO	Food and Agricultural Organisation
FC	Forestry Commission
FDI	Foreign Direct Investment
FGD	Focus Group Discussion
GCM	Ghana Chamber of Mines
GDP	Gross Domestic Product
GNMC	Ghana National Manganese Corporation
GSS	Ghana Statistical Service
GTV	Ghana Television

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HIV	Human Immunodeficiency Virus
ICT	Information and Communication Technology
IMF	International Monitory Fund
KII	Key Informant Interview
LC	Lands Commission
LI	Legislative Instrument
LTR	Land Title Registration
MC	Minerals Commission
MDGs	Millennium Development Goals
MESTI	Ministry of Environment Science, Technology and Innovation.
MLNR	Ministry of Land and Natural Resource
NAP	National Action Plan
NGOs	Non-Governmental Organisations
NIE	New Institution Economics
NMCP	National Malaria Control Programme
NRCD	National Redemption Council Decree
OASL	Office of the Administration of Stool and Lands
PMMC	Precious Minerals Marketing Company
PNDC	Provisional National Defensive Council

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PPE	Personal Protective Equipment
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RMSC	Resource Management Support Centre
SAP	Structural Adjustment Programme
SD	Survey Department
SGDs	Sustainable Development Goals
SSM	Small-scale Mining
STEM	Science, Technology, Engineering and Mathematics
TB	Tuberculosis
TCPD	Town and Country Planning Department
UMaT	University of Mines and Technology
UN	United Nations
UNDP	United Nations Development Programme
WITC	Wood Industry Training Centre
WRC	Water Resource Commission

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CHAPTER ONE

GENERAL INTRODUCTION

1.0 Introduction

This chapter gives a background to the study. It is structured as follows: the study's background, problem statement, study research question, study objectives, the significance of the study, limitations, and organisation.

1.1 Background of the Study

The term “small-scale mining” was first used in the United Nations publication; Small-scale Mining in Developing Countries (Skelding, 1972). It underlined the economic relevance of small-scale mining in developing countries, emphasising the need to enable the creation and implementation of related laws and policies by identifying and defining the sector’s significant features (Hilson, 2002; Skelding, 1972). In general, small-scale mining refers to mining by individuals, groups, families, or cooperatives with little or no mechanisation, typically in the informal market. Nevertheless, small-scale mining operations are as necessary as large-scale mining operations in many countries globally, mainly due to the number of people the sector employs (Thomas et al., 2002).

Small-scale Mining (SSM) in Developing Countries became officially recognised as an industry after the United Nations released a study in 1972 (Skelding, 1972). The study examined the situation of worldwide operations and historical production patterns to put the economic relevance of small-scale mining into context (Hilson, 2002).

Many developing countries, notably those in Africa and South America, have relied on gold mining for their socio-economic growth. For example, Ghana was the world’s biggest gold

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producer between 1493 and 1600, accounting for nearly 36% of worldwide output (Tuokuu et al., 2019; Tuokuu et al., 2018). Small-scale mining provides a variety of benefits to developing countries, notably revenue generation and employment, particularly in rural areas with few livelihood options (Thomas et al., 2002; Hilson, 2001). For instance, according to the World Bank, SSM directly employs 44.75 million people in over 80 countries. When SSM's direct and indirect labour figures are combined, 134 million to 269 million people are employed in service and downstream businesses (Perks & McQuilken, 2020; WorldBank 2019).

Economists believe that mining will be the vehicle for continuous economic progress in emerging nations, as it has been in Canada, Australia, and the United States (Betancur-Corredor et al., 2018; Whitmore, 2006). Nevertheless, when mining operations are carried out in underdeveloped political, social, and economic institutions, the income generated by the exploitation of a non-renewable resource is wasted, social conflict rises, and environmental harm is nearly irreversible (Power, 2002). These have grave consequences for sustainable development and a high tendency to erode the economic gains of the activity in the long run, as a result, evaluating the expansion of the extractive industry as a possible development driver entails rigorous deliberations before reaching definitive judgments concerning the magnitude of expected net benefits or inherent costs (Betancur-Corredor et al.,2018; Power, 2002).

Although legalised small-scale mining has inevitable negative environmental consequences, environmental permits and regular field monitoring can minimise these consequences in most situations. The level of the damage is minimized by the mining and processing procedures employed (Aryee et al., 2003). Many environmental and health problems connected with mercury use are globally related, with similar technological processes leading to emissionsin tailings, vapour inhalation, and contamination of water bodies (Spiegel & Veiga, 2010). Land degradation, diversion of rivers, deforestation, water siltation, destruction of aquatic life

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habitats, and mercury pollution are some of the ecological effects of illegal small-scale mining (Mol & Ouboter, 2004). Direct impacts of this type of mining on human health can include acute mercury poisoning, brain and kidney damage, silicosis, and cardiovascular and pulmonary dysfunctions. Also, injury and death from landslides, cave-ins, and chronic physical overexertion are direct impacts (Spiegel & Veiga, 2010; Hinton et al., 2003).

Small-scale mining in Ghana refers to operations carried out on a full-time basis utilising simple equipment and tools by individuals or organised groups of Ghanaians, usually, a group of four (4) to eight (8) people, or cooperatives of ten (10) or more persons, operated, owned and financed by Ghanaian (Hilson, 2002). Like many other nations in Sub-Saharan Africa, Ghana is rich in valuable resources such as gold, diamonds, bauxite, and manganese, with significant mineral reserves, especially gold, concentrated in the Ashanti, Central, Brong-Ahafo, Western and Eastern Regions. Between 1986 and 1988, Ghana's gold mining sector produced roughly 45 per cent of total foreign exchange and injected over $300 million into the economy. Foreign Direct Investment (FDI) in the mining industry surged fourfold between 1988 and 2009, from US$205.24 million to US$762.26 million (5.6 per cent increase). Additionally, revenues from mineral exports increased significantly throughout the time, from US$186 million to US$2.618 billion, a 14-fold increase. (Dauda, 2020; Tuokuu et al., 2018; Aryee et al., 2003).

In spite of the significant contribution of the gold mining industry to Ghana's GDP and employment, it has also aggravated incidences of environmental degradation, including contamination of rivers and lakes, which provide drinking water to many people in communities (Tuokuu et al., 2018). In addition, some lands have been disappropriated from the local people (landowners) by the Government of Ghana and awarded as concessions to multi-national mining companies, with the original landowners receiving little or no compensation,

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leaving them impoverished (Dery et al., 2020). This has fuelled illegality amongsmall-scale miners, who breach all regulations to exploit the precious mineral by kinds of methods.

Unfortunately, the policy and legal frameworks for Ghana's mining sector have largely prioritised large-scale activities at the expense of small-scale activities, consequentially facilitating illegalities (McQuilken & Hilson, 2016). Studies conducted by McQuilken & Hilson in 2016 revealed that changes to policy and regulations have primarily resulted in policyand legal gaps or inefficiencies. This gap is attributed mainly to a lack of adequate consultation of stakeholders, which leads to the formulation of policies and laws that are difficult to implement (McQuilken & Hilson, 2016). Therefore, this study sought to investigate from the stakeholders' perspective, policies, and legal challenges in small-scale gold mining in Ghana that hinder its formalisation.

1.2 Problem Statement

The search for gold by indigenes and foreigners in Ghana is a critical environmental, social, and health issue of national concern (Ofosu et al., 2020). Gold mining is a substantial aspect of Ghana's economy, contributed about 96.68 per cent of total export mineral profits in 2015 (Botchwey & Crawford, 2019). The small-scale mining sector produces about 1.6 million oz, representing 39% of Ghana's total gold production (Boafo et al., 2019; Minerals Commission, 2016). Approximately one million Ghanaians are directly engaged, and 4.5 million Ghanaians, around 12% of the population, rely on small-scale mining for their livelihoods. It employs about 60 per cent of the mining sector's workforce in the country (Botchwey & Crawford, 2019; McQuilken & Hilson, 2016).

One major concern is that about 80 per cent of the small-scale mining operators are unregistered. Though these illegal operations contribute significantly to Ghana's economy and

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local communities where it takes place (Afriyie et al., 2016), it is associated with several negative environmental consequences and societal and developmental challenges that governments and environmentalists have struggled numerous times to overcome (Azumah et al., 2020). Most worrying is the contamination of water resources through indiscriminate use of mercury and other heavy metals, on the one hand, and the loss of forest resources, fertile farmlands, and land degradation, on the other (MLNR, 2017).

According to UNDP (2017), poverty and significant unemployment are the main factors that contribute immensely to illegal mining operations in many parts. In addition, the tedious and cumbersome nature of the regulatory processes of centralised bureaucracy and the costs of getting a licence to mine make the illegal miners fail to apply for operating licence (Ofori, 2015). Osei-Kojo et al. (2016) also indicated that implementation agencies do not have the adequate personnel and logistics to carry out their mandates effectively. This problem is exacerbated by corruption, the politicisation of the implementation process, and onerous bureaucratic requirements associated with obtaining small-scale permits.

The Inter-Ministerial Committee on Illegal Mining (in, Graphic, 2018) noted that small-scale mining management had become a highly complicated problem at the local level since some local people partner with foreigners to participate in the illicit operations with impunity.

Article 257 (6) states that, "*Every mineral in its natural state in, under or upon land in Ghana, rivers, streams, water-courses throughout the country, the exclusive economic zone and an area covered by the territorial sea or continental shelf is the property of the Republic and is vested in the President in trust for the people of Ghana*". In line with this, the government have enacted laws and policies to manage natural resources including mineral resources however, the government still struggles to effectively manage these resources through the enacted laws and

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policies. The 1992 Constitution of the Republic of Ghana, Article 36 (9), states that "*the State shall take appropriate measures needed to protect and safeguard the national environment for posterity*…." Article 41, clause k also enjoins citizens to "*protect and safeguard the environment*." This however, is not the reality on ground.

The quest for the government to exercise its constitutional mandate of protecting the environment from illicit mining has resulted in using the security apparatchik to crack down on illegal small-scale mining operators. In Ghana, such a combative attitude has a long tradition and history.The illegality of the small-scale mining was initially occasioned by the enactment of "the Mercury Ordinance of 1933" by the British colonial government to prohibit and criminalise the participation of indigenous Ghanaians from engaging in small-scale artisanal gold mining, according to Ghana's Minerals and Mining policy (Sewordor, 2020; Ofosu-Mensah, 2011; Akabzaa & Darimani, 2001). However, the legality ofsmall-scale miners was restored after 56 years by the promulgation of PNDC Laws 217 and 218 of 1989 (Hogarhet al., 2016).

In 2013, the political administration formed the Inter-Ministerial Taskforce to "wipe out" illicit local and foreign miners, which resulted in several arrests and expulsions (Ayelazuno & Mawuko-Yevugah, 2019). In 2017, the succeeding government intensified the effort by usinga combative approach through a joint police/military task force (Eduful et al., 2020; Hilson et al, 2017) christened 'Operation Vanguard' to fight the menace.

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Despite the numerous attempts by successive governments to stop illegal mining activities in the country, lack of political will and definite directions coupled with weak and inadequate institutional arrangements have yielded no noticeable results (Osei-Kojo & Andrews, 2016; Osei-Kojo et al., 2016; Ofori, 2015).

The UNDP, in 2017, opined that the existence of policy gaps and challenges in current legal and regulatory frameworks are partly to be blamed for the persistence of illegal small-scale mining operations in the country. The informality resulting in illegalities in small-scale mining activities can be attributed to flaws in resource allocation, geographical data, and bureaucratic bottlenecks (McQuilken & Hilson, 2016). "*Even though laws have been enactedand numerous attempts have been made to formalise the small-scale mining sector, the evidence suggests these have been largely unsuccessful*" (Geographical Survey of Denmark and Greenland, 2017 p. 111).

The real issue is the government's inability to institute a regulatory structure to bring together all the small-scale mining stakeholders in the formalising process (Corbett et al., 2017; O'Faircheallaigh & Corbett, 2016; Buxton, 2013; Siegel & Veiga, 2009).

In view of the foregoing, this study sought to identify and examine existing gaps in small-scale mining laws and policies that contributes to illegal small-scale gold mining, the level of awareness among small-scale miners regarding mining laws and policies, stakeholder engagement and challenges that hinders the development and implementation of mining laws, policies and stakeholder institutions and agencies, as well as identify possible trade-offs and synergies, and recommendations to influence the policy framework.

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1.3 Research Questions

The main research question of this study is; What are the factors that promote illegal small-scale gold mining operators from regularising their operations from policies and legal perspectives?

The specific research questions for the study are;

1. What are the existing policies and laws governing small-scale mining in Ghana?
2. What are the Policy and Legal gaps that may have led to the menace of illegal small-scale mining?
3. What are the contributory factors leading to illegal small-scale mining?
4. What are the possible recommendations to influence the policy framework?

1.4 Research Objectives

The main research objective of the study is to examine the factors that contribute to illegalsmall-scale gold mining from policies and legal perspectives.

The specific research objectives for the study are;

1. To review and examine existing policies and laws governing small-scale mining.
2. To determine the legal and regulatory weaknesses or gaps that may have led to illegal small-scale mining.
3. To investigate the institutional capacity to enforce mining policies and legislations
4. To assess other factors encouraging illegal small-scale mining despite the legal and regulatory regimes (Technical constraints, e.g., licensing, turnaround time,

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differentiating between what is legal and illegal attractive world price, constraints from the point of view of miners)

5. To assess Community perception on illegal small-scale mining.
6. To identify possible recommendations that can influence the policy framework.

1.5 Significance of the Study

The study adds to the expand knowledge concerning small-scale gold mining, especially regarding its dangerous nature, legality, policy, and regulations (Vangsnes, 2018).

Researchers are urged to serve as intermediaries between professionals and policymakers to conduct impactful studies that contribute to the literature and policy on formalising small-scale mining (Huggins & Kinyondo, 2019). This study links academia, field practitioners, and policy formulators.

To ensure a significant and timely development of the small-scale mining subsector, the need for formalisation is imminent through the formulation and implementation of practical and well-thought policies and laws (McQuilken & Hilson, 2016).

This research is timely and relevant in light of the national agenda to formalise small-scale mining. It becomes increasingly essential to incorporate direct reforms into mining policy and licencing practices, which have become the government's main priority in formalising small-scale mining.

According to UNDP (2016), the Mining industry, for example, helps economic growth by offering chances for employment, company growth, improved fiscal revenues, and infrastructural links, among other things. Similarly, illicit mining may jeopardise the SDGs.

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The findings will help policymakers understand the gaps and limitations in current policies and regulations that have encouraged illicit mining and hampered small-scale mining formalisation in Ghana.

Osei-Kojo & Andrews (2016) revealed in their study that the existing formalisation designs did not consider the majority of local miners' situations, and the policy outline made it extremely difficult or incredibly expensive for small-scale miners to comply. As a result, most of the miners' views and contributions were not included in the policy. This research contributes to the body of knowledge about mining policy development stakeholders and their relationship with field mining professionals, allowing for a better understanding of mining-stakeholder perceptions and interactions (Karidio & Talbot, 2020). This interaction will form the basis of consultative stakeholders' knowledge co-production of mining policies, identifying trade-offs and synergy gaps in policy and legal regulations.

In addition, there are nine primary mining laws, regulations, and general laws governing small-scale mining operations (Hilson, 2001). However, small-scale mining policy and legal failures have necessitated a thorough study such as this one.

By supporting the development of relevant local infrastructure, involving all stakeholders in land use and settlement planning, implementing cultural heritage plans, and reclaiming mined land into parks and green spaces where appropriate, the mining sector can contribute to Sustainable Cities and Communities (SDG 11) (Columbia Centre on Sustainable Investment, 2016). Furthermore, Ghana's mining industry may incorporate and implement pollution-reduction targets, which would eventually contribute to the attainment of Climate Action (SDG 13). This (SDG 13) can be accomplished if mining industries cut emissions, increase climate change resilience, and incorporate climate change into their investment and planning strategies.

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Mining operations contribute to ecosystem disturbance; hence the mining industry must incorporate and execute measures to protect, restore, and promote life on land (SDG 15) (Columbia Centre on Sustainable Investment, 2016).

Additionally, a well-crafted legal and policy framework within the small-scale mining sector will help streamline the operations to achieve SDG 1 (reduce poverty) and SDG 8 (Decent Work and Economic Growth). In addition, SDG 9 can be achieved by considering shared infrastructure solutions (For example, *exploring co-funding arrangements with governments, sharing rails, road, power, water and ICT infrastructure*) through collaboration and leverage (e.g., *Utilising the business profile to encourage the creation of horizontal linkages and promoting domestic research and development initiatives*) (Columbia Centre on Sustainable Investment, 2016).

1.6 Definition of Terms

1.6.1. Policy

According to Torjman (2005), it is difficult to define policy since it is used in many practice areas, impacting every aspect of life from birth to death. Wies (1994) noted that a policy is a collection of rules applied to a domain-managed set of objects. For example, the Centres for Disease Control and Prevention (2015) described policy as legislation to direct governments and corporations in their operations. Policies are intended to guide a group of people, a set of activities, or the allocation of resources. According to Islam et al. (2014), environmental policy entails a dedication to the enforcement of laws, regulatory systems, and sustainability to protect the environment. Thus, environmental policy is a formal framework with defined goals and

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attempts to conserve and improve the environment. Ghana's main environmental policy statement is enshrined in the National Environment Policy of 2014.

1.6.2 Laws

Law is a reason, order, justice, fairness, morality, punishment, and reward to organise people by guiding and controlling their activities, conducts, and behaviours within a geographical region(Rajpoot, 2020; Sabharwal, 2018). A predetermined, defined, or established method or procedure for coordinating events or acts with punishments or legal repercussions can be described as law (Black, 1968). Ghana's ultimate law is the 1992 Constitution, and Article (1) provides for the various sources of law; for instance, an Act of the Legislature or a Court decision are examples of law. This research focuses on environmental laws that protect and sustain the ecosystem. Law's rightness or wrongness is seen societally. This study focuses on Environmental Laws that seek to protect and sustain the various ecosystems and the entire biophysical environment.

1.6.3. Institutions

This study focuses on formal institutions governed by laws, regulations, and legal orders that define their rights, responsibilities, and functions (Hodgson, 2006). On the other hand, Friel (2017) argues that institutions exist to align people's actions and expectations through multi-actor coordination. Institutions help shape societal actions or behaviour and comein several forms. According to Keiozer (2008), an institution is an artificial structure governedby rules. So, a legally constituted institution is created to specify the scope of action of a designated collection of people or agents. It develops regulations and legislation to regulate social behaviour and ensure adherence to recognised norms and values. In effect, institutions serve as the vehicle through which policies, laws are formulated, enacted, and implemented.

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1.7 Organisation of the Study

The study is structured into six chapters. The first chapter sets the stage for the study by describing the background, problem statement, research objectives, significance of the study, limitations,and thesis structure. The second chapter examines the conceptual and theoretical literature. Key policies, laws and legal and regulatory documents on small-scale mining are reviewed. The approach used in the study is detailed in Chapter Three. It describes the research area and the sample sites, instrument data gathering and analysis processes, and the target population. The study's findings are presented in Chapter Four. The results are discussed in the fifth chapter. The conclusion and recommendations are based on the study findings as captured inchapter six.

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CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter introduces the study by reviewing the mining literature. The chapter discusses worldwide and Ghanaian mining history. The chapter also relates mining to the SDGs. The literature on the global mining business and its importance to the global economy and the Ghanaian mining industry is also evaluated. This chapter also covers Ghana's small-scale mining industry. First, the phrases artisanal and small-scale mining in Ghana are defined. The fundamental incentives for illicit mining are then examined, as are the implications. The issues faced by small-scale mining are then examined to understand the sector better. This chapter also discusses the research's theoretical foundation and the institutional and legal context for small-scale mining. The theoretical framework summarises relevant theories. Numerous regulations and legislation govern small-scale mining. The conceptual framework concludes the chapter.

2.1 Definition of concepts

2.1.1 Mining

Minerals have played a significant part in human civilization since they build houses, automobiles, computers, etc. Copper, salt, uranium, gold, silver, bronze, lead, zinc, coal, tin, potash, iron, and oil are listed by Freslon and Cooney (2018), Dubiski (2013) and Berger and Alexander (2019) as some of the key minerals. National Research Council (2002) noted that mining generates jobs, taxes, and foreign exchange. Duncan (2020) and Amponsah-

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Tawiah and Dartey-Baah (2011) describe mining as "digging up the earth's crust to acquire minerals." Alternatively, Haddaway et al. (2019) defined mining as the process of prospecting, exploring, building, operating, maintaining, expanding, abandoning, decommissioning, and repurposing.

Amponsah-Tawiah and Dartey-Baah (2011) distinguished between surface and underground mining, while Blachowski et al. (2017) noted surface, underground, and borehole mining. This research will define surface and underground mining. Surface mining includes blasting ores at the soil's surface and these ores are taken to be refined and extract the minerals (National Geographic Society, 2021; Wang et al., 2020). Many unskilled employees are needed than in underground mining (Ramani, 2012). Examples include s trip, open-cast, and quarrying. Surface mining results in leaving open pits which is dangerous to the environment. Underground mining however occurs deep within the earth and it is used to recover ores from deep within the earth by blasting into the rock underground which can result into catastrophes such collapse surface and trapping of miners underground (National Geographic Society, 2021).

For this study, mining is defined as extracting mineral resources from either earth's surface or beneath the earth's surface through prospecting, exploration, excavation, operation, maintenance, expansion, abandonment, decommission, and repurposing for human consumption.

2.1.2 Small-Scale Mining

Small-scale mining is defined by each nation's mineral and mining legislation. The number of employees, the type of equipment used, and the quantity and value of minerals mined by small-scale miners are other essential components of the definition. Boateng (2018) defines small-

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scale mining as requiring little capital. A small-scale mine employs no more than nine people who are not part of a cooperative group of 10 or more, according to Boateng (2018).

Small-scale mining is defined under Section 93 of the Minerals and Mining Act 2006 (Act 703) as an individual or a group licensed to prospect, mine, and produce minerals in accordance with good mining practices, health, safety, and environmental standards. Small-scale mining is defined in this study as the act of extracting minerals from the ground by a person or group of people permitted by the relevant authorities and working within the framework of the laws and with the application of rudimentary technologies and the use of many unskilled persons.

2.1.3 Large-scale Mining

Multinational mining firms with higher production, more trained labour (primarily expatriate), machinery, technology, and foreign direct investment is defined as large-scale mining (Ayelazuno and Mawuko-Yevugah, 2019; Algee, 2020; World Bank, 2009). For example, large-scale mining is used in Ghana to extract gold, diamonds, bauxite, and manganese, and their activities are regularised (Minerals Commission, 2015). Large-scale scale mining removes mineral resources from the earth's surface or below using sophisticated mining technologies, tools, equipment, and skilled personnel.

2.1.4 Illegal Mining

Any mining conduct that breaches the Minerals and Mining Act 2006 (Act 703) is considered illegal mining in Ghana. Illegal mining is any mining activity by large-scalesmall or large-scale miners that violates national regulations involving exploration, mining, land rights, and mineral transportation licenses, according to Hentschel et al. (2003) and Dozolme (2019). Illegal mining in Ghana is called "galamsey" (collect and sell). It accounts for a large share of small-scale mining in Ghana (Danquah, 2019; Owusu-Nimo et al., 2018). Therefore, the working definition

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for illegal mining is a group of large or small-scale miners extracting minerals fromthe soil outside the confines of the minerals laws in Ghana is considered illegal mining.

2.1.5 Mining Support Service

Mining support services help mining businesses run their operations efficiently. For example, mine management and maintenance services provide vehicles, human resources, tools, and knowledge (Danquah, 2020; Loh, 2017; AMECO, 2016). Mining support services in Ghana are defined under the Minerals and Mining (Support Services) Regulations, 2012 (LI 2174) as the provision of mining services such as machinery, equipment, and spare parts to mining companies; laboratory services**,** servicing debts and paying dividends on behalf of mining companies for efficient mining operations. Mining support services can be defined asoperations and activities undertaken by specialised companies contracted by mining companiesto provide mining services such as exploration, exaction, maintenance, transport of mined materials, goods, and personnel, and rehabilitation of mines for effective and sustainable mining operations. These mining support services are generally not economically profitable tobe carried out in-house.

2.2 Global Mining Industry

2.2.1 History of mining

Before the Egyptian and Roman empires, these minerals were mined for human sustenance from prehistoric times (Husseini, 2018; Coulson, 2012). Mining stretches back to about 40,000BC (New Stone Age), whereas subterranean mining dates back to Africa (Berger & Alexander, 2019; Mason, 1982). Hunting metals used by the ancients included meteoritic iron (Lynch, 2003). According to Fred et al. (2006) and Kündig (1994), the oldest mine is the

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43,000-year-old Lion Cavern in Swaziland (which contains hematite). By 3,000 BC, copper was mined in Egypt (Rhatigan, 2020). Locally produced ochres, ambers, flints, and salt have become increasingly popular. However, between 10,000 and 7,000 BC, the ancients grew more skilled in mining (Earth Systems, 2021). The Nubian and Egyptian civilisations reportedly began gold mining before 6,000 BC. Iron mining in Delhi and China occurred in 310 and 525 AD, respectively. Like the Roman Empire, other empires relied on lead, silver, mercury, copper, and iron ores mined in Britain, Spain, the Alps, and Gaul (Augustin, 2000). Several of

the world's oldest mines are still operating, including Khewra, discovered by Alexander the Great and his troops around 320 BC; the Chuquicamata copper mine discovered by Incan and Spanish explorers in Calama Chile; and The Skour (Husseini, 2018).

Lynch (2003) indicated that copper was smelted in clay pots in the Armenian highlands, central Turkey, and the Sinai Peninsula in prehistoric times. Shepherd (1993) revealed that miners used shafts and slaves to work on silver-bearing lead ore mines near Athens in the 5th and 4th centuries BC. This shows the evolution in mining technology.

The employment of fire in mining was an important technological breakthrough in human civilization. Between 960 and 1127, the Sung dynasty invented the blast furnace to refine extracted the iron. The Romans had perfected hydraulic mining. Later in the Industrial Revolution, miners invented steam-powered lifts, drills, and pumps. According to Lin (2006) and Bergreen (2008), some of the most significant technological breakthroughs in mining happened between the 16th and 19th centuries in England, resulting in the building of blast furnaces. Other raw metals were converted by fire into usable metals (Earth Systems, 2021). Around the Banská tiavnica mines in Hungary, explosives were first used in 1627.

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2.2.2 Contributions of Mineral Resources to the Global Economy

During the twentieth century, 60 billion tons of natural resources were extracted annually (Jowitt, 2020; Ramani, 2012), despite the decline in the mining sector between 2004 and 2012 (Humphreys, 2015). This occurred because developed, and emerging nations (particularly China) used over half of the world's minerals (Humphreys, 2019). China, for example, grew its interest in mining over time, amassing over USD 140 billion in mining assetsby 2015 (Gold Council, 2017). In 2016, the most mined minerals were phosphorus (276 million tons), followed by coal (7.4 billion tons), gypsum (267.1 million tons), iron (3.3 billion tons), and bauxite (299 million tons) (Casey, 2018; Calam, 2018).

In 2019, 2018, 2017, 2016, and 2015, the top 40 mining companies produced USD 686, 683, and 632 billion (Garside, 2020; Price Water House coppers, 2019). Despite the COVID-19 impact, the global mining sector is anticipated to increase from USD 1641.67 billion in 2020 to USD 1845.55 billion in 2021 and USD 2427.85 billion in 2025, according to Wood (2021).The table below summarises the global mining industry production of major minerals mined in Ghana. The table solely provides statistics on mineral-rich nations. In 2019 the global production of bauxite, diamond, gold and manganese ore was 347,100,000 tons metric, 135,800,000 carats, 3,350,000 kilograms, 56 600 000 metric tons, respectively (Brown et al. 2021).

2.2.3 Mining of mineral resources and its consequences on the environment

A mine's life cycle (from prospecting to decommissioning) has an environmental impact (Haddaway et al., 2019). Mining has generated broad land-use change (Sonter et al., 2014), resulting in deforestation (for example, between 2005 and 2015, almost 10% of the Brazilian Amazon was destroyed) (Farmer, 2021; Sullivan, 2017; Swenson et al., 2011). Mining also pollutes and alters soil characteristics (Karaca et al., 2018; Wuana & Okieimen, 2011).

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Furthermore, mineral mining and processing pollute water bodies and wetlands (Zamzow & Chambers, 2019; Jain & Das, 2017). Mining also causes erosion, habitat damage, noise, dust, and harmful gas emissions (Mwakesi et al., 2021; Omotehinse & Ako, 2019; Scanes, 2018; Chauhan, 2010).

The following paragraphs highlight some of the environmental impacts of mining mineral resources.

Mining and the quality of air within mining areas

Air quality is at risk in mining zones due to lack of pollution management and particle emission (Woniak & Pactwa, 2018; Jain et al., 2012; Petavratzi, 2005). Dust from land clearing, excavation, ore processing, loading, and vehicle movement wreaks havoc on air, land,and water quality (Sahu et al., 2018; Saarikoski et al., 2018; Momoh et al., 2013). Polluted air from mining activities harms the ecosystem, especially flora and animals. Thus, mining companies must be mindful of their impact on air quality and take necessary measures to decrease pollution. Mining produces CO_2 and NO_2 emissions from mining equipment (diesel vehicles) and mining operations (rock blasting) (Farjana et al., 2019; Pandey et al., 2018). Kholod et al. (2020) noted that mining produces gaseous pollutants like methane. Giventhat elemental mercury is very flammable, it may stay in the atmosphere for long and be transported and deposited wherever on the planet (World Health Organisation, 2007).

Mining and the Water quality and quantity impacts

Water is utilised in all stages of mining (Gunson et al., 2012). However, the detrimental effects of mining on water quality and quantity are increasing internationally (United States Geological Survey, 2021; Safe Drinking Water Foundation, 2017). Mining wastes, chemicals,reagents, and fuels are polluting water sources. Water quality is also affected by mining chemicals like lead

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and mercury. Furthermore, mining wastewater released onto surface watersand on the ground degrades water quality (Nkansah & Attiogbe, 2017; Mohapatra & Kirpalani,2017; Hogarh et al., 2016). Groundwater withdrawals for mining activities decrease the watertable, and over-pumping of groundwater diminishes the safe aquifer yield (National Academyof Engineering, 2010).

Mining and land impacts

The exploitation of mines has a major influence on the land's physical characteristics (Hilson, 2002). According to Wuana and Okieimen (2011), mining activities can cause soil pollution by extracting large quantities of earth materials containing heavy metals and other pollutants. Mining also includes processing ore-bearing earth elements with potentially dangerous chemicals, resulting in waste products, including tailings, waste rock, slag, and muds (Masindi & Muedi, 2018; Ashraf et al., 2014). Unfortunately, these waste mining materials are kept in tailing ponds without adequate management, causing leaks that pollute mined land surfaces. Soil provides nutrition and habitat for many animals and plants, but soil quality and quantity are harmed by mining operations (Jain & Das, 2017). The disturbance of the environment occurs due to the removal of topsoil and vegetation during mining. Again, Ge et al. (2007) noted that underground mining causes rocks above the mined areas to lose their ability to support top soil adequately and leads to sinkholes, surface depressions, cracks, and even collapse weight of the overlying material.

2.3 Mineral Resources and Sustainable Development (SDGs)

Effective and efficient mining propels sustainable development since mining directly or indirectly impacts every area of our existence. Moreover, sustainable development is a vital

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indication of a country's progress and development (Shahzalal & Hassan, 2019; Mensah & Enu- Kwesi, 2018; Ukaga et al., 2011).

The capacity of institutions and people to successfully cope with issues, adapt to change, and take actions that increase economic growth, reduce inequality and eradicate poverty is described by Du Pisani (2006) and Todaro and Smith (2006) as development. By efficiently distributing finite and limitless resources for generational use, a nation or community can enhance and maintain a healthy economic, ecological, and social system favourable to human growth (Mensah & Enu-Kwesi, 2018; Milne & Gray, 2013; Stoddart et al., 2011).

This demands the adoption of policies that promote and sustain growth in society, environment, and economy (Gossling-Goidsmiths, 2018; World Bank, 2017). The Brundtland Commission was established in 1984 to assist UN member states with sustainable development implementation (Kono, 2014; Brundtland, 1985) and defined sustainable development as "development that meets the needs of the current generation without jeopardizing the ability of future generations to meet their own" (World Commission on Environment and Development, 1987). According to Sachs (2015), sustainable development entails economic growth that is ecologically and socially responsible. In 2015, United Nations members startedto advance the agenda for sustainable development to replace the Millennium Development Goals (MDGs) (Buse & Hawkes, 2015; Dye & Acharya, 2017; Bennett et al., 2020). Swain and Yang-Wallentin (2020), Kroll et al. (2019), Lee et al. (2016), and United Nations (2016) noted that world leaders have committed to 17 Sustainable Development Goals to be achievedby 2030 by mainstreaming the goals into their strategic plans and programmes. Bettelli (2021), United Nations Department of Economic and Social Affairs (2021), and United Nations (2021)provided the main 17 sustainable development goals.

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Goal 2: Zero hunger

Mining significantly affects food security by destroying cropland and further marginalising impoverished smallholder farmers (Wegenast & Beck, 2020). Due to land grabs by miners, environmental degradation, and structural changes in the labour market, many young people are now mining instead of farming. Physiological and non-pathogenic issues in agricultural plants are caused by changes in environmental factors such as nutritional imbalances, genetic predisposition, and hydration problems (Ocansey, 2013). Mining also damages vast acreage of land by removing topsoil and plants and exposing them to severe weather. Due to the loss of vast tracts of farmland due to mining, Assan and Muhammed (2018) and Amoah-Frimpong (2013) hypothesised that families living in communities do not participate in large-scale farming. Moreover, mining firms have failed to pay farmers the full compensation for the land loss. Additionally, mining allows locals recruited by mining firms to make money and better feed their families (Yadav et al., 2019). Nevertheless, farmers (peasants) have no mining job possibilities, andthey are not hired by mining companies, which usually claim a lack of needed skills and education (Schueler et al., 2011).

Goal 3: Good health and wellbeing

Mining negatively impacts human health because it is prone to accidents, injuries, and fatalities (Stewart, 2019; Haddaway et al., 2019; Loayza & Rigolini, 2016). Mining is associated with occupational hazards including accidents, overexertion, dust inhalation, hazardous chemical andgas exposure, violence, and illicit and prescription drug and alcohol addiction (Schwartz et al.,2021). Anaemia affects women near heavy metal mines, whereas stunted development affectschildren (Von der Goltz & Barnwal, 2019). Surface mining releases particulate matter, causinghealth issues such as reduced lung capacity and function, increased cardiovascular

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disease, pneumoconiosis, cancer, and neurotoxic effects (Patra et al., 2016; Murray et al., 2011). Nelson(2013) stated that between 1975 and 2007, silicosis rates among white and black gold miners in South Africa climbed from 18% to 22% and 3% to 32%, respectively.

Mining companies also contribute significantly to the health systems of the countries where they operate by funding economic and human development infrastructure, including health (Osewe, 2015). Mining companies have developed health centres for their employees and community members. Occupational health services, emergency treatment, primary health care, hospital in-patient care, medical aid, TB screening, and HIV counselling are provided by mining corporations, according to Balfour (2018). For example, in 2014, the Ahafo Mine provided free medical care and counselling to over 1200 Ahafo people living within the mine's catchment areas, as well as donated over USD 2 million in medical equipment and supplies to Acherensua, Gyedu, Kenyasi, St. Elizabeth Catholic Hospital, Tanoso, and Yamfo health facilities.

Goal 6: Clean Water and Sanitation

Mining uses much water for sluicing, dust control, rock drilling, and amalgamation (Danoucaras et al., 2012). Many small-scale and illegal mining activities occur in or near water bodies, or water is diverted to mining sites (Boateng, 2018). These procedures result in mercury, arsenic, and cyanide-contaminated mining tailings discharged into the environment. Mining also causes air pollution, noise and vibrations, and damage to the natural drainage system (Jhariya et al., 2016).

The likelihood of soil and silt eroding into water bodies and impacting water quality and availability in the mining zone is high (Agboola et al., 2020; Yeboah, 2008). Mines wastewater discharge and tailings and waste rock seepage pollute water resources in mining locations (Safe Drinking Water Foundation, 2017). Heavy metals including iron (Fe), cadmium (Cd), lead (Pb),

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copper (Cu), zinc (Zn), and mercury (Hg) are released into the environment during mining (Duncan, 2020; National Geographic Society, 2021; Kuffour et al., 2018).

Goal 13: Climate Action

Mining and climate change are closely connected (Damigos, 2012; Pearce et al., 2011). This is because mining activities cause environmental and geographic changes that drive climate change through forest degradation and the release of greenhouse gases. On the other hand, climatechange impacts mining firms' infrastructure and equipment (Ndlovu, 2018; Nelson & Schuchard, 2011). Climate change may impact water and energy sources, affecting mining operations (Odell et al., 2018; Rüttinger & Sharma, 2016; Mining Association of Canada, 2009).

Goal 16: Peace, Justice, and Strong Institutions

Large and small mining companies have harmed indigenous peoples' traditional customs and culture by demolishing sacred places, including shrines, graves, and cultural sites, to make way for mining leading to inter-communal conflict (Nakazawa et al., 2016; Adonteng-Kissi, 2015; Hossain et al., 2013; Gibson & Klinck, 2005). Compensation for indigenous landowners displaced by mining remains a contentious issue (Taabazuing et al., 2012). To maintain peace and security in mining towns, armed militia organisations protect their area.

This is especially true considering that most resource-rich developing countries, particularly Africa, are impoverished due to weak and opaque governance systems, rendering them more prone to violent conflict (examples include Niger Delta, Democratic Republic of Congo, Liberia, Sierra Leone, Angola, Sudan, etc.). Foreign miners sometimes fought with local miners and land owners (Crawford & Botchwey, 2017). Globally, mining activities are regularly greeted by large-scale community demonstrations, notably in South Africa, Mexico,Peru, Chile,

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and Guatemala, with 46%, 24%, and 17% of conflict events reported in 2012 and 2013 (Andrews et al., 2017).

Mining companies invest in police stations, military bases, and checkpoints to help maintain peace and avoid conflict (Issifu, 2016). The construction of a police station for mining villages by Golden Star Resources has boosted the presence of security personnel and reduced crime (Ansu-Mensah et al., 2021; Adonteng-Kissi & Adonteng-Kissi, 2017; Issifu, 2016).

2.3.1 Merits of mining in respect of the Sustainable Development Goals

Mining operations are critical to achieving the SDGs by 2030 due to their impacts on the economy, environment, and people (United Nations, 2021; United Nations Development Programme & United Nations Environment Programme, 2018). United Nations Development Programme (2021) and O'Faircheallaigh & Corbett (2016) believe that mining companies can help achieve the SDGs by providing jobs, paying taxes, and promoting economic growthin low-income and developing nations.

In addition to enhancing economic fundamentals, mineral resources contribute considerably to export earnings, foreign direct investment and foreign exchange (Ericsson & Löf 2019; McMahon & Moreira 2014; Awudi 2002). As mining earnings strengthen national economic foundations, governments have more capacity to eliminate poverty and provide essential social infrastructures like education and health care (Wilson et al., 2015; Bocangel, 2001). Global economic integration and rising demand for commodities have increased rural economies' exposure to mining investments, encouraging local economic growth (Antoc et al., 2019). The mining industry also promotes local commerce and infrastructure development, promoting economic and social growth in rural and disadvantaged regions (Deller & Schreiber, 2012). Mining activity, directly and indirectly, empowers women (through sales of food, clothing, and

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other mining equipment) (Mwakumanya et al., 2016; Jenkins, 2014). Moreover, mining companies invest in local infrastructures such as pipelines, power plants, highways, and ports (Bilal, 2017).

In order to achieve SGDs, mining firms, governments, community members, and civil society groups must create effective partnerships to promote sustainable mining practices, waste reduction, safer mining procedures and sustainable technology. Green mining will improve human health, reduce greenhouse gas emissions, and encourage environmental stewardship (Sonesson, 2015; Columbia Centre on Sustainable Investment, 2021). As stated above, mining's contributions to the 17 SDGs fall within sustainable development's economic and social pillars. However, mining's contributions to the SDGs' second and third pillars (environmental and social) are negative. As a result, the next section examines mining's negative impacts on the SDGs.

2.3.2 Demerits of mining in respect of the SDGs

A lack of sufficient capacity to develop, manage, and control mining activities means governments cannot effectively address severe environmental and social repercussions (United Nations, 2021). Mining has s severe negative impacts on ecosystems, biodiversity, andsocial development (Abbiw, 2020; United Nations Development Programme & United Nations Environment Programme, 2018; Emmanuel et al., 2018; Baah-Ennumh & Forson, 2017). Metal mining generates 15 billion tonnes of garbage each year, 10 times more than global municipal waste (Geological Survey of Sweden, 2021; Jain & Das, 2017). Research has established that mining waste contains metals, acidic and chemically hazardous waste, and dust particles. Furthermore, mining wastes pollute groundwater and surface water, endangering human and aquatic life (Agboola et al., 2020; Sikhakhane, 2018; & Utembe et al., 2015).

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2.4 Ghanaian Mining Industry

2.4.1 History of Mining in Ghana

Gold mining in Ghana dates back as far as the 7th and 8th centuries A.D, even before the first white men (Portuguese) set foot on the land in 1471 to name the land Gold Coast, according to Emmanuel et al. (2018) and Ofosu-Mensah (2017). Ghana's gold mining history predates the arrival of the first white settlers (Portuguese) in 1471 Emmanuel et al., 2018 & Ofosu-Mensah, 2017).

Akan villages like Asante, Denkyira and Akyem often discovered gold on the surface of the ground without digging, according to Dumett (1979). Gold mining supported the Akan kings' economy. The Phoenicians and Carthaginians bought gold from the indigenous inhabitants in the 5th and 6th centuries B.C. (Peters, 2013). Commercial, economic activity began with the advent of gold traders from the Sudan kingdom, where the ancient inhabitants mined alluvial gold and sold it to Arab traders.

Gold was mined in rivers, where miners gathered gold-bearing sediments and washed them to extractgold (Hilson, 2002; Junner, 1973). Gold in Ghana influenced the British colonialization and established gold mining businesses in 1874 (Agbesinyale, 2003; Arhin, 1978; Hilson, 2002; Ofosu-Mensah, 2011). Between 1493 and 1997, Ghana produced around 2,488 metric tons of gold (Tsikata, 1997). Other minerals mined in Ghana include bauxite, diamond,and manganese (Perez, 2019).

After independence, Ghana had tremendous economic growth, but by 1965, the economic growth slowed down (Fosu & Aryeetey, 2006). The gold output fell after the 1966 coup d'état. Between 1983 and 1992, Ghana sought financial assistance from the International Monetary Fund (IMF) and the World Bank, resulting in the Economic Recovery Programme (ERP) and Structural

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Adjustment Programme (SAP) implementations. The ERP and SAP improved Ghana's macroeconomic indices and international financial responsibilities but harmed agriculture (Benhin & Barbier, 2001; Bawumia, 1998; Agyekum, 1997). The ERP alsoforced the government to streamline small-scale sector activities to maximise income, which boosted Ghana's mining sector performance (Ofosu-Mensah, 2011).

2.4.2. Ghanaian Mining Industry

Mineral deposits include copper, phosphate nickel, chromium, uranium, barites basalt clay, dolomites, feldspar granite gravel, gypsum iron ores, kaolin's laterites limestone magnesites marble mica phosphate salt sandstone (Republic of Ghana, 2013). Gold, diamond, manganese, and bauxite are the most commercially feasible minerals for income and jobs creation. Before 1983, the Ghanaian government controlled most mining firms. The mining industry has been privatised and deregulated since 1992 to increase production and efficiency (Hilson, 2001). Israel's Trade and Economic Mission to Ghana (2020) and Perez (2019) found that foreign businesses carry out most mining investments and activities. The Minerals Commission(2021) noted that Ghana has a large-scale (multinational mining enterprises) and small-scale gold mining (by artisanal miners and local mining companies). According to Tuokuu et al. (2018) and Bebbington et al. (2018), Ghana produced around 36% of the world's gold between1493 and 1600. Ghana produced 4.8 million ounces of gold in 2019 (Newcore Gold, 2021; International Trade Administration of the U.S. Department of Commerce, 2020; Whitehouse, 2019). The revenue produced by Ghana Chambers of Mines members from mineral productiongrew to USD 5.9 billion in 2017 from USD 5.1 billion in 2016 (Israel's Trade and Economic Mission to Ghana, 2020). Table 1: Ghana's principal mineral output.

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Table 2.1 Mineral Production in Ghana from 2017 to 2019

Mineral	2017	2018	2019
Gold Produced by Large-scale Mines (Ounces)	2,808,435.00	2,807,918.00	2,989,446.00
Gold Assayed by PMMC (Small-scale Sector)	1,478,687.00	1,984,370.00	1,588,191.00
Total In-Country Gold Production (Ounces)	4,287,122.00	4,792,288.00	4,577,637.00
Manganese (Tonnes)	3,003,580.00	4,551,754.00	5,383,014.00
Bauxite (Tonnes)	1,476,966.00	1,011,302.00	1,116,334.00
Diamond (Carats)	86,925.00	57,531.00	33,789.00

Source (Ghana Chamber of Mines, 2020; Ghana Chamber of Mines, 2019).

Emmanuel et al. (2018) noted that the mining business is extremely saturated with huge international firms and international mining firms. Goldfields Ghana Ltd (Tarkwa and Abosso mines); AngloGold Ashanti (Obuasi and Iduapriem mines); Central Africa Gold (formerly AngloGold Ashanti Bibiani Mines); Golden Star Resources (Bogosu/Prestea and Akyempim mines); and, more recently, Redback Mining Ltd (Chirano mine) and Newmont Ghana Gold Ltd (Chirano mine) (Ahafo and Akyemmines). Ghana Bauxite Company Limited (GBC) runs

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the country's sole bauxite mine at Awaso, just like Ghana Manganese Company Limited's Nsuta-Wassa open-pit mine is the country's sole substantial producer of manganese ore. The Consolidated Diamonds of Ghana, the Akwatia diamond mine is Ghana's only operational mine.

2.4.3 Contribution of the Mining Industry to the Ghanaian Economy

Mining businesses substantially contribute to economic growth. According to the Ghana Chamber of Mines (2020), Perez (2019), Emmanuel et al. (2018), the mineral industry contributed 10.3%, 9.8%, 7.3%, 4.2%, and 5.4% to Ghana's GDP in 2019, 2018, 2016, and 2015. The uneducated and unskilled workers are among the 300,000 employed by small-scale mining businesses, according to Emmanuel et al. (2018). However, large-scale mining firms that are members of the Ghana Chamber of Mines directly employed 11,899 people in 2019 (Ghana Chamber of Mines, 2020). Total direct domestic fiscal receipts from mining and quarrying were GHC 4.02 billion in 2019, GHC 2.36 billion in 2018 and GHC 2.16 billion in 2017. These figures were made up of corporate tax receipts from the mining companies was GHC 2,269,768,470 in 2019, GHC 1,199,597,591 in 2018 and GHC 969,567,315 in 2017; Employee Income Tax (Pay-As-You-Earn) of GHC 736,256,367 in 2019, GHC 457,156,177 in 2018 and GHC 487,988,013 in 2017; Royalty GHC1,006,668,500 in 2019, GHC 705,262,160 in 2018 and GHC 702,407,281 in 2017; Other (Self-Employed) GHC 674,312 in 2019, GHC 178,498 in 2018 and GHC 780,164 in 2017 (Ghana Chamber of Mines, 2020; Ghana Chamber of Mines, 2019).

According to the US Department of Commerce's International Trade Administration (2020), Tuokuu et al. (2018), and Israel's Trade and Economic Mission to Ghana (2020), the mining industry accounts for more than half of all foreign direct investment and one-third of all export income. Mineral export revenue was predicted to reach USD 6.678 billion in 2019, USD 5.779

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billion in 2018, and USD 6.004 billion in 2017. (Ghana Chamber of Mines, 2020; Ghana Chamber of Mines, 2019). Mining companies spent USD 1.88 billion on non-energy items and services to promote the Ghanaian economy in 2019.

2.5 The concept of Small-scale Mining in Ghana

2.5.1 Background of Small-scale Mining

Small-scale gold mining has historically used alluvial gold extraction techniques and winning procedures to separate gold from sand (Hilson, 2001). Small-scale mining attracts indigenous peoples since it is simple and employs thousands of unskilled workers. However, until the early 1980s, the small mining business was uncontrolled (Marie-Noelle, 2019; Dinye & Erdiaw-Kwasie, 2012). In the 1980s, the government sought to regulate small-scale mining to diversify its revenue sources after implementing ERP (Hilson, 2003). The government had enacted and implemented laws and regulatory procedures to simplify small-scale mining activity by 1989, alongside international partners such as the IMF and the World Bank (Sibiri, 2020). Due to Ghana's abundant gold reserves, most illegal small-scale miners are gold miners. However, a few also mined diamonds. Small-scale Gold Mining Law (PNDC Law 28), Mercury Law (PNDC Law 217), and Precious Minerals Marketing Corporation Law (PNDC Law 299) were enacted in 1989 in response to the problems mentioned. These regulations limited mercury usage in small-scale mining and provided legal markets for small-scale gold output (Minerals Commission, 2015).

2.5.2 Characteristics of Small-scale Mining (SSM)

Unlike large-scale miners, small-scale miners do not employ heavy machinery and technology (Boateng, 2018). Sibiri (2020) further observed that Ghanaian's small-scale mining rules restrict Ghanaians' participation and exclude foreigners. It also provides major job possibilities for persons in rural and poor areas. However, it's linked to unsafe and unhealthy conditions,

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social and legal issues, and significant environmental harm. Small-scale mining ranges in size and supplies minerals to the local markets (Marie-Noelle, 2019; Kane, 2013; Ahiadeke et al., 2013; Hilson, 2003;). Aryee et al. (2001) noted that it uses primitive equipment, resulting in inefficient production, low output levels, and low capital investment. Adu-Baffour et al. (2021) claim that small-scale mining operations have developed from usingbasic equipment such as shovels, pickaxes, and sluice boards to semi-mechanised processes. Small-scale mining is characterised by its informality and illegality (Boafo et al., 2019;Teschner, 2012; McQuilken & Hilson, 2016)

The Minerals and Mining Act 2006 (Act 703) established the following legal features of small-scale mining in Ghana.

- Only Ghanaians over 18 years holding a mining license can participate.
- To obtain a small-scale mining license (only valid for five years and are renewable), applicants must pay the fees for the license and pay royalty on gold outputs.
- Small-scale mining is only allowed on lands approved by the Minerals Commission and must register with the Minerals Commission's District Office (which oversees small-scale mining operations.

2.5.3 Contribution of small-scale mining to the Ghanaian economy

Small-scale mining benefits the Ghanaian economy by providing jobs for illiterate young persons in mining areas and revenue for the government, thereby boosting the economy (The World Bank, 2019; Arah, 2015; Sibiri, 2020). In the views of Hilson et al. (2015), small-scale mining indirectly employs almost 3 million people due to its low entry barriers and absence of strict standards for skills and formal education before entering the business. Small-scale mining offers several employment options, from mining to buying and selling minerals to making

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mineral-based jewellery. Small-scale mining is a vital source of income for many unemployed and low-income rural Ghanaians. It's also possible for locals, particularly women, to indirectly profit from small-scale miners by selling their goods to them (Boateng, 2018; Ministry of Lands and Natural Resources, 2017). The Ministry of Lands and Natural Resources (2017) stated that diggers earn between GHC60 and GHC80 each eight-hour workday, while dealers andinvestors earn indirect money.

McQuilken and Hilson (2016) remark that small-scale mining contributes to local wealth generation. Miners typically invest their money to help family farms by providing farming inputs. Small-scale mining also contributes significantly to Ghana's foreign exchange earnings by exporting gold and diamonds. According to Hilson (2002), the government sold over USD 98 million in diamonds and over USD 117 million in gold in 1999. Small-scale mining in Ghana now accounts for about 30% of total gold production, up from 5% in 1990 (Barenblitt et al., 2021; Sibiri, 2020; Owusu et al., 2019). Small-scale miners produced 16,606,699.00 ounces of gold between 1990 and 2019. (Ghana Chamber of Mines, 2016; Minerals Commission, 2015).

2.6 Illegal Mining

Illegal gold mining is common in Ghana It is heavily criticised for its negative environmental consequences, which often exceed its economic advantages (International Growth Centre, 2021). Despite the Mineral and Mining Act (Act 703), significant bureaucratic bottlenecks discourage illegal miners from regularising their operations, resulting in 60-80% of miners working unlawfully (Akpalu & Wong, 2020). The availability of gold in Ghana attracts locals and foreigners to illegal mining activities. Most illicit miners are motivated by poverty (McQuilken & Hilson, 2016; Alves et al., 2019). As a result, illegal miners dominate the small-scale mining sector, contributing considerably to gold output (Reuters, 2021). Illegalminers use alluvial, selection, and vein/lode (hard rock) techniques in mining (Mantey etal., 2016).

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Alluvial miners dig holes or excavate along with water bodies or dredge water bodies for gold-bearing sand. It is then washed to extract gold using sluice boards, washing plants, and pans. Most Illegal miners steal gold from regulated mining firms' stockpiles. In hard rock mining, miners extract gold-bearing rock, smash it, and then mix it with water and mercury to collect the gold particles.

2.6.1 Causes/factors fuelling Illegal Small-scale Mining in Ghana

The Ghanaian government is concerned about illegal mining, often known as "galamsey" (Wireko-Gyebi et al., 2020; Boafo et al., 2019). Because most small-scale mining is done manually, unauthorized miners can easily engage in illicit mining. Zindzy (2018) claims that unemployment, particularly among the Ghanaian young, drives illicit mining in Ghana. Hilson (2003) further demonstrated that the regulatory environment is highly burdensome and irritating for small-scale miners, mostly illiterate. Numerous procedures in the license applicationprocess deter small-scale miners from licensing their activities.

Azumah et al. (2020) noted that poverty, inadequate parental care, bad peer pressures, illiteracy, and low academic performance are reasons for illegal mining. Weak macro- and microeconomic indices leading to high housing, utilities and health care expenses are all factorscited by Agbesi (2017) to be contributing to illegal mining. Boateng (2018) attributes the rise in illegal mining in Ghana to a lack of enforcement of rules and regulations by state agencies and the activities of corrupted chiefs and opinion leaders. Most miners are uneducated and unaware of the rules and regulations governing small-scale mining; thus, they unknowingly engage in unlawful mining.

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2.6.2 Effects of Illegal Mining

Illegal mining activities hinder Ghana's capacity to accomplish sustainable development goals. Wireko-Gyebi et al. (2020), Hilson et al. (2014), and Hilson & Garforth (2013) claim that illegal mining in Ghana is threatening environmental protection and water supplies. Illegal mining results in excessive use of dangerous chemicals, water pollution, poor health and safety conditions for miners, and involvement of minors in mining operations, affecting their health and education (Antwi-Boateng & Akudugu, 2020; Buss et al., 2019).

According to Clifford (2017) and Amankwah (2013), illegal mining in Ghana pollutes water bodies, destroys natural flora, and destroys agricultural lands since most illegal miners are inexperienced and operate with dangerous chemicals. These harmful chemicals are released as acidic effluents, contaminating water sources (underground and surface) used for drinking and agriculture (Tschakert & Singha, 2007). Moreover, responsible officials entrustedwith educating miners on properly utilising harmful chemicals find it difficult to perform sincethe activities are uncontrolled.

Aquatic organisms are sensitive to pH fluctuations induced by illegal mining, which harm their reproduction and possibly cause death (Younger & Wolkersdorfer, 2004). Low pH fluids are also more likely to contain soluble heavy metals and other dangerous components, reducing oxygen solubility and availability for aquatic organisms and causing fish death. Illegal mining also increases acid mine drainage by disturbing soil and allowing sulphide-richminerals, which pollute surface and groundwater with low pH.

Water is used in every stage of mining. So, the activities of uneducated illegal miners in the water poses significant water conservation issues. Gardner et al. (2015) and Arscott et al.

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(2012) discovered that mining depletes water supplies unsustainable through over-pumping, and reduces the aquifer's safe yield.

Duncan (2020) notes that illegal mining harmed river water quality by diverting river paths to mine on the river bed, introducing heavy metals into the river, and river dredging, which dispenses gravels, mud, and rocks, disrupting the river's natural flow and waters quantity (Attiogbe & Nkansah, 2017). Illegal activities have further increased the cost of watertreatment since the bulk of water consumed originates from rivers affected by illegal mining.

Illegal mining severely affects the soil and forest ecosystem through rock movement, creating craters and damaging the surrounding terrain and vegetation (Yaa, 2014). Small-scaleminers in Ghana can harvest huge quantities of buried minerals and carry them to the surface for processing using heavy-moving machinery (Marie-Noelle, 2019). These operations damagethe soil by adding heavy metals and other contaminants not found in surface soils (Wuana & Okieimen, 2011). Waste materials are frequently stored in heaps or tailing ponds, but illegal miners lack the knowledge to manage such waste properly. Thus, it is left untreated and pollutes soils (Lottermoser, 2011; Australian Centre for Sustainable Mining Practices, 2011). Soil provides nutrients and space for plants harbouring beneficial microbes, but mining negatively impacts soil quality (Jain et al., 2012; Jacoby et al., 2017; Butler, 2019; Shrestha & Lal, 2011; Bandyopadhyay et al., 2020).

Yaa (2014) stated that various health concerns plague Ghana's illicit mining industry, ranging from accidents to fatalities in the mines. Business & Human Rights Resource Centre (2020), Adjei et al. (2012), and Arkorful et al. (2018) indicated that galamsey operators face many dangers, including pit collapse and landslides. For example, Ghana News Agency (2009) reported that the pit collapse in Dopaose and Attaso killed 15 and 12 and 5 unlicensed miners

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in 2009 and 2011. Also, Emmanuel et al. (2018) and Basu et al. (2015) revealed that the Ofin River overflowed on June 27, 2010, killing over 100 illegal miners. Stewart (2019) connected illegal mining to psychological, cardiovascular, pulmonary, sexual, nutritional, and water related issues. Along with injuries and accidents, illegal mining contributes to diseases like malaria, upper respiratory diseases, and skin disorders (Basu et al., 2015).

Small-scale mining displaces smallholder farming (Hilson & Garforth, 2013). Illegal mining has also displaced many workers from agriculture and other income-generating activities in nearby communities (Kotsadam & Tolonen, 2014). Food production has fallen in many illegal mining areas causing high food expenses (Nti et al., 2020). The following paragraphs provide information on some of the critical challenges confronting the small-scale mining sector.

2.6.3 Challenges/barriers to Formalising Small-scale Mining

Ghana's small-scale mining has many issues that vary from law to small-scale miners' attitudes and the migration of foreigners. Kane (2013) and Ahiadeke et al. (2013) noted that since 2000, about 50,000 Chinese gold miners have migrated to Ghana to participate in small-scale mining (mainly illegal mining). However, Adu-Baffour et al. (2021) emphasised that small-scale mining governance and regulation outdated and infeasible legislation that fails to recognise the complexities of small-scale mining, bureaucracies in license acquisition, high fees for licenses and other regulatory requirements, poor land tenure, lax compliance monitoring by state agencies managing the sector, and ineffective stakeholder collaboration.

Minerals Commission (2015) also indicated that the small-scale mining sector in Ghana is confronted with challenges such as pollution, social conflicts, over-reliance and exploitation, inadequate geological information, inadequate financial and technical support, difficulty in attracting and retaining local human resources, and inadequate sectoral collaboration such as

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energy, water and transportation. Ministry of Lands and Natural Resources (2017) noted that key difficulties facing small-scale mining include lack of social amenities, rise in adolescent pregnancy, and physical abuse of women in mining villages. There arealso concerns about health and safety in mining communities, rising cases of juvenile delinquency and child labour, rising levels of substance abuse among youth, rising levels of prostitution and promiscuity, rising levels of sexually transmitted diseases, rising levels of foodand economic.

Regularisation of the Small-scale Mining Sector

Though the government has tried to formalise small-scale mining, many unregistered small-scale miners pollute the environment (Hilson et al., 2015). The governmental authorities in charge of regulating small-scale mining are weak. Politicians also lack the political resolve to formalise the industry since non-formalised operations benefit their political parties (Crawford & Botchwey, 2017; Aidoo, 2016). Small-scale miners are irritated by delays, excessive bureaucracy, and corruption in the registration procedure (Adu-Baffour, Daum & Birner, 2021). The cost of formalisation is particularly exorbitant for small-scale miners, who are predominantly poor.

Lack of transparency in small-scale mining encourages mine owners and purchasers to exploit young miners, thus entangling them in a cycle of borrowing and indebtedness (Owusu et al., 2019; Ministry of Lands and Natural Resources, 2017; Minerals Commission, 2015; Meznaric et al., 2021). Even though small-scale miners are required to pay taxes and royalties, the government loses millions of dollars small-scale miner avoids taxes (Prichard, 2009).

Regulatory agencies also cannot properly supervise small-scale miners' activities to assess their environmental, economic, agricultural, and social impacts (Adu-Baffour et al., 2021; Ministry of Lands and Natural Resources, 2017; Bagah et al., 2016; Barenblitt et al., 2021; Arah, 2015).

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As a result, unskilled small-scale miners destroy cocoa plants to mine gold and diamonds (Aborah, 2016).

Use of Rudimentary Technology

Small-scale mining is characterised by low efficiency and production due to its low technology and indigenous nature (Kumah, 2021; Aryee et al., 2003; Hilson, 2002). Most small-scale miners are unaware of Ghana's geological history. They don't know how to estimate mineral resource quantity (inferred or proved reserves) and quality (Ministry of Lands and Natural Resources, 2017; Minerals Commission, 2015). Excavators, bulldozers, chisels, hammers, and pickaxes are used by many small-scale miners who cannot afford to buy or hire heavy moving equipment such as excavators or bulldozers. This increases the risk of injury and death in small-scale mining operations (Jennings, 1999). Hardhats, safety glasses, gloves, and work boots are uncommon among small-scale miners in developing nations like Ghana (Chimamise et al., 2013).

Illegal Business Dealings

The Ministry of Lands and Natural Resources (2017) believes that the informal and uncontrolled nature of small-scale mining in Ghana makes it difficult for the government to maintain openness and accountability. Many small-scale miners sell their gold and diamonds on the black market and smuggle them out of Ghana (Myjoyonline.com, 2021; Barreto et al., 2018). These small-scale miners' illicit business operations cost the state a lot of money. Some Ghanaians with small-scale mining concessions are enticing outsiders, mainly Chinese, to mine (Boafo et al., 2019; Boafo, 2019; Crawford et al., 2015). Moreover, many small-scale miners employ illegal mining chemicals like mercury and cyanide (Bansah et al., 2016). Regulations have little or no control over these miners' purchases of hazardous mining chemicals (Chaparro,

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2003). Gangs with unauthorised firearms are formed to defend small-scale mining locations (Hausermann et al., 2020; Ministry of Lands and Natural Resources, 2017).

Deviant behaviours associated with Small-scale Mining

Due to poverty, many young girls in Ghana's small-scale mining villages are lured into sexual activity, resulting in early adolescent pregnancy, early marriage, and abortion (Kwofie, 2019; Britwum et al., 2017; O'Driscoll, 2017; André & Godin, 2014). Children in small-scale mining communities work in mining to earn money. This impacts the children's schooling (Ankutse, 2016; Botchwey & Crawford, 2016). Many small-scale miners also abused drugs and alcohol to gain strength for mining and relieve pain after mining (Ministry of Lands and Natural Resources, 2017).

2.7 Sustainable Mining Analytical Framework

Globally, the mining industry is characterised by many approaches and perspectives on sustainable mining (Levesque et al., 2014; Franks et al., 2011; Leskiw & Singh, 2007; Overell et al., 2008). Based on this assumption, the study attempts to build an analytical framework that theoretically drives sustainable mining best practices using the sustainable development idea (Kumi et al., 2020; Bryman, 2016; Ragin & Amoroso, 2011).

This research adopted the World Bank Group's Extractive Industries Review (EIR) Principles (Hatcher, 2012; Slack, 2012; Franks et al., 2011; Bush, 2010; Pegg, 2006). Tuokuuet al. (2019) provide comprehensive insight into its use and effectiveness. To support the adoption of EIR principles, opposing critiques from critical research/studies are presented.

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Franks et al. (2011) noted that developing and implementing global mining standards, including EIR principles, has facilitated sustainable waste disposal procedures. The impact of EIR principles implementation is questioned by Slack (2012) noting that it is "primarily window dressing designed to assuage public fears about the fundamentally harmful character of extractive industry activities" (p.179). Achieving environmental and social sustainability goals while engaging in profit-making private investment activities lacks harmony and balance, according to Campbell (2003), quoted by Tuokuu et al. (2019). While some EIR elements, including implementing sound environmental rules and stakeholder involvement, are important for sustainable mining (Dupuy, 2014; Campbell, 2009; Hilson and Murck, 2000).

Generally, the EIR principles focus on three key areas; social development (stakeholder engagement), environmental policies, and effectual governance (including economic management). For this study, it is essential to note that the EIR principles address the "*need to integrate small-scale and artisanal mining into the formal sector*" (EIR, 2003, p. 24). This largely falls within the remits of the governance aspect of the EIR principles. According to Weiss et al. (2021, p. 3), theories regarding governance definitions are "*rooted in management, innovation or policy studies*." This underscores the adoption of the Department for International Development's (2006, p.15) definition of governance, as cited by Hilson and Maconachie (2008), – "*the capability of governments to get things done, how they respond to the needs and rights of their citizens, and how, in turn, people can hold their governments to account*." Tuokuu et al. (2019, p. 924), and Mackay (2004), clearly highlight the EIR principles' recommendation that to achieve sustainable mining, the quality of extractive sectorgovernance must be improved, with a focus on "transparency and accountability in revenue flows and revenue management" throughout the project life cycle. However, literature assessment shows that weak governance systems and regimes impede resource exploitation benefits in developing

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countries especially in African countries, including Ghana (Toukuu et al.,2019; Oppong, 2018; Tuokuu & Kuusaana, 2015; Smith et al., 2012; Ross, 2004). This research outcome indicates that the state of governance within a country's mining sector directly impacts the success or failure of sustainable mining best practices.

Social development via comprehensive stakeholder engagement actions remains a key element of the EIR principles (EIR, 2003). It is recognised as a necessary factor for achievingsustainable development goals (Tuokuu et al., 2019). Pegg (2006, p. 379), as cited by Tuokuuet al. (2019, p. 924), acknowledges that "*giving poor people a stronger voice in their respective countries' governance is vital to making state institutions more responsive to the needs of the poor*," hence, supporting sustainable mining best practices. This remains important due to evidence of the prevalence of tokenism and other ineffective stakeholder engagement practices in Africa's mining sector, including Ghana (Masterwille, 2014; Ayee et al., 2011, Kumah, 2006). Active participation of stakeholders in policy decision-making, implementation, and monitoring and evaluation drive effective policy and legal outcomes (Tuokuu et al., 2018) and address challenges of illegal small-scale mining. An analysis of the EIR (2003) shows that practical poverty alleviation efforts must be underscored regarding the rights of local people (MacKay, 2004). Further assessment of the EIR (2003), as consistently asserted by Pegg (2006), indicates the World Bank Group's position to ensure mining activities directlysupport the development of local groups, mainly the vulnerable, needy, and women.

To facilitate effective environmental management within the mining sector, some key aspects of the EIR principles were envisaged to be incorporated into future international mining standards to ensure sustainable mining (Tuokuu et al., 2019). The applicable guidelinesinclude: (a) integrated and social impact assessments; (b) update and full implementation of the natural habitat policy to allow for protection of animals in their natural habitat; (c) update and full

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implementation of the resettlement policy; (d) revision of the disclosure policy to improve mining projects' transaction transparency; and (e) development of guidelines for emergency prevention and response – green technology uptake (Tuokuu et al., 2019; Hatcher,2012; Lange, 2011; Campbell, 2004; EIR, 2003). However, despite considerable strides in the adoption/implementation of recommendations, observations about environmental management and outcomes (in Ghana, for instance, and predominantly in Africa) do not indicate a laudable case of progress. Consequentially, a strong case for a comprehensive view on facilitating effectual governance through a well thought out and participatory stakeholder engagement approach to achieve necessary environmental policy implementation impact remains critical to achieving sustainable mining and addressing illegal small-scale mining.

2.8. Institutional Arrangement in Ghanaian Small-scale Mining Industry

The institutional framework under which the implementation of the mining function falls is broad and involves cross-cutting and national level institutions such as the Ministry of Environment Science, Technology and Innovation (MESTI), Environmental Protection Agency (EPA), Ministry of Lands and Natural Resources (MLNR), Minerals Commission (MC), Forestry Commission (FC), Lands Commission (LC), Water Resource Commission (WRC), Ghana National Association of Small-scale Miners, Precious Minerals Marketing Company Limited (PMMC), Geological Survey Department, Local Assemblies, etc.

2.8.1 Ministry of Lands and Natural Resources

MLNR is in charge of creating land and natural resource policy and providing political leadership to assure optimal use/management of the nation's natural resources. The Ministry has three divisions: forestry, land, and mining. These agencies include FC, LC, Ghana Boundary Commission, and the Office of the Administrator of Stool Lands, MC, Ghana Geological Survey Authority, PMMC, the Minerals Development Fund, and Ghana Integrated

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Aluminium and Steel Development Corporation (Ministry of Lands and Natural Resources, 2021).

2.8.2. Ministry of Environment Science Technology and Innovation (MESTI)

The MESTI is responsible for environmental policies. A new Environmental Policy emphasised linking long-term economic growth, social transformation, poverty alleviation, and environmental sustainability. The Ministry also controls statutory agencies that execute environmental and scientific policies such as the Council for Scientific and Industrial Research, the Ghana Atomic Energy Commission, the Environmental Protection Agency, the Land Use and Spatial Planning Authority, the National Biosafety Authority, and the Ghanaian Nuclear Regulatory Authority (Ministry of Environment, Science, Technology & Innovation, 2021).

2.8.3. Minerals Commission (MC)

Article 269 of the 1992 Ghana Constitution and the Minerals Commission Act 1993 (Act 450) established the MC to control and manage the country's mineral resources and to coordinate and execute mining policy (Minerals Commission, 2019).

2.8.4 Precious Minerals Marketing Company Limited (PMMC)

PMMC began as the Ghana Diamond Marketing Board in 1963. It is a state-owned company that buys gold and diamonds from small-scale miners. It also helps expand Ghana's jewellery business to create value locally. The PMMC's role has moved from buying minerals from local miners to testing them before export in recent years. The firm was selected as the government's assayer in 2016 and has been doing so since February 2018 (PMMC, 2018).

2.8.5. Forestry Commission

FC is established by Article 269 of the 1992 Constitution and FC Act 1999 (Act 571). The Commission also consults, supports, and instructs persons and businesses involved in the forest

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sector and provides technical services. The Commission has five primary departments and centres: Wildlife Division, Forest Services Division, Timber Industry Development Division, Resource Management Support Centre (RMSC), and Wood Industry Training Centre (WITC), which was recently restructured as the FC Training Centre (Forestry Commission, 2021).

2.8.6 Lands Commission

The LC Act of 1994 (Act 143) created the LC in 1992. It is in charge of administering vested public and non-public properties, providing recommendations for national land use policy, and keeping records on public lands. The Lands Commission is assisted in carrying out its duty by the Office of the Administrator of Stool and Lands (OASL), the Survey Department (SD), the Land Title Registry (LTR), and the Town and Country Planning Department (TCPD) (Lands Commission, 2021).

2.8.7 Ghana Geological Survey Authorities

Ghana Geological Survey Authority Act 2016 (Act 928) and the 1962 Survey Act (Act 127) established the Ghana Geological Survey Authority. The Department ensures that geological information is reliable and current through geological mapping, research, and investigations. It also supports sustainable mining by sharing geological data to protect the environment and human health (Ghana Geological Survey Authority, 2021).

2.8.8. Environmental Protection Agency (EPA)

The Environmental Protection Agency Act, 1994 (Act 490) creates the EPA to prevent water, air, and land pollution and advises MESTI on environmental policy formation. The Act mandates EPA to issue environmental permits and pollution abatement notices to all businesses and persons whose actions affect the environment.

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2.8.9 Water Resources Commission of Ghana

The Water Resources Commission of Ghana was established by the Water Resources Commission Act, 1996 (Act 522), which mandates it to manage the country's water resources through the development of integrated water resource management plans that guide the country's water resource utilisation, conservation, development, and improvement (Water Resources Commission of Ghana, 2021).

2.8.10. Ghana National Association of Small-scale Miners

The primary objective of the Ghana National Association of Small-scale Miners is to "promote effective, efficient, and responsible artisanal scale mining for sustainable development."

2.8.11. Local Assemblies

District Assemblies continue to be essential components of Ghana's decentralised policy structure. As the basis and focal point for local planning and development, District Assemblies have the authority to oppose applications for mineral rights that might jeopardise human, environmental, and socioeconomic well-being. Furthermore, when mining activities continue, the Assemblies must spend mineral royalties prudently on economic and social infrastructure provision and improvement (Minerals Commission, 2014).

2.8.12. Ghana Chamber of Mines (GCM)

The Ghana Chamber of Mines (GCM), the mining sector's major representative organisation, was created in 1928 and functions as a voluntary private-sector employers' organisation representing enterprises active in the minerals and mining industry. The West Africa Chamber of Mines, which gave rise to the Ghana Chamber of Mines, established its first offices in 1903 with the primary purpose of furthering and preserving the shareholders' mining interests. 2021) (Ghana Chamber of Mines).

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2.9. Theoretical Framework

Theories are essential in research as they give a framework for successful analysis and practical application (Collins & Stockton, 2018). Abend (2008) and Kivunja (2018) said that a good theory is defined by four essential criteria: conceptual definitions, connection construction, domain restrictions, and predictions. Hence any theory picked for research must be generalisable, coherent, unique, and significant. The study utilised Systems theory, Stakeholder theory, New Institutional Economics, Property Rights Theory, Transaction Cost Theory, Agency theory

2.9.1 Systems Theory

The systems theory is one of the oldest scientific ideas widely used in management, society, the environment, and other fields. According to Biel (2018), ecologists first adopted systems theory in 1971. System theory is credited to famous Austrian scientist Karl Ludwig von Bertalanffy. The scientist challenged and highlighted Newtonian notions' limits like closed systems and linear cause-and-effect connections in the early 1920s (Anderson, 2016). A systemphenomenon cannot be reduced to individual components acting alone. Instead, the entire system must be examined, emphasising interdependencies (Bertalanffy, 1968).

A systemic approach to management and other disciplines of study, according to Adams (2011), improves group alignment and analysis of complex and multidisciplinary social issues.The use of systems theory to understand concepts across disciplines is generally accepted, according to Adams (2012) and Mele et al. (2010). In this study, system theory allows thoroughresearch of policy problems relating to small-scale mining in Ghana. The theory will provide aholistic approach to policy issues in the small-scale mining sector. Chikere and Nwoka (2015) and Straub (2013) described that a system comprises interdependent components that must be coordinated for optimal efficiency and effectiveness. The systems theory is based on Aristotle's

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work on holism, which states that knowledge is obtained through understanding the whole concept, not just its components. So, instead of focusing on particular policies and institutions, this study employed system theory. In this study, the system theory considers all the policies and laws (regulations) and institutions regulating the small-scale as interrelated units. Thus, comprehensive policy and institutional evaluation are required to properly recognise and resolve challenges impeding the formalisation of small-scale mining.

Small-scale institutions, laws, and policies share structural commonalities. So, when analysing the obstacles facing small-scale formalisation, it is important to keep in mind the different laws and regulations and the organisations charged with implementing regulations and policies. Asa result, the study was able to realistically assess the effectiveness of laws, policies, and institutions in formalising the small-scale sector. However, implementation is influenced by various factors, and leaders must discover and understand the functional and efficient systems that affect performance and embrace their effects to get the most outstanding performance from individuals.

Systems theory, as defined by Mele et al. (2010), is an interdisciplinary field of study that focuses on the entire system. The study's stance aligns with Weinberg's (2001) notion that systems theory examines the different characteristics of discrete pieces as a whole. The basic idea of systems theory is that all parts work together to achieve a common objective (Chikere, & Nwoka, 2015; Ng et al., 2009; Leighninger, 1978). So, by analysing all of the basic concerns impacting laws and regulations, the formalisation process of small-scale mining may be more efficient and effective.

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Despite its broad applicability, system theory has problems in natural situations since not all parts of the system have equal influence or contribution (Basile & Caputo, 2017; Berman, 1996). Determining the effect and control of formalisation concerns in Ghana's small-scale industry is not easy. Some regulations, norms, and institutions will have a greater influence on small-scale mining activities than others. Given the ambiguity of Ghana's political structure, it is difficult to perform a complete review of all laws, rules, and institutions in the small-scale sector. Adapting laws and regulations to changing environmental conditions requires periodic evaluation.

2.9.2 Stakeholder Theory

Dr. F. Edward Freeman proposed stakeholder theory in his book Strategic Management: A Stakeholder Approach, stating that any organisation's success depends on meeting the demands of all stakeholders (Basile & Caputo, 2017; Parmar et al., 2010). Stakeholder theory defines the interests and actions of individuals or institutions in a society, sector, or industry (McGrath& Whitty, 2017; Matuleviciene & Stravinskiene, 2015). Stakeholder theory also includes viewpoints, ideas, expressions, and metaphors (Haataja, 2020). In the policy cycle, the stakeholder theory depicts the needs of the citizens and how the policies affect the citizens (Mathur et al., 2007).

According to stakeholder theory, an organisation's actions and inactions impact stakeholders. The Stakeholder Theory is used in this study to propose that citizens and organisations may influence small-scale mining policies and regulations. Similarly, small-scale mining regulations and legislation impact persons and organisations. Stakeholder theory defines the Ghanaian small-scale mining industry as the connections among persons and organisations interested in the development and implementation of policies and regulations and the activities of the institutions governing the sector. Stakeholders are individuals or groups who influence or are

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influenced by small-scale mining rules and regulations. Miners, opinion leaders (chiefs, district chief executives, assembly members, unit committee members, religious leaders, etc.) and civil society groups are stakeholders.

There are three types of stakeholder theories: normative stakeholder theory, descriptive stakeholder theory, and instrumental stakeholder theory (Donaldson & Preston, 1995). therefore, normative stakeholder theory and instrumental stakeholder theory were used. Enyinna (2013) and Wijnberg (2000) revealed that normative theory focuses entirely on the features of individuals and institutions with links to another organisation and discusses why leaders should prioritise stakeholders' interests.

To interact with an institution, one must have genuine power and influence over the institution's fortunes (Ali & Abdelfettah, 2016). In this study, normative stakeholders can affect the execution of small-scale mining rules and regulations. Thus, normative stakeholder theory prescribes what (and how) small-scale mining regulators should undertake to maintain strong stakeholder relationships, interests, and influence. The instrumental stakeholder theory outlines

how organisations affect stakeholders (Fontaine et al., 2006; Egels, 2004; Jones, 1995). In this study, instrumental stakeholder theory efficiently manages stakeholder interests within the small-scale mining industry. The study can effectively evaluate the link between small-scale mining regulators' functions and the effects of their activities. Using the stakeholder theory, they will identify the many interests, concerns, and problems that all small-scale mining stakeholders face while developing and implementing rules and regulations One of the major challenges of stakeholder theory is defining stakeholder interests, legitimacy, and rights; perspective of success; power distribution (Freeman, 2017; Ambler & Wilson, 1995). This research must also identify and manage diverse interests, legitimacy, and rights informalising

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the small-scale mining industry. Sadly, some of the small-scale miners' goals may not be genuine yet are vital to their existence. They need to mine to survive, yet their actions harm the ecosystem. Thus, stringent adherence to laws and regulations may appear cruel to miners, but non-adherence will cause ecological and human problems. This is where the stakeholder theory comes into play.

2.9.3 New Institutional Economics

Klein (1998) describes New Institutional Economics (NIE) as a new interdisciplinary theory. It draws heavily from the social sciences but economics' main language. It explains institutions' origins, objectives, evolution, and modification. It was developed in 1975 by Oliver Williamson, Leonard Silk, and Eirik G. Furubotn popularised it in the New York Times(Richter, 2005; Dequech, 2006). Ronald Harry Coase's academic writings spawned the NIE in1937 (Coase, 1960; Coase, 1995). For example, NIE includes the influence of the institutional framework as a viable issue of economic study. In other respects, the NIE incorporates institutional issues. The national institutions responsible for the legal, political, and social systems have a critical role in defining the nation's development (North, 1990).

So, in the research, NIE implies institutions supervise small-scale miners' actions to assure mining sector growth. Thus, the formalisation of the small-scale mining industry is heavily dependent on the institutions' effectiveness in implementing policies and laws. Moreover, no real progress can be made in the small-scale mining industry unless the government implements and enforces mining rules and regulations. Thus, NIE tries to explain the origins of institutions and their impact on economic performance, efficiency, and resource allocation. To reduce uncertainty in human interaction, institutions in the NIE sense are a set of formal and informal norms and standards that have been developed to govern and coordinate interactions between persons and groups (North, 1993; Kaufmann, Hooghiemstra & Feeney, 2018; Dobler, 2011).

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The NIE combines a political, social, and legal framework for production, exchange, and distribution with a transaction management framework that includes quasi-market, market, and hierarchical ways of contracting (Kherallah & Kirsten, 2002). The New Institutional Economics' main theories are Transaction Costs, Property Rights, and Agency. But this study will employ the property rights framework.

Property rights theory establishes resource distribution and ownership in economics (Alchian, 1989). Theoretically, owners of economic resources have property rights (Segal & Whinston, 2010; Congost, 2003). Sanford Jay Grossman, Oliver D. Hart, and John Moore support the Property Right Theory. Owners have exclusive property rights over resources, which cannot be transferred. Individuals, groups, and even the state can own property (Libecap, 1986). According to Ghana's 1992 constitution, the state owns mineral rights. However, the mineral rich land belongs to individuals, families, clans, and states (protected forested land). It means the gold on the earth is collectively owned. So, mining without licenses is considered theft and an infringement of the state's rights.

Thus, property rights show how one might benefit or harm another and who should be paid. Property rights theory is a comprehensive theory of contractual choice requiring residual control rights to match residual income rights when conceptualising ownership. Ownership theory reveals the firm's boundary selection. Furthermore, property rights theory provides unique theoretical connections to other disciplines of organisational economics relevant to resource management (Kim & Mahoney, 2002). In this research, the state can contract out somemineral rights to small-scale miners (individuals, cooperatives, and businesses). This contract includes paying concession fees, royalties, taxes, and other small-scale mining policies and requirements. The contract extends to landowners and small-scale miners to guarantee prudent use of Ghana's natural resources.

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The following key characteristics of property rights were identified by Obiska-Wajda (2016): universality, exclusivity, and transferability. Encouraging the formalisation of the small-scale sector requires everyone to respect people's property rights. This improves market efficiency and enhances output for small-scale miners.

But applying the New Institutional Economics is not easy. First, New Institutional Economics relies on institutions to ensure resource efficiency. However, institutions might be weak, impeding the implementation of the New Institutional Economics (Chhotray & Stoker, 2009; Lissowska, 2006; Herath, 2005). The application of New Institutional Economics to formalise the small-scale mining industry is hampered if the institutions that regulate it are not strengthened.

2.10. Conceptual framework

The study established a framework to improve small-scale mining by guaranteeing optimal stakeholder management and resource use. The framework is built on the literature review. This framework is termed the Small-scale Mining (SSM) Sector Formalisation. The framework depicts the SSM sector as a whole. Thus, a breakdown in any policy and regulatory (legal) components undermines the state's capacity to assure effective mining and resource usage. A study of the policy and legal initiation, development, implementation, and review processes is required to enhance the SSM sector's policy and regulatory framework. Therefore, the framework offers a platform for the enhanced formalisation of the SSM sector in Ghana by analysing every legislative and legal system component. The framework with its dimension is presented in Figure 2.1.

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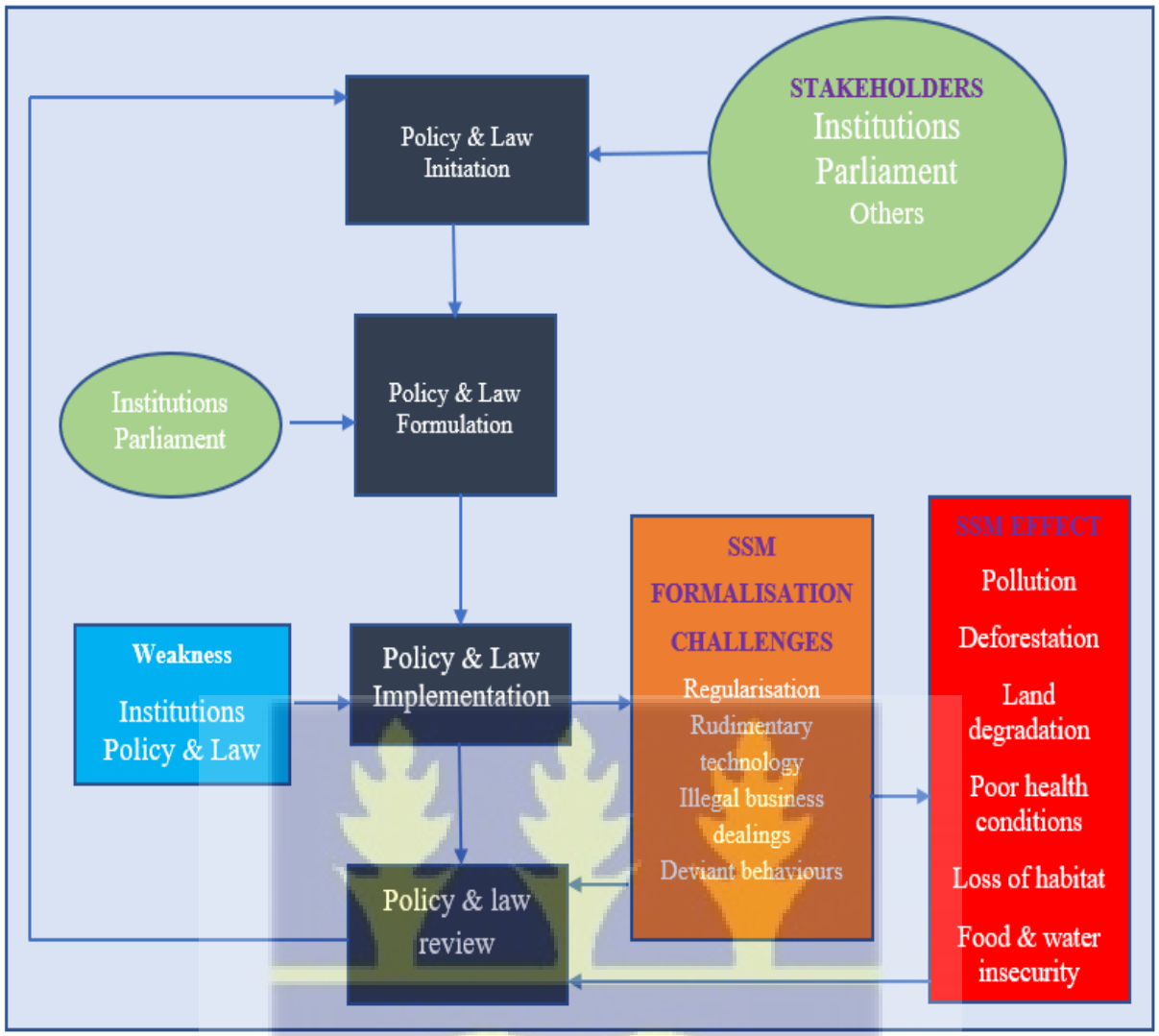

Figure 2.1 Formalisation of the Small-scale Mining (SSM) Sector

Source: (Authors own construct, 2021)

The framework suggests that policies and laws in the SSM sector are initiated based on the various stakeholders' concerns, opinions, and interests in the SSM sector. The framework posits that stakeholder influences the quality and quantity of information used to initiate policies and laws in Ghana. However, most of the information required for policy and law initiation emanates from the executive arm of government acting through its regulatory agencies.

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Moreover, with the passage of the private member bill, individual citizens can also gather information and initiate a policy and law process.

The framework further indicates that after SSM policies and laws are initiated, they are forwarded to appropriate authorities for formulation. Here, the policies are formulated by institutions related to the SSM sector under the executive branch of government. In contrast, the laws are formulated (enacted) by parliament and accented to by the president. However, the effectiveness of the policies and laws developed is influenced by the quality of information generated at the initiation level.

Furthermore, the framework suggests that SSM policies and laws are implemented by various institutions whose functions regulate the SSM sector. The institutions' capacity influences the institutions' ability to effectively implement the SSM policies and laws to formalise the activities in the SSM sector. The framework suggests that institutional and policy, and law challenges theoretically affect the effective implementation of the policies and regulations, leading to regularisation, rudimentary technology application, illegal business dealings, and deviant behaviours. In this case, there are formalisation challenges in the SSM sector.

The ability of the institutions, policies, and laws to deal with these formalisation challenges influences the operations of the SSM to cause adverse impacts such as pollution, deforestation, land degradation, poor health conditions, loss of habitat, food insecurity, etc. However, as the citizens feel the adverse impacts of SSM operations, there is the need to constantly review the effectiveness of the policies and laws in formalising the SSM sector. The review process reveals the relevant issues that need to be addressed to ensure practical mining and utilisation

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of mineral resources in Ghana. These issues form the basis for initiating other policies and laws with the SSM sector to improve effectiveness and efficiency.

2.11. Summary of Literature Review

Ghana ought to have a well-developed small-scale mining industry with registered communities and small-scale mining companies. Small-scale mining in Ghana is labour demanding and has existed for2,000 years using primitive technology. Our ancestors profited from small-scale mining. Despite the numerous regulations and laws regulating the small-scale mining industry, the necessity to regularise and legitimise it arose in the 1980s when the government enlarged its revenue net to include it. A substantial number of small-scale miners still operate legally. The Minerals and Mining Act 2006 defines Ghana's small-scale mining (Act 703).

Small-scale mining is restricted to Ghanaians by law, and it contributes considerably to Ghana's economy by providing direct and indirect job opportunities, sustaining rural mining communities, reducing poverty, generating tax revenue, and providing foreign exchange. Unemployed and unskilled people typically do small-scale illegal activities. Small-scale mining is plagued by lengthy and onerous procedures and non-enforcement of regulations. Illegal mining harms the environment, the economy, and the people. The unformalized nature of small-scale mining, usage of rudimentary equipment, illegal business dealings, and deviant behaviour connected with small-scale mining are major challenges.

The chapter also analysed the various policy and legal frameworks governing small-scale mining. The study found that small-scale mining has adequate institutional and legal frameworks. To manage small-scale mining successfully, all institutions must work efficiently, and rules must be followed without fear or favour. The chapter also examined relevant theories

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for developing and executing successful small-scale policies such as Systems Theoryand New Institutional Economics (Property Rights Theory).

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CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter gives a detailed method by which this study was planned and carried out. First, it involves the general description of the study areas and the rationale for their selection. Next, the research design and methods used and the sampling techniques employed to show a fair and accurate representation of selected participants. The later part of this chapter discusses the research instrument, data collection, and data analysis procedures used for the study.

3.1 Description of the Study Area

The study was carried out in four regions of Ghana, namely Western, Ashanti, Eastern, and Upper East Regions. In all, seven districts were considered (Western Region - Tarkwa Nsuaem, Amenfi East, Prestea/Huni Valley; Ashanti Region - Atwima Mponua, Amansie West; Eastern Region – Atiwa; and Upper East Regions - Talensi). The section presents information on the locations' cultural and physical characteristics. Figure 3.1 shows the map of Ghana indicating all the selected districts. These sites were selected because research shows that illegal mining activities are common in these areas, as indicated by (Owusu-Nimo et al., 2018)

According to Ghana's Environmental Protection Agency (EPA), these seven districts are the hotspot areas for illegal small-scale mining. Owusu-Nimo et al. (2018) attest that these areas have a history of illegal mining activities for over decades. Their study identified many illegal mining sites in the Tarkwa Nsuaem (294 galamsey sightings and 3648 individual galamsey sites), Amenfi East (223 galamsey sightings and 1397 individual galamsey sites), and Prestea

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Huni-Valley (156 galamsey sightings and 1130 individual galamsey sites). Illegal mining activities are carried out in some major forest reserves and rivers. Most popular among these reserves are the Atiwa, Subiri, Apaprama, and Odaw. Major rivers such as Bonsa, Birim, Densu, Pra, Ankora, Tano, and Offin (Mantey and Otoo, 2020), and ICIR (2019).

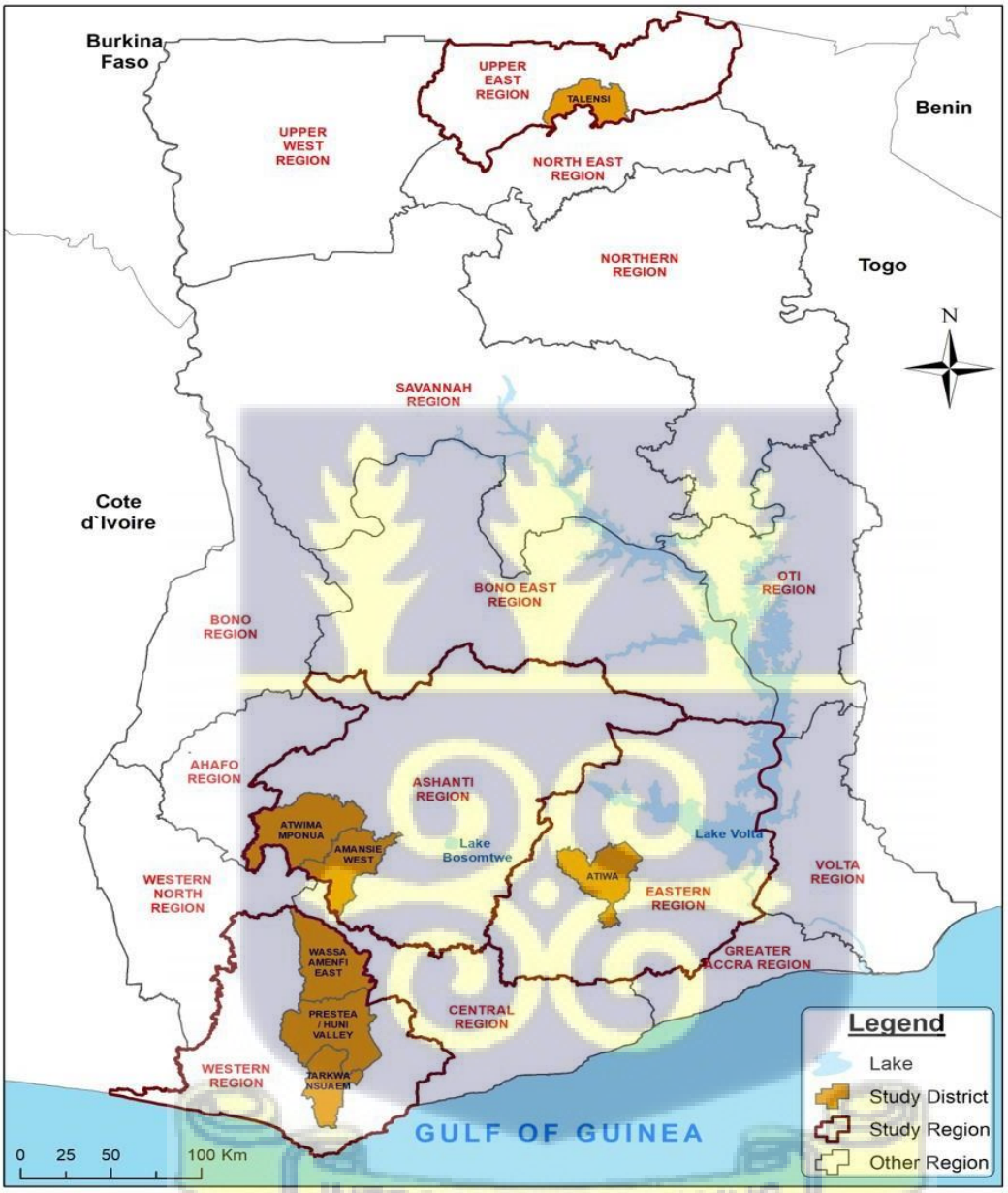

Figure 3.1 Map of Ghana showing the study sites

Source: Author's construct, 2019

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3.1.1 Background and Geographical Location.

The study was carried out in seven districts and municipalities. These include Tarkwa Nsuaem Municipality, Amenfi East Municipality, Prestea/Huni-Valley Municipality, Atwima Mponua district, Amansie West District, Atiwa West district and Talensi district

Tarkwa Nsuaem Municipality (Appendix 1) was established in 2007, and it is geographically between longitude 5º5′ and latitude 4º5′ with approximately 438 communities and a combined land area of 978.26 square kilometres (Osei et al., 2021). It is bordered on the north by Prestea Huni-Valley Municipality, south by Ahanta, West by Nzema East, and east by Mpohor Districts. Tarkwa is the capital of this district. Tarkwa Nsuaem Municipal is split into six (6) zone councils.

The Prestea Huni-Valley Municipality (Appendix 2) is in the Western Region. The Municipality was established in 2008 and bordered on the north by Wassa Amenfi East and Wassa Amenfi Central Districts, on the West by Wassa Amenfi West Municipal, on the South West by Nzema East Municipal, on the south by Tarkwa Nsuaem Municipality, on the east by Mpohor and Wassa East District, and on the North-East by Twifo-Ati Mokwa District in the Central Region. There are about 29 villages and small towns in the district, and its capital is Bogoso, with seven (7) zonal councils (GSS, 2014b).

Wassa Amenfi East Municipality (Appendix 3) was established in 2004 and shares borders with Wassa Amenfi Central District to the West, Upper Denkyira East District to the east, Prestea Huni - Valley District to the south, and Upper Denkyira West District to the north (GSS, 2014c). There are 162 villages and 28 electoral areas in the Municipality, and it has a high gold volume of gold reserve.

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The Atiwa West District (Appendix 4) is in Ghana's Eastern Region, with Kwabeng as its capital. In 2004, the district was created. In the north, it borders Kwahu West Municipal and Kwahu South; in the south, it borders West to Birim North, Kwaebibrim District; it borders Fanteakwa District south-east, East Akim Municipal. There are 34 electoral zones in the district (GSS, 2014d).

Atwima Mponua District (Appendix 5) was established in 2004 it is bordered by eight districts, South with the West District of Amansie (Appendix 6), the North District of Ahafo Ano South, the East District of Atwima Nwabiagya, and the West District Bibiani-Anwhiaso-Bekwai. The district has 310 communities grouped under 11 zonal councils. The district has a high gold reserve.

The Talensi District (Appendix 7) is in the Upper East Region of Ghana, with its capital as Tongo. It is bordered by Bolgatanga Municipality to the north, East and West Mamprusi (both in the North East Region) on the south, Kassena-Nankana district on the West, and the Nabdam and Bawku West districts on the east. It has 35 electoral areas. Gold mining and quarrying are the two major extractive industries in the district Tangonyire & Akuriba, 2020).

3.1.2 Physical features

Tarkwa Nsuaem district lies within the geological formations of the Birimian and Tarkwain and has high mineral deposits (gold and manganese) (Samlafo & Ofoe, 2018; Osei et al., 2021). Due to excessive leaching of bases from the top owing to high rainfall, humidity, and temperatures, many soils are deep, open, and acidic (Osei et al., 2021). While the acidic nature of the ground decreases the supply of phosphorus, calcium, and magnesium, levels are typically sufficient for healthy plant growth, as evidenced by the widespread cultivation of cassava, maize, plantain, rubber, cocoa, and oil palm. The Bonsa Reserve, Neung South Reserve, Ekumfi Reserve, and

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Neung North Reserve are central forest reserves in Tarkwa Nsuaem. The elevation varies between 240 and 300 meters above sea level (Osei et al., 2021). The temperature varies from 26°C in August to 30°C in March. For most of the year, the average sunshine per day is 7 hours. However, the relative humidity is high all year, ranging from 70 to 80 per cent in the dry season to 75 to 78 per cent in the rainy season (Nunfam et al., 2019). It receives a mean annual rainfall of 1,500mm, with a double maximum rainfall from March to September. The North-East trade winds blow over the city from November to February, with parched weather. The terrain is undulating in general, with an average height of about 70 meters. About 150 and 300 meters above sea level is the highest point (Osei et al., 2021). The Bonsa River and its various tributaries, such as Anoni, Ayiasu, Buri, and Sumin, form a dendritic pattern that drains the area (Samlafo & Ofoe, 2018). There are three prominent large scale mining firms in the Municipality (Goldfields Ghana Ltd, AngloGold Ashanti, and Ghana Manganese Company) and many small-scale mining outlets that employ a significant portion of the local population (GSS, 2014a).

The Prestea Huni-Valley Municipality lies on the same stretch of geological formation as Tarkwa Nsuaem district. The Birimian Precambrian rocks underlie the forest-disserted table and has high mineral (gold) potential (Osei et al., 2021; Nkrumah et al., 2014). The Bonsa Reserve (Aboso) is the municipal's most extensive forest reserve, covering 160.58 square kilometres. Ben West (Huni-Valley) 26.00 square kilometres, and Nkontoben (Huni-Valley) 49.98 square kilometres, are the remaining two reserves. Illegal mining and other forms of illicit logging pose a danger to natural vegetation. The average annual temperature is between 26°C and 30°C. The rainy season's humidity ranges from 75 to 80%, while the dry season's humidity ranges from 70 to 80%. The Ankobra, Bogo, Bonsa, Huni, Oppon, Mansi, Subri, and Peme rivers and streams flow through the Municipality.

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Wassa Amenfi East municipality is similar to Tarkwa Nsuaem district and Prestea Huni-Valley municipality due to their proximity to each other. Upper Birimian, Lower Birimian, and Granites are the three major geological soil formations in the Municipality. The average annual rainfall is between 1400 mm and 1730 mm. However, extremes can exceed 2110 mm on rare occasions (GSS, 2014c). The municipality has four forest reserves namely; Bowie, Angoben, Opon-Manse, and Tonton, totalling 212.62 square kilometres. The reserves provide residents with a source of high-value medicinal herbs and trees.

The Atiwa District is located in the wet semi-equatorial region, which has a bi-modal rainy season that peaks in April-July and September-October. The average rainfall ranges from 1,250 to 1,750 mm. Temperatures range from 26°C to 30°C. The predominant soil type in the Atiwa district is usually reddish-brown and well-drained, located on relatively high lands. The district's rivers and streams include the Adenchemsu, Akuku, Sea Abena, Kankan, Awusu, Abresu, Kokobeng, Subri, Frempong, Kade, and Anikorkor. In addition, the Atiwa ranges are the source of the Birim, Densu, and Pra rivers. Mineral deposits (bauxite, manganese, gold, diamond, and kaolin) are present in the Birim river basin located in the district (Eastern Regional Co-ordinating Council, 2016).

The Atwima Mponua district and the Amansie West shares similar physical characteristics. They both lies in a wet semi-equatorial forest region. The major season's total annual rainfall is around 1,700 mm – 1,850 mm each year, with annual mean temperature differences varying from 22ºC to 30ºC. The Offin and Tano rivers are the major rivers that run continuously during the year in Atima Mponua district, making them suitable for domestic and agricultural use. While in Amansie West the Oda and Offin rivers drain the district in the north, and their tributaries, including Pumpin, Jeni, and Emuna. Atwima Mponua has four forests Namely; Asanayo Forest Reserves, Tano–Offin Forest Reserves, Gyemara Forest Reserves, and Offin

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Forest Shelter (GSS, 2014e). Amansie West also has four central forest reserves, Gyeni River Forest Reserve, Oda River Forest Reserve, Jimira and Apanprama Forest Reserves. Gold and bauxite-bearing rocks can be located all over the two districts due to the mineral-rich Birimain and Tarkwaian rocks' interbedding, including gold. Atima Mponuas' Nyinahin has bauxite, but it has not been exploited (GSS, 2014e).

Talensi district's topography is marked by scattered rock outcrops and upland hills, and pretty undulating lowlands with mild slopes varying from 1º to 5º degrees at the Tongo areas. The district has a challenge to cultivate and are prone to seasonal floods and waterlogging. The White Volta and its tributaries are the district's main rivers (GSS, 2014g). The district is characterised with an erratic rainfall, lasting from May to October, and a dry season, extending from October to April with an average annual rainfall of 95 mm and ranges from 88 to 110 mm and a maximum temperature of 45°C at day, and in December, they have a minimum temperature of 12°C at night (Tangonyire & Akuriba, 2020; GSS, 2014g). Guinea Savannah woodland with sparse short trees and shrubs and a grassy ground flora is the vegetation.

3.1.3 Social and Cultural Structure

All the seven districts understudy has a paramountcy with a traditional capital serving as the home to the paramount chief or leader. The chief exercises administrative and legislative authority within the stool borders, supporting a well-structured hierarchical council of elders. Apart from the Talensi district which practices a patrilinear system of inheritance succession. The rest practices matrilinear and land control is in the hands of the head of the family. Each district has a traditional festival which is been celebrated either annually or twice in the year. Traditional authorities also have courts that hear cases including stool lands, lineage and family lands, chieftaincy title disputes, custom abuses, and conflicts between localities, clans, families, and persons (Eastern Regional Co-ordinating Council, 2016).

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3.2 Study Design

This study was a cross-sectional mixed technique and a systematic documentary review. This technique is founded on the concept that no single approach completely addresses, delineates, or validates a given problem (Creswell & Clark, 2017). Both quantitative and qualitative methods of analysis were employed. Complementary results from one approach were utilized to enhance the outcomes of the other. Both quantitative and qualitative approaches crossed different populations and concurrently concluded (Zheng, 2015).

Notwithstanding the strength, others scholars have criticised this method. Mitchell (2018) have also argued that researchers have to learn about multiple methods and approaches and understand how to mix them appropriately, which is very difficult to achieve by some researchers. Furthermore, the mixed-method technique tends to broaden the scope of research beyond what was initially envisaged (Teye, 2012). Zhou & Wu (2020) also believe that data collection and analysis in mixed methods research may be time-consuming, labour-intense, and expensive. More time and other resources are usually needed to carry out the various research activities. This study did not compromise the design procedures' data quality, accuracy, validity, and management.

To effectively assess the policy and legal gaps which may be accountable for illegal small-scale mining, the study also adopted documentary analyses and thematic assessment and interrelation via a systematic review. Additionally, qualitative research design inputs, mainly interviews and focus group discussions, complemented and strengthened the overall approach to gap analysis.

As put forward by Mensah et al. (2016), a systematic review allows for evidenced-based approaches supported by well organised empirical and theoretical research due to the possibility of developing and defining encompassing and objective-based protocols to address research

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questions/problems. Furthermore, literature on adopting this methodology indicates its gradual acceptance in the sustainable development research theme evidentially regarding policy and implementation (Tuokuu et al., 2019; Pullin & Stewart, 2006; Tranfield et al., 2003). Additionally, the study adopted the systematic review method due to its ability to allow for thematic assessment and interrelation of relevant literature to address the research questions (Tuokuu et al., 2019; Lavis et al., 2005). As a result, outcomes of the research bear rigour and produce pragmatically adaptable conclusions.

Furthermore, to make a strong case for this research's academic relevance, the research methodology's replicability remains highly important as it indicates the extent of transparency, considerations of critique, and extent of literature comprehensiveness for the study. The systematic review method satisfies these requirements and, as argued by Tranfield et al. (2003, p. 209), and applied by Tuokuu et al. (2019), reiterates the need for a "replicable, scientific and transparent process," hence, its adoption for the study.

3.3 Data Source

The data sources for the studies were both secondary and primary data collection. Secondary data was obtained from documentary sources such as, policy documents, laws, regulations and legislations. These provided available knowledge to the study (Largan & Morris, 2019).

However, primary data collection was also used, which requires the researcher to go onto the field with the needed tools and equipment to get the necessary information for their study (Wilcox, et al., 2012. A questionnaire survey and an in-depth interview were used as the primary strategy for data collection.

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3.4 Study Population

3.4.1 Qualitative study population

The sampled population for the qualitative study was adult men and women who are part of the regulatory bodies within the mining sector of Ghana, local authorities, and miners. Specifically, policymakers such as the Ministry of Environment, Science, Technology, and Innovation (MESTI) develop national environmental policy. The Ministry of Lands and Natural Resources oversees all natural resources. It encourages careful exploration, extraction, and processing with the most negligible environmental impact for maximum societal benefit (Republic of Ghana, 2014). The Parliament is also part of the policymakers, and is in charge of enacting mining policy and legislation. Civil Society Organisations and Non-Governmental Organisations (NGOs) engage in advocacy activities and play a critical role in enabling mining communities to improve their living circumstances and awareness of their rights as host communities. They also contribute significantly to sustainable development by giving alternative policy recommendations for the industry. Furthermore, the Ministry of Finance is responsible for national fiscal policy development and execution (Republic of Ghana, 2014).

The Regulators, including the Minerals Commission, Environmental Protection Agency, Forestry Commission, Lands Commission. Water Resource Commission, Municipal and District Authorities (Republic of Ghana, 2014).

The Enforcers consist of the Ghana Police Service, Galamstop, and Operation Vanguard. Galamstop under MESTI protects the Birim River (in Ghana's Eastern Region) from pollution (Republic of Ghana, 2014). Operation vanguard is in charge of combating illicit mining in Ghana's Ashanti, Eastern, and Western regions, are the most affected (Republic of Ghana, 2014)

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3.4.2 Quantitative study population

Illegal small-scale miners were part of the respondents in the study. These consisted of all persons directly involved in the mining and persons such as traders and security who provide an enabling environment for the illegal small-scale miners on the mining site. Information regarding the factors leading them into illegal small-scale mining, the benefits of small-scale mining, the challenges, perception of illegal mining on the environment from the perspective of illegal small-scale miners, and recommended solutions were assessed using a structured quantitative-based questionnaire.

3.4.3 Inclusion and Exclusion Criteria

3.4.3.1 Inclusion criteria

For the qualitative population, persons are eligible if they play institutional roles (Policymakers, CSOs, Regulators, or Enforcers) within the mining sector of Ghana, institutional field mining monitoring officers, local authorities (Traditional rulers, community leaders, assembly members, etc.), or miners, and have occupied their specified position for at least a year. These criteria were adopted to obtain quality and well-detailed information and the specific role, inputs, and challenges the respective sector has identified. In addition, a top- ranked official with at least a year and above period in office is assumed to be well abreast with vital, reliable, and accurate information about their representing institution (Leung, 2015).

On the other hand, the quantitative population for the study comprise persons who contributed directly to illegal small-scale mining in Ghana. Therefore, persons must be identified as illegal small-scale miners.

Only scholarly works/academic publications from 1960 to 2019 were used for the systematic review. The search for usable literature was limited to Web of Science, Academic Search

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Complete, Academic Journals (Multi-Disciplinary), Science Direct, and Google Scholar. Also, relevant mining policy/legislation outlook in Ghana was considered eligible. These inform progress and non-progress about policy and legal outcomes concerning mining in Ghana, including illegal small-scale mining, and gave the premise to the inclusion and exclusion protocols for the study (Pullin and Stewart, 2006).

3.4.3.2 Exclusion criteria

Persons who fell within the inclusion criteria stated above but did not consent to the study were excluded. The researcher excluded all publications that did not meet all the inclusion protocols. Additionally, the researcher sought the views of other researchers to eliminate incidences of subjectivity or bias and test the relevance of selected publications in addressing the research questions.

3.5 Sample Size and Techniques

3.5.1 Sample Size

3.5.1.1 Qualitative

Ninety participants were sampled to participate in the qualitative component of the study. Specifically, 70 participants were sampled to participate in Focus Group Discussions (FGDs) with 10 participants per group for seven study districts, and 20 participants were sampled to participate in the Key informant interviews (KIIs) component of the study. This sample size was based on the fact that there are no general guidelines for a specific sample size (Marshall et al., 2013). Creswell & Poth (2016) recommended 20 – 30 interviewees based on a particular qualitative study grounded theory. Also, FGDs typically consist of 8-12 participants for miners. Rodriguez et al. (2011) view that FGD participants more than 12 are considered a large group and become difficult to control. They limit each person's opportunity to share insights and

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observations. Morse (2000) confirmed that saturation is the key to excellent qualitative work. The number of targeted institutions involved in mining regulations played a key role in this size determination. They comprise policymakers, CSOs, Regulators, and Enforcers within the mining sector of Ghana, district field monitory officers, local authorities, and miners. The actual number of KIIs was determined when a saturation point was reached. In addition, some policy documents were reviewed to assess institutional weaknesses in small-scale mining management and formalisation and identify policy and legal gaps that may have contributed to illegal small-scale mining.

3.5.1.2 Quantitative

The population size of the illegal small-scale miners in the country is unknown. Hence, the study used the sample size formula for prevalence studies. (Cochran, 1977; Sarmah & Hazarika, 2012)

$$n = \frac{\left(Z_{(1-\alpha/2)}\right)^2 * P(1-P)}{e^2}$$

Where:

P *is the proportion of artisans with adequate awareness on the existing policies and law* (*assumed at* 50%)

e *is the margin of error* (*set at* 0.05%)

α *is the level of significance* (*set at* 0.05, *thus* 95% *confidence level*)

Z *is standard normal deviate at the confidence level* (*hence* 1.96)

Based on the above parameters, the estimated sample size for interviewing the small-scale miner was:

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$$n = \frac{(1.96^2) * (0.5) * (1 - 0.5)}{0.05^2} = 384.16 \approx 385$$

Making a 5% upward adjustment for incomplete data and missing values, we obtain a final sample size of

$$n' = 1.05 * n = 1.05 * 385 = 404.25 \approx 405$$

Hence a total of 405 illegal small-scale miners are expected to be interviewed for this study.

Sample Size Allocation to the Various Regions and Districts

The sample size allocation was done in two stages. First, the sample size was allocated to the regions proportionally. Due to limited data on the population size of miners within the regions of Ghana, estimates of the total population size of the four regions from the population and housing census 2010 and the number of districts for the study were used as proxies to allocate the sample size. According to the 2010 population and housing census in Ghana, Ghana's population in the Ashanti region was 19.5%, the Eastern region was 10.5%, the Upper East region was 4.3%, and the Western region was 9.4% (Ghana Statistical Service (GSS), 2012). Therefore, the proportion of allocation for each region was estimated as:

$$P_{ai} = \frac{P_i * X_i}{(P_1 * X_1) + (P_2 * X_2) + (P_3 * X_3) + (p_4 * X_4)}, \qquad where: i = 1, 2, 3, 4.$$

And:

P_{ai} *is the proportion of total sample size allocated to region i*

P_i *is the percentage of population size of region i in the whole country*

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$P_1, P_2, P_3, and\ P_4$ *is the proportion of population size of Ashanti, Eastern, Western and Upper East respectively for the whole country*

X_i *is the number of districts selected from region i*

Table 3.1 Sample size allocation per region and districts within regions

	Region				
Variables	**Ashanti**	**Eastern**	**Upper East**	**Western**	**Total**
Percentage of population size of region in the country (P_i)	19.5	10.5	4.3	9.4	43.7
Number of districts for the study (Xi)	2	1	1	3	405
P_i*X_i	39.0	10.5	4.3	28.2	82.0
Proportion of total sample size to be allocated to the region (P_{ai})	0.4756	0.128	0.0524	0.3439	1.000
Actual sample size allocated to the region (n_i)	193	52	21	139	405
Sample size allocation for each district for the region	96	52	21	46	-
Adjusted sample size allocation per district for the region **	90	50	40	45	-

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** The sample size for Upper East is adjusted upward to 40, hence caused a downward adjustment for other regions.

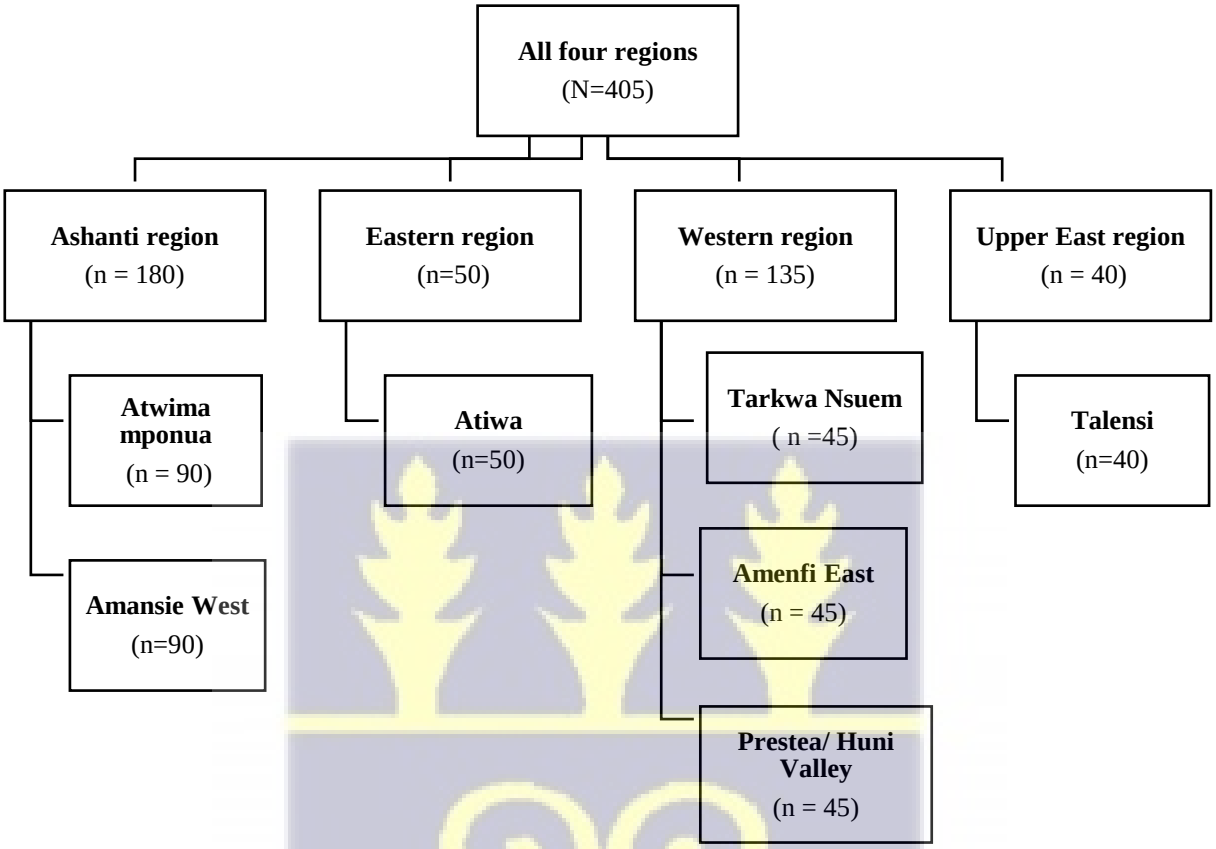

Figure 3.2 Sample size allocation to regions and districts

3.5.1.3 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

In all, 1,402 articles were assessed and retrieved from the selected study search databases – Web of Science (309), Academic Search Complete (487), Academic Journals (Multi-Disciplinary) (279, Science Direct (294), and Google Scholar (33). The researcher applied a screening procedure to sort and select relevant literature for the systematic review (Figure 3.3).

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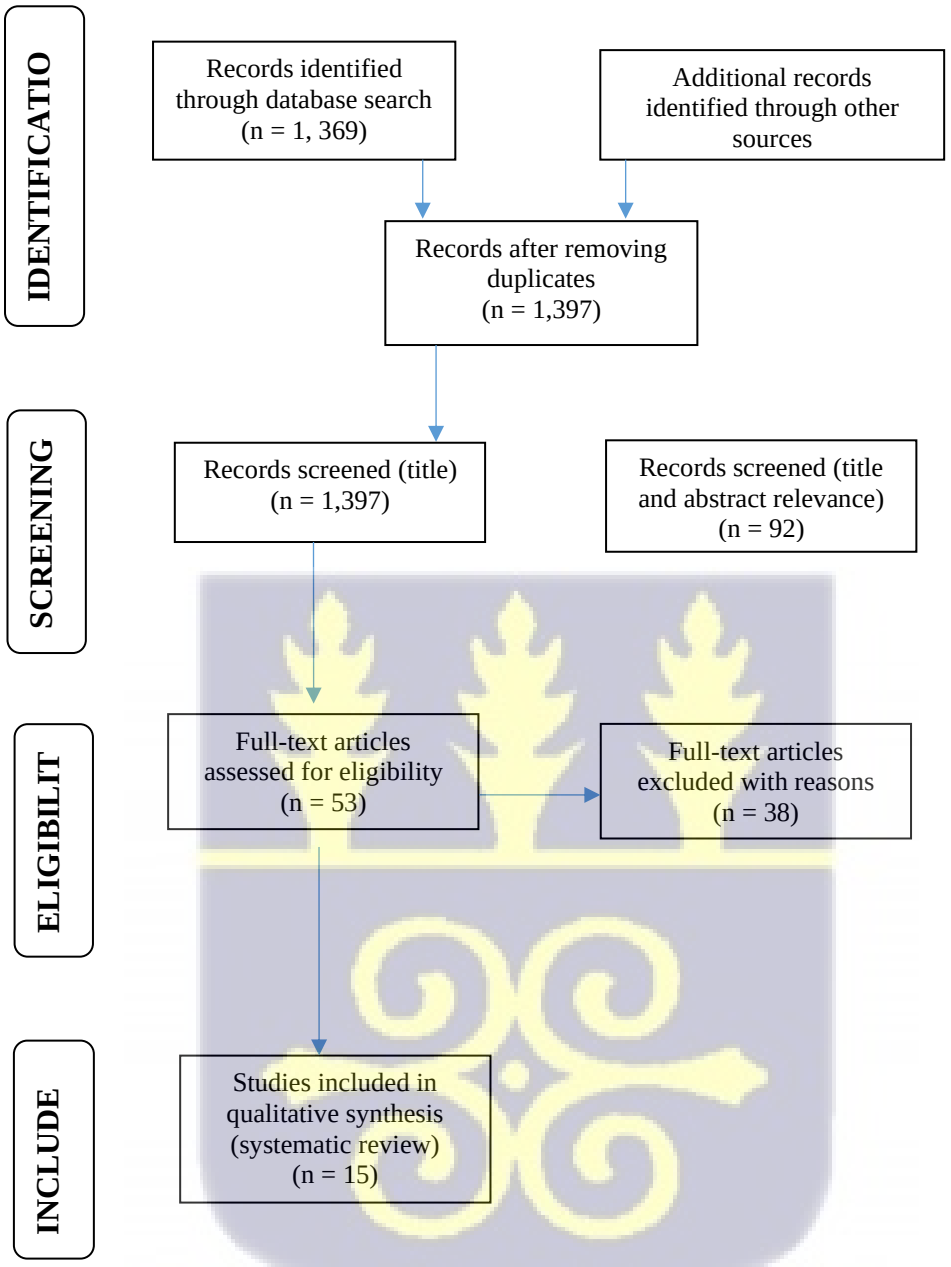

Figure 3.3 PRISMA Flow Diagram

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3.5.2 Sampling Method

A multi-stage sampling procedure was adopted, considering the nature of the study. First, the study sites (seven districts) were selected purposefully because the districts are described as hotspot areas for illegal small-scale mining. Owusu-Nimo et al. (2018) attest that these areas have a rich history of illegal mining activities for decades. Second, participants are purposively selected because they are directly engaged in illegal small-scale mining activities or their regulations. Adu et al. (2016) suggested that purposive, snowballing, and convenient are the right way to go for effective and efficient study in the mining sector.

Participants for the qualitative component were purposively selected to achieve the project's objectives. After identifying participants based on their roles in the mining sector of Ghana, maximum variation sampling, a type of purposive sampling was employed to select participants that exhibit a wide range of characteristics such as setting, specific institution (Policymakers, CSO's, Regulators, and Enforcers), years of experience in the mining sector, education background, etc. to allow for a more excellent representation of study participants (Ames, Glenton & Lewin, 2019). Eligible participants were contacted, and the purpose of the study explained to them and given a chance to decide to participate. Also, reviewed policy documents provided information in selecting participants. Participants for FGD were identified and sampled using snowballing. Thus, the first contact point through the Assemblymen and women helped identify the next until the required number was obtained.

For quantitative, due to the sensitive nature of illegal small-scale mining activities within the country, the snowballing and convenient sampling methods were employed in selecting study participants (Ames, Glenton & Lewin, 2019). The selection of illegal mining sites was made using the snowballing approach. Since these illegal mining sites are known mainly to the other miners, the most appropriate approach to selecting a representative number of sites to

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participate in the study was the snowballing and convenience approach (Etikan, Musa, & Alkassim, 2016). For a selected illegal mining site, a minimum of 10 and a maximum of 15 miners were interviewed for the study

For the systematic review, titles of publications were retrieved and imported into Endnote Reference Manager to check for duplicates. The retrieval process was achieved by interrelating the publication titles and abstracts to the research questions. The criteria below were used to review abstracts of all retrieved publications: (a) Ghana's mining sector; (b) Peer-reviewed journal/academic publication; (c) They are published in the English language; (d) Selected research databases must provide full text; (e) Publication years must be between 1960 and 2019; and (f) The publication addresses the consideration/application of the sustainable mining concept in Ghana's mining sector., A full-text read was carried out after selecting all articles that met the inclusion protocol. Finally, a brief of extensive literature analyses outcomes has been put forward to summarise the focus/aspects of the studies (Table 3.5).

3.6 Data Collection Procedure/Method

3.6.1 Qualitative Data Collection.

The qualitative approach provided an in-depth understanding of policy and legal gaps that may have led to illegal and small-scale mining and institutional weaknesses in small-scale formalisation. In this regard, various qualitative data collection techniques [Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs)] were used. This involved policymakers, Civil society officers (CSOs), regulators, enforcers, and miners within the various mining communities. A total of seven (7) focus group discussions, each comprising 10 participants (see Plate 1) and twenty (20) Key informant interviews, were conducted.

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Focus group discussions explored policy and legal gaps that may have led to illegal and small-scale mining and institutional weaknesses in small-scale formalisation and community's perception. Authorities at the National and District levels and miners within the mining communities of Ghana were engaged. Participants for all FGDs were purposively selected based on key characteristics indicated in the inclusion criteria. FGD guides were developed to facilitate the data collection process. The FGD guide consisted of questions that aided in achieving the study objectives (appendix 8). These included questions on Knowledge of Existing Policies and Laws Governing Small-scale Mining (SSM), Opinion /Perception about Policy and Legal Gaps Contributing to small-scale mining, Opinion/Perception about Institutional Weaknesses in small-scale mining management and Formalisation, Knowledge of Sustainable Development Goals and link to SSM policy in Ghana and Recommendations on addressing institutional gaps and SSM formalisation in Ghana.

In addition, Interviews (KIIs) were conducted among Regulators within the mining sector of Ghana (see Plate 2) to identify policy and legal gaps that may have led to illegal and small-scale mining and institutional weaknesses in small-scale formalisation. Twenty interviews were conducted among policymakers and CSOs, Regulators, and Enforcers within the mining sector. An interview guide was developed to facilitate the interviews (appendix 9). The interview guide was preceded with questions about socio-demographic information, and then with questions on Knowledge of Existing Policies and Laws Governing Small-scale Mining (SSM) in Ghana, Perception of Policy and Legal Gaps Contributing to small-scale mining, Perception about Institutional Weaknesses in small-scale mining management and Formalisation, Knowledge of Sustainable Development Goals and link to SSM policy in Ghana and Recommendations on addressing institutional gaps and SSM formalisation in Ghana.

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After participants were identified for the interview, contacts were made, and approved letters were submitted. After approval was granted, an appropriate time was scheduled, and participants were interviewed at their preferred location. The interviews lasted for about 45-60 minutes for each participant. Permission was sought from each FGD participant for the interviews and audio-recording. Interview and FGD guides were assigned with codes, first mentioned before an interview and focus group discussion to ensure data collected and analysed belonged to the suitable participant. All KIIs were conducted in English, while FGDs were conducted in English and local dialects [Akan (Twi or Fante) and Frafra].

During each interview, field notes were taken to capture participants' reactions and any other observations, mostly non-verbal, that the audio recorder may not have captured. To ensure confidentiality, pseudonyms were used for participants during FGDs and interviews, transcription and analysis.

3.6.2 Quantitative Data Collection

The quantitative approach to this study mainly sought to address the following sections in objective five (5)

i. Assess the awareness level of illegal small-scale miners on the laws and policies governing Small-scale Mining (SSM).

ii. Assess the socio-demographic and socio-economic characteristics associated with the awareness level of illegal small-scale miners on the laws and policies governing SSM.

iii. Assess the perception of illegal small-scale miners on the effects of SSM on the environment.

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iv. Assess the socio-demographic and socio-economic characteristics associated with the awareness level of illegal small-scale miners on the laws and policies governing SSM.

The research instrument employed for the quantitative data collection was a set of closed and open-ended questionnaire (appendix 10).

Study Variables - Dependent Variables

The quantitative aspect of this study focused on two independent variables, which are:

1. The awareness of illegal small-scale miners on existing policies and laws governingsmall-scale mining and
2. The perception of the effect of illegal mining on the environment

Assessment of the awareness of illegal small-scale miners on existing policies and laws governing small-scale mining

A series of right and wrong 16 questions based on the policies and laws governing small-scale mining in Ghana were asked of the study respondents (illegal small-scale miners). These were used to assess the awareness level of these miners on the current state of the laws and policies governing the mining and extracting industries in Ghana.

For each question, the correct response was scored **1**, and an incorrect response scored **0**. In addition, a composite score was computed for each of the study respondents. Respondents with 50% or more of the questions answered correctly were categorised as having a high awareness of the laws and policies governing small-scale mining in Ghana. Table 3.2 below shows the scoring of the awareness of illegal small-scale miners on the laws and policies governing small-scale mining in Ghana.

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Table 3.2 Scoring of the awareness of the laws and policies governing small-scale mining in Ghana

No	Questions	Scoring	
		No	Yes
1.	Foreigners are allowed to be engaged in small-scale mining	1	0
2.	Can miners mine in the water bodies?	1	0
3.	Can less than 18 years old engage in mining activities?	1	0
4.	Anyone can mine in a reversed forest	1	0
5.	One can mine within 100meter (buffer) from water bodies if there isa lot of gold in that zone	1	0
6.	I have flawed the law if I export my gold mined and sold by myself	0	1
7.	A miner can use mercury to mine for more gold without approval from the Minerals commission	1	0
8.	I need a permit before I can mine on a piece of land	0	1
9.	I have to reclaim (cover) the land after mining	0	1
10.	Any person can mine without a mining lease	1	0
11.	I have to do reconnaissance & prospecting before mining	0	1
12.	One must renew licenses every five years	0	1
13.	I must pay royalties to the state on my revenue acquired through my mining activities	0	1
14.	Small-scale mining is permitted only in Minerals Commission-designated zones	0	1
15.	It is lawful for Minerals Commission's District Office to supervise and monitor small-scale mining activities and operations	0	1
16.	It is lawful for Minerals Commission's District Office to coach and teach small-scale miners to conduct successful and efficient mining operations	0	1
	Total possible score	**16**	

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Assessment of the perception of the effect of illegal mining on the environment

The independent variable for this study is the perception of illegal small-scale miners on the effect of illegal mining on the environment. Ten binary response questions were asked of the illegal small-scale miners to assess their perception of the effect of illegal small-scale mining on the environment. Each of the ten questions had a yes or a no response. A yes response was scored 1, and a no response scored 0. A composite score was generated from the ten questions, indicating a higher score indicating the negative effect of illegal small-scale mining. For each question, the yes response was scored 1, and the no response scored 0. In addition, a composite score was computed for each of the study respondents. Respondents who answered yes to 50% or more of the questions were categorised as having a high awareness of the effect of illegal small-scale mining on the environment. Table 3.3 below shows the scoring of the awareness of illegal small-scale miners on the effect of illegal small-scale mining on the environment.

Table 3.3 Scoring of the awareness on the effect of illegal small-scale mining on the environment.

No	Small-scale illegal mining …	Scoring	
		No	Yes
1.	**... leads to water pollution.**	0	1
2.	**... leads to agricultural depletion.**	0	1
3.	**... leads to extinctions of aquatic lives.**	0	1
4.	**... leads to injury and death.**	0	1
5.	**... has negative implications on the health of people within the community**	0	1
6.	**... leads to air pollution.**	0	1
7.	**... leads to noise pollution.**	0	1

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8.	**... leads to deforestation and habitat destruction, which harms endangered species in the forest**	0	1
9.	**... has a long-term negative effect on the livelihood of people in the community**	0	1
10.	**… has a long-term health effect on small-scale miners.**	0	1
	Total possible score	**10**	

Independent Variables

The independent variables were breakdown into socio-demographic characteristics, socioeconomic characteristics, and mining methods-related characteristics.

Socio-demographic characteristics

The socio-demographic characteristics considered for the study are region, district, age, sex, marital status, educational status, household size, relationship to household head, number of dependents, and type of respondent. Table 3.4 below describes the socio-demographic characteristics in detail.

Table 3.4 Description of the socio-demographic characteristic considered for the study

Variable name	**Variable descriptions**	**Type of variable**	**Levels of categorical variables**
Region	Region of the illegal small-scale mining activity of study respondents	Categorical	The Ashanti region, Eastern region Western region, Upper East region
District	District of the illegal small-scale mining activity of study	Categorical	Atwima Mponua, Amansie West Atiwa, Tarkwa Nsuaem, Amenfi East, Prestea /Huni Valley,

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	respondents		Talensi
Age	Age of illegal small-scale miner	Continuous & categorical	15-19 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years, 60+ years
Sex	Sex of illegal small-scale miner	Binary	Male, Female
Marital status	Marital status of illegal small-scale miner	Categorical	Never married, currently married, formerly married
Education	Highest level of education of illegal small-scale miner	Categorical	None, Primary, JHS/JSS/middle school, SHS/SSS/Vocational/Technical, Tertiary
Household size	The number of household members living in the same household as the illegal small-scale miner	Continuous	
Relationship to the household head	The relationship of the illegal small-scale miner to the household head	Categorical	Household head, spouse of household head, child of household head, parent of household head, others
Dependents	Number of family members or people depending on the illegal	Continuous	

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	small-scale miner		
Type of respondent	The native or foreign status of the illegal small-scale miner in the community of mining	Categorical	Native, non-native Ghanaian, Foreigner

Socio-economic and mining activities

The socio-economic and mining-related characteristics for this study include previous occupation, other secondary occupation, the role of the illegal small-scale miner, income level, and the method of small-scale mining of respondents. A detailed description of these variables is provided in table 3.5 below.

Table 3.5 Description of the socio-economic and mining characteristics considered for the study

Variable name	Variable descriptions	Type of variable	Levels of categorical variables
Previous occupation	The previous economic activity of occupation before illegal small-scale mining	Categorical	None, street hawker/trading, farming, Okada rider, labour work (Mason, carpentry, etc.), Skilled work (Mason, carpentry, etc.), Others
Other secondary occupation	Currently involvement in other economic activity other than illegal small-scale mining	Binary	Yes No

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Income level	The monthly income level of the illegal small-scale miner	Continuous & Categorical	<1000.00 GHc, 1000.00-1999.00 Ghc, 2000.00-2999.00 Ghc, 3000.00-4999.00 Ghc, 5000.00-9999.00 Ghc, 10000.00+ Ghc
Method of illegal small-scale mining	The various methods or approaches of mining the respondents employed in mining	Categorical	Anomabo methods, Chisel, and hammer, Underground method, Dig and wash method, More-blade method, Changfa method, Dredge method, Alluvial washing plant, Others (specify)

3.6.3 Systematic Review

Relevant literature on Ghana's mining policy/legislation outlook was analysed to comprehensively assess essential themes necessary for evaluating gaps in mining policy and legislation in Ghana, mainly regarding illegal small-scale mining. A brief of extensive literature analysis outcomes was generated and analysed the focus/aspects of the studies (Table 3.6). In addition, essential themes identified from the literature comments were also captured (Table 3.7). These inform progress and non-progress about policy and legal outcomes concerning mining in Ghana, including illegal small-scale mining, and give the premise to the inclusion and exclusion protocols for the study (Pullin and Stewart, 2006).

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Chiwona-Karltun et al. (2017) define a protocol as any activity to "search, identify and describe the evidence." Accordingly, the researcher uses only scholarly works/academic publications in the systematic review process (Table 3.6). Borrowing from considerations of research scope and relevance by Tuokuu et al. (2019), the publications used were from 1960 to 2019. Some key reasons underpin the adoption of this approach. First, a look at the political economy of mining and its evolution in Sub-Saharan Africa, as Hilson (2002) indicated, reveals a case of post- independence nationalisation of mining for many countries, mainly from 1960 and beyond. Second, Akabzaa (2009) and Akabzaa and Darimani (2001) argue that the period between 1980 and 1990 welcomed Structural Adjustment Programmes by the World Bank Group and International Monetary Fund, which called for the liberalisation of mining sectors across Sub- Saharan Africa. Third, the 2000s witnessed the Millennium Development Goals and Sustainable Development Goals by the United Nations, which purposed to tackle poverty and enhance social, economic, and environmental gains across many facets of development, including mining as an industry (Tuokuu et al., 2019; Kervankiran et al., 2016; World Economy and Social Survey, 2013; Sachs and Reid, 2006). Fourth, the systematic review method enabled the exploration of relevant literature on policy and legal actions being carried out across public and private spheres in Ghana's mining sector, against the sustainable analytical framework presented above.

Only English language scholarly works focusing on Ghana (peer-reviewed articles, academic publications) were retrieved. The search for usable literature occurred between February and June 2019 was limited to Web of Science, Academic Search Complete, Academic Journals (Multi-Disciplinary), Science Direct, and Google Scholar (other). The keywords for the search were; "sustainable mining" OR "mining best practices" OR "mining principles" OR "illegal small-scale mining" OR "small-scale mining" OR "Ghana" OR "social justice" OR "economic

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implications" OR "environmental management" OR "mining policy" OR "mining legislation" OR "mining policy framework" OR "sustainable mining policy" OR "mining policy implementation" OR "sustainable mining livelihood."

3.7 Data Processing and Analysis

3.7.1 Qualitative Data Processing and Analysis

All audio recordings were listened to and transcribed verbatim. FGDs conducted in local dialects (Akan and Frafra) were translated and transcribed into English by a bilingual consultant. All transcripts were compared to existing notes recorded during data collection to ensure no missing data. This procedure assisted the researcher in becoming more acquainted with the data and identifying preliminary ideas/codes. All data were saved on the lead investigator's computer, password-protected. Thematic analysis, employing both deductive and inductive processes described by Braun and Clarke, 2006 was used to analyse the qualitative data. This process entails familiarisation with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing a report (Braun & Clarke, 2006). A codebook was also developed to help in the analysis of the data.

All transcripts were cleaned and imported into QSR NVivo 12 software for analysis. The data was explored by firstly running the query. The initial codes generated based on the research questions and objectives were used to code (generate nodes). Each transcript was read line-by-line, and relevant information was dropped into created nodes based on the research objectives. Also, codes realised from the data (inductive codes) aligned with the research objectives and questions were added to nodes to code the data further. The coding was then reviewed, where nodes were rearranged and merged to develop themes and sub-themes. The codebook initially developed was revised throughout the coding process. The coded themes and sub-themes were

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then exported from NVivo into Microsoft Word to review further and interpret data. Identified themes were reviewed to align with the coded extracts and the whole data set. After which, the specifics of each theme were refined to create clear definitions and names of each theme. Thus, themes were verified, coded, legitimised, and the most vivid and compelling extracts were selected, connecting the analysis to the research questions and literature to produce the report for this study.

3.7.2 Quantitative Data Processing and Analysis

3.7.2.1 Data Processing

Data were collected using an electronic-based structured questionnaire. The questionnaire was designed onto the kobo-collect application software. A skip pattern was incorporated into the electronic-based questionnaire to collect more accurate and consistent data. In addition, an interviewer-assisted data collection method was employed in interviewing illegal small-scale miners by trained interviewers using an electronic device such as a tablet. Daily, the interviews were synchronised onto a database for daily quality checks and consistency in respondents' responses. Data from the kobo-collect app were then exported as a comma-separated delimited file (CSV file). The exported CSV file was imported into STATA IC version 16 for further data consistency checks, coding, and further analysis.

3.7.2.2 Quantitative Data Statistical Analysis

The quantitative analysis of this study was primarily descriptive-based. First, the various socio-demographic characteristic of study participants was described using frequency and percentages. Second, the mean and standard deviations were used to summarise continuous

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variables. Finally, a comparative analysis of the four regions considered in the study was done where appropriate.

Analysis of the awareness of study respondents on the laws and policies governing small-scale mining in Ghana

The percentage of illegal small-scale miners providing the correct responses to each of the laws and policies governing small-scale mining in Ghana considered in the study were presented on a bar chart. The distribution was further analysed at the regional level in tables.

The percentage of illegal small-scale miners with a high awareness of the laws and policies was further analysed on regional and district levels. The Pearson's chi-square test was used to assess the association between socio-demographic characteristics illegal small-scale miners' awareness of the laws and policies governing small-scale mining in Ghana.

A binary logistic regression model was used to quantify the associations between small-scale miners' socio-demographic characteristics and their level of awareness of the laws and policies governing illegal small-scale mining in Ghana using odds ratios. The multivariate binary logistic regression model is used to estimate adjusted odds ratios. Variables with p-values less than 0.05 were considered significant.

Analysis of the perception of study respondents on the effect of illegal small-scale mining. The responses of illegal small-scale miners to each of the effects of small-scale illegal mining considered in the study were presented on a bar chart. The distribution was further analysed at the regional level in tables.

The perception of illegal small-scale miners on the effect of illegal small-scale mining was further analysed together on a regional level and a district level. Finally, the Pearson's chi-

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square test was used to assess the association between socio-demographic characteristics and the level of perception on the effect of small-scale illegal mining among small-scale miners.

A binary logistic regression model was used to quantify the associations between the socio-demographic characteristics of illegal small-scale miners and the level of perception of the effect of small-scale illegal mining using odds ratios. The multivariate binary logistic regression model is used to estimate adjusted odds ratios. Variables with p-values less than 0.05 were considered significant.

3.7.3 Content Mapping

Tuokuu et al. (2019) employed the suggestions put forward by Sandin and Peters (2018) concerning mapping including research works. This study uses inputs from the two studies to map relevant publications via the following criteria;

- Aim(s)/objective of the study
- Sustainable development issues investigated/addressed
- Research is undertaken in Ghana
- The methodology is replicable and of high academic standard
- Main findings of the study

Conclusions concerning the policy and legal measures introduced/adopted to address issues of sustainable mining within Ghana's mining industry, including the small-scale mining industry.

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Table 3.6 Important Themes from Literature Analyses (Study Evaluation Checklist)

Author(s) / Year of Publication	Environmental Management	Mining Policy Regulation Implementation	Stakeholder Engagement	Human Rights Protection/ Social Justice	SSM Formalisation	Conflict Resolution /Compensation	Land Acquisition / Titling	Alternative Livelihood Programmes/ Alternative Employment
Bansah et al., 2018	✓	✓		✓	✓			✓
Ofori & Ofori 2018			✓	✓				
Bai et al., (2017)	✓							
Hilson et al., 2017					✓		✓	
Kervankiran et al., 2016	✓	✓	✓	✓				
Kumi 2014		✓	✓			✓		
Darimani et al. (2013)		✓	✓					
Okyere 2013			✓			✓		✓

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Armah et al. (2011)	✓			✓	✓		
Hilson & Clifford (2010)	✓						✓
Nyame (2010)	✓			✓			
Bawa (2010)	✓						
Hilson & Banchirigah (2009)				✓			✓
Hilson et al., (2007)	✓				✓		
Hilson & Nyame (2006)		✓					

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3.8 Data Quality Assurance

For quality assurance of the data, a series of activities were undertaken. These activities included training, pre-test, supervision, etc. These activities were carried out through pre-data collection, data collection, post-data collection processes, and analysis.

3.8.1 Training

Research assistants were recruited to assist in effective data collection. Research assistants were recruited based on relevant research skills. They then underwent appropriate training to understand the objectives and aims of the study, data collection procedures to be used, interview techniques, confidentiality, and any other ethical issues.

Field data collectors were adequately trained for three days. All field data collectors used for the study had experience in quantitative data collection. Kobo-collect electronic-based data collection application tool was used. This process ensured that internal consistency checks and skipped patterns were incorporated into the data collection tool. The data collectors were divided into teams for each of the seven districts with experienced supervisors. Daily, data collected were checked for inconsistencies and inaccuracies, and feedback on any anomalies found were reported to field workers for corrections and confirmation.

3.8.2 Pre-Testing of Interview Guide and Focus Group Discussion Guide

The interview and focus group discussion guides were pre-tested to know if the data collection instrument was compactible with collecting appropriate data to achieve the research objectives.

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This process helped refine the guides and data collection process based on relevant information realised during the field experience (pre-testing).

3.8.3 Quality Control and Quality Assessment of Systematic review data and analysis

The researcher carried out a detailed read of all selected publications to ascertain the selected documents' relevance. This process ensured that the data was reliable and valid for suitability for inclusion in the review process. An overview of the detailed reading outcomes has been put forward to summarise the focus/aspects of the studies (Table 3.6). Table 3.7 also captures important themes identified from the analyses of literature (results and conclusions) under eight key headings.

3.8.4 Estimating Qualitative Study Trustworthiness

The qualitative study ensured the transferability and credibility of the study findings (Braun & Clarke, 2006). The data were analysed using the thematic analysis approach described by Braun and Clarke (Braun & Clarke, 2006) and the NVivo analysis software version 12. In addition, the data were triangulated.

3.8.5 Limitation of the study

The results reported and discussed herein should be considered in light of some limitations. Although a few interviews and Focus Group Discussions were conducted in the local dialect and translated into English using the services of a professional translator, some nuances in the

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account of respondents could have been lost during translation. Ideally, this study had wanted to interview the substantive Directors of the institutions. However, some delegated their deputies to stand in for them. Notwithstanding this, whoever was interviewed fell within the inclusion criteria. The study would have preferred face-to-face or in-person interview sections because qualitative data collection such as face-to-face interviews allows the interviewer to observe the interviewee's facial expressions and body language and record more than the verbal response to the degree to which they agree or disagree with topics asked. However, some interviews had to be done virtually due to the lingering effect of COVID-19.

Furthermore, the questionnaire's appraisal of policies, laws, and illegal mining is based on the respondents' experiences and perspectives. As a result, the subjective nature of the reactions rises. Thankfully, the scales used are universally recognized as accurate and scientific measurements.

The study's final limitation is based on statistics. Due to the statistical software's inability to perform this test, the study could not conduct additional diagnostics checks on the specification in the systematic review. It should be noted that all other diagnostic checks performed with the statistical program are reliable, indicating that the data and statistical conclusion are both accurate.

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CHAPTER FOUR

RESULTS

4.0 Introduction

The major findings from the study have been presented in this chapter. The chapter begins withdescriptive results of the demographic characteristics of the qualitative and quantitative participants engaged in this study. Details of the qualitative findings of this study relating to the research questions and objectives are presented in this chapter. The findings are presentedunder the following headings; Existing Policies and Laws Governing Small-scale Mining, Gaps Contributing to Illegal Small-scale Mining, Community Perception of Illegal Small-scale Mining, Institutional Capacity to Enforce Mining Policies and Sustainable Development Goalsand Mining in Ghana. The quantitative findings also give a detailed account of community perceptions, livelihood, activities and effects of illegal mining on the environment and people,and ways of addressing these challenges.

4.1. Socio-demographic Characteristics of Participants

The study used 485 respondents for the final analysis of this study. The quantitative componentconsisted of 395 respondents, while the qualitative used 90 respondents. Out of the total engaged respondents, males (406) constituted 83.7 per cent while females (79) represented 16.3per cent. The details are presented in the form of a method used.

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4.1.1 Socio-demographic Characteristics of Qualitative Participants.

A total of ninety (90) participants were involved in the qualitative component of the study. The participants included representatives from mining-related institutions (n=20) who served as Key Informants (KI) and miners/community members from mining communities (n=70) who participated in community Focus Group Discussions (FGDs). The age range of key informants was between 30 and 55years, whereas that of community members (FGDs) ranged from 22 to 61years. All community participants were males (n=70), while key informants comprised five females and 15 males, with the highest educational level of education being Tertiary level. At least all the KI had a minimum of the first degree with four years minimum of working experience in the institution they represented. Table 4.1 gives the detailed characteristics of qualitative respondents.

Table 4.1 Socio-Demographic Characteristics of Qualitative Participants.

Characteristics of Participants	Number of Participants		
	Key Informant	Focus Group Discussion	Total
Region/District			
Greater Accra Region			
Accra	20		
Western Region			
Tarkwa		10	
Amenfi East		10	
Prestea		10	
Ashanti Region			
Atwima Mpouna		10	
Amansie West		10	
Eastern Region			
Atiwa		10	
Upper East			
Talensi		10	
Total	**20**	**70**	**90**

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Sex			
Female	5	-	
Male	15	70	
Total	**20**	**70**	**90**
Age			
>30	-	20	
30-39	2	30	
40-49	10	10	
50+	8	10	
Total	**20**	**70**	**90**
Educational Level			
No formal Education		20	
Primary/JHS		30	
Middle School/SHS/Secondary		15	
Tertiary	20	5	
Total	**20**	**70**	**90**
Length of Stay in Institution/Sector			
<5years	3	10	
5 - 10years	8	40	
11-20years	6	15	
20+years	3	5	
Total	**20**	**70**	**90**

Source: Study Interviews, 2021.

4.1.2 Socio-demographic Characteristics of Quantitative Participants.

A total of 395 respondents was used for the final analysis of this study. Most (42.0%) of the respondents were in the age range 20-29 years, with 3.0% aged 15-19 years and 9.6% aged 50 years and above. A majority (81.3%) of the participants were males. Most participants were currently married (48.1%) or never married (45.3%) while 6.6% were formerly married. Over a third (34.4%) of the participants had JHS/JSS/or middle school education, whilst 4.8% had

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no formal education, and 18.0% had tertiary education. Over a third (41.5%) of the participants were school dropouts. (Table 4.2)

Most (44.8%) of the respondents lived in households of 5-9 members, whilst 34.2% lived in a household of 10 or more. Less than a fifth (15.8%) of the respondents had no dependents, whilst more than a third (34.7%) had 1-4 dependents, 21.8% 5-9 dependents, and 27.8% had ten or more dependents. Most (45.8%) of the respondents were the head of their households. (Table 4.2).

Table 4.2 also shows the socio-demographic characteristics of the study respondents by the seven districts in the study. The age group distribution of the study participants significantly varied across the districts ($p<0.001$). The sex ($p=0.002$), marital status ($p<0.001$) and the highest level of education ($p<0.001$) also significantly varied across the districts in the study. The household size ($p<0.001$), number of dependents ($p<0.001$) and relationship of respondents to the household head ($p<0.001$) also significantly varied across the seven districts. The percentage of school dropouts did not significantly vary across the districts ($p=0.390$). (Table 4.2).

4.1.2.1 Distribution of Study Quantitative Respondents at the regional and district level

The study interviewed a total of 395 respondents in the study. At the regional level, 46.3% were interviewed from the Ashanti region, 12.7% from the Eastern region, 10.1% from the Upper East region and 30.9% from the Western region. At the district level, 19.5% were interviewed from Amansie West, 26.8% from the Atwima Mponua, 12.7% from Atiwa, 10.1% from Talensi, 10.4% from Amenfi East, and 10.4% from the Prestea/Huni valley and 10.1% from the Tarkwa Nsuaem district. (Figure 4.1).

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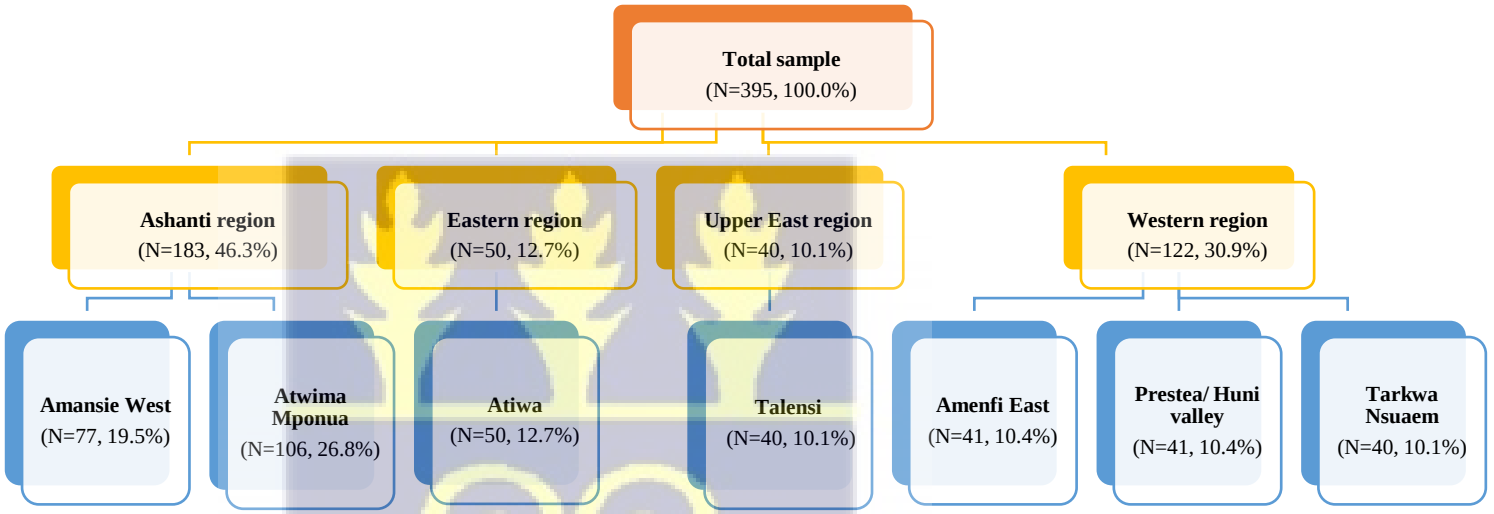

Figure 4.1 Distribution of quantitative study respondents at the regional and district level

Source: Study Data Collection, 2021

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Table 4.2 Socio-Demographic Characteristics of Study Quantitative Participants by Districts

Variable	Total	Districts						p-value
		Amansie West	Amenfi East	Atiwa	Atwima Mponua	Prestea /Huni Valley	Talensi	Tarkwa Nsuaem	
N	395	77	41	50	106	41	40	40	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Age group of respondents									<0.001
15-19	12 (3.0)	1 (1.3)	3 (7.3)	0 (0.0)	6 (5.7)	2 (4.9)	0 (0.0)	0 (0.0)	
20-29	166 (42.0)	38 (49.4)	18 (43.9)	13 (26.0)	47 (44.3)	24 (58.5)	2 (5.0)	24 (60.0)	
30-39	114 (28.9)	21 (27.3)	14 (34.1)	18 (36.0)	33 (31.1)	6 (14.6)	10 (25.0)	12 (30.0)	
40-49	65 (16.5)	8 (10.4)	5 (12.2)	15 (30.0)	14 (13.2)	6 (14.6)	13 (32.5)	4 (10.0)	
50 and above	38 (9.6)	9 (11.7)	1 (2.4)	4 (8.0)	6 (5.7)	3 (7.3)	15 (37.5)	0 (0.0)	
Sex of study respondents									0.002
Female	74 (18.7)	15 (19.5)	9 (22.0)	8 (16.0)	16 (15.1)	14 (34.1)	0 (0.0)	12 (30.0)	
Male	321 (81.3)	62 (80.5)	32 (78.0)	42 (84.0)	90 (84.9)	27 (65.9)	40 (100.0)	28 (70.0)	
Marital status									<0.001
Currently Married	190 (48.1)	37 (48.1)	14 (34.1)	33 (66.0)	48 (45.3)	12 (29.3)	34 (85.0)	12 (30.0)	
Formerly Married	26 (6.6)	1 (1.3)	4 (9.8)	5 (10.0)	9 (8.5)	4 (9.8)	1 (2.5)	2 (5.0)	
Never Married	179 (45.3)	39 (50.6)	23 (56.1)	12 (24.0)	49 (46.2)	25 (61.0)	5 (12.5)	26 (65.0)	
Highest level of Education									<0.001
No formal education	19 (4.8)	1 (1.3)	3 (7.3)	0 (0.0)	5 (4.7)	4 (9.8)	4 (10.0)	2 (5.0)	
Primary	60 (15.2)	12 (15.6)	2 (4.9)	10 (20.0)	30 (28.3)	0 (0.0)	6 (15.0)	0 (0.0)	
JHS/JSS/ Middle School	136 (34.4)	39 (50.6)	7 (17.1)	22 (44.0)	40 (37.7)	8 (19.5)	9 (22.5)	11 (27.5)	
SHS/SSS/VOC./TECH.	109 (27.6)	20 (26.0)	12 (29.3)	10 (20.0)	28 (26.4)	15 (36.6)	11 (27.5)	13 (32.5)	
Tertiary	71 (18.0)	5 (6.5)	17 (41.5)	8 (16.0)	3 (2.8)	14 (34.1)	10 (25.0)	14 (35.0)	
School drop-out?									0.064
No	231 (58.5)	38 (49.4)	29 (70.7)	37 (74.0)	57 (53.8)	26 (63.4)	22 (55.0)	22 (55.0)	
Yes	164 (41.5)	39 (50.6)	12 (29.3)	13 (26.0)	49 (46.2)	15 (36.6)	18 (45.0)	18 (45.0)	
Household size									<0.001
1-4	83 (21.0)	17 (22.1)	14 (34.1)	11 (22.0)	11 (10.4)	14 (34.1)	2 (5.0)	14 (35.0)	
5-9	177 (44.8)	30 (39.0)	19 (46.3)	26 (52.0)	47 (44.3)	17 (41.5)	22 (55.0)	16 (40.0)	
10+	135 (34.2)	30 (39.0)	8 (19.5)	13 (26.0)	48 (45.3)	10 (24.4)	16 (40.0)	10 (25.0)	
Number of dependents									<0.001
None	55 (15.8)	15 (21.1)	7 (20.6)	0 (0.0)	19 (20.9)	6 (18.8)	0 (0.0)	8 (25.8)	
1-4	121 (34.7)	31 (43.7)	17 (50.0)	11 (22.0)	31 (34.1)	14 (43.8)	1 (2.5)	16 (51.6)	

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5-9	76 (21.8)	15 (21.1)	5 (14.7)	15 (30.0)	25 (27.5)	4 (12.5)	8 (20.0)	4 (12.9)	
10+	97 (27.8)	10 (14.1)	5 (14.7)	24 (48.0)	16 (17.6)	8 (25.0)	31 (77.5)	3 (9.7)	
Relationship to household head									<0.001
Household head	181 (45.8)	43 (55.8)	11 (26.8)	27 (54.0)	44 (41.5)	12 (29.3)	35 (87.5)	9 (22.5)	
Child	116 (29.4)	22 (28.6)	12 (29.3)	7 (14.0)	41 (38.7)	17 (41.5)	4 (10.0)	13 (32.5)	
Spouse	37 (9.4%)	7 (9.1)	4 (9.8)	8 (16.0)	10 (9.4)	3 (7.3)	0 (0.0)	5 (12.5)	
Others	61 (15.4%)	5 (6.5)	14 (34.1)	8 (16.0)	11 (10.4)	9 (22.0)	1 (2.5)	13 (32.5)	

Source: Study Data Collection, 2021.

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4.2 Existing Policies and Laws Governing Small-scale Mining

This section explored the existing legal and policies arrangement of small-scale gold mining industry in Ghana, participants' knowledge of existing policies and laws governing small-scale mining in Ghana, and findings are presented under themes comprising legal arrangements, knowledge of existing policies, perception of comprehensiveness of existing policies, institutional roles in policy development and institutional relationship with small-scale miners.

4.2.1 The Legal Arrangement in the Ghanaian Small-scale Mining Industry

4.2.1.1 Principal Enactments (Framework for Mining Law)

The 1992 Constitutions of Ghana

This is the country's supreme law. Key aspects important to the use/management of mineral/natural resources are provided below.

Article 36

(9) "The State shall take appropriate measures needed to protect and safeguard the national environment for posterity; and shall seek co-operation with other states and bodies for purposes of protecting the wider international environment for mankind."

(10) "The state shall safeguard the health, safety, and welfare of all persons in employment, and shall establish the basis for the full deployment of the creative potential of all Ghanaians."

Article 41

(k) "To protect and safeguard the environment."

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c. Article 257

(6) "Every mineral in its natural state, under or upon any land in Ghana, rivers, streams, watercourses throughout Ghana, the exclusive economic zone and any area covered by the territorial sea or continental shelf is the property of the Republic of Ghana and shall be vested in the President on behalf of, and in trust for the people of Ghana."

Mineral and Mining Act, 2006 (Act 703)

This serves as the overarching legislation/regulation in Ghana's mining sector. Formerly known as the Minerals and Mining Act, 1986 (PNDCL 153) – the first mining-specific legislation of Ghana (Akabzaa, 2009) – the act has undergone three amendments/reviews(2010, 2015, and 2019) since its development and implementation in 2006, puts forward considerations of environmental safeguarding and socio-economic improvements undermining operations (Ghana Chamber of Mines, 2019; Tuokuu, 2019).

Minerals and Mining (Amendment) Act, 2019 (Act 995)

This is the most recent Act, which amends the Mineral and Mining Act, 2006 (Act 703) to streamline the activities in the mining sector by providing licenses to the miners (Ghana Chamber of Mines, 2019).

Mineral and Mining (Amendment) Act, 2015 (Act 900)

This Act amended the Mineral and Mining Act, 2006 (Act 703) to provide critical legal backing for implementing illegal small-scale mining mitigation actions, including confiscating equipment of all forms used in illegal small-scale mining (Ministry of Lands and Natural

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Minerals Commission Act, 1993 (Act 450)

The Minerals Commission Act, 1993 (Act 450) provides the required, continuous legal backing necessary for the existence and functioning of the Mineral Commission in regulating and managing mineral use in Ghana (Minerals Commission, 2021).

General enactments (Framework for Mining Law)Environmental Protection Agency Act, 1994 (Act 490)

In 1994, EPA Act 490 gave the legal mandate to the EPA to ensure compliance of all investments and undertakings with established Environmental Assessment procedures in the planning and execution of development projects, including compliance concerning any existing procedures. This Act also states that the EPA may require an EIS submittal for a project that will affect the environment adversely.

Forestry Commission Act, 1999 (Act 571)

The Forestry Commission Act, 1999 (Act 571) seeks to ensure the protection, development, management, and regulation of forests and wildlife resources. This regulation encompasses the monitoring and evaluating compliance requirements for sustainable use of the forest for mining operations (FAO, 2005).

Ghana Revenue Authority Act, 2009 (Act 791)

This Act is primarily responsible for tax administration-related activities (Ghana Revenue Authority, 2009).

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Income Tax Act, 2015 (Act 896)

This Act (a replacement of the Internal Revenue Act, 2000 (Act 592)) is the current taxation legislation of Ghana, which seeks to drive taxation across key industries such as petroleum, minerals and mining, and finance (Johnson and Toledano, 2022)).

Local Government Act, 1993 (Act 462)

The Act purposes of regulating Ghana's local governance within the remits of District Assemblies in compliance with the 1992 Constitution of Ghana. The regulation of local governance activities includes land use under which mining operations fall (Ferrazi, 2006).

Minerals Act, Act 126 (1962)

This Act spells out a clear ownership regime for all minerals in Ghana. It puts forward that "theentire property in, and control of all minerals in, under or upon, any lands in Ghana, all rivers,streams, and watercourses throughout Ghana and land covered by territorial waters are as a result of this declared to be vested in the President of the Republic of Ghana in trust for the people of Ghana" (Loh, 2017). The Act also provides licensing and permitting regimes (Loh, 2017).

Minerals Development Fund Act, 2016 (Act 912)

The Act aims at driving local development within mining communities by capitalising on the financial gains accrued from royalties as socio-economic investment portfolios. It further sets out allocation arrangements to pay mineral royalties and has seen the development and implantation of the Mining Community Development Scheme (Hira and Busumtwi-Sam, 2018).

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Mining Operations (Government Participation) Decree, 1972 (NRCD 132)

This Act allowed for the acquisition of major shares (55%) in foreign mining companies and provided an avenue to gain access to foreign currency earned from mining operations. The state participation regime affected some companies, including; Ashanti Goldfields Corporation (AGC), Consolidated African Selection Trust (CAST), and the Ghana Bauxite Company. Others included; the African Manganese Company (a subsidiary of Union Carbide), fully owned by the government and given a new name, Ghana National Manganese Corporation (GNMC) (Minerals Commission, 2014).

Office of the Administrator of Stool Lands Act, 1994 (Act 481)

This Act establishes the Office of the Administrator of Stool Lands. The Act primarily aims at providing administrative inputs for stool lands across the country. Mobilisation and disbursement of stool land revenue for the sustainable use of stool lands in Ghana remain keyactions under the Act (Ministry of Lands and Natural Resources, 2017).

Precious Minerals Marketing Company Act, 1989 (PNDCL 219)

The transformation of the then Diamond Marketing Corporation into the current Precious Minerals Marketing Corporation, authorised to deal in the purchase and sale of precious minerals, resulted from the coming into force of this Act (Hilson, 2001). This Act also grants power to "appoint licensed buying agents for the purchase of precious minerals produced by small-scale miners" (Precious Minerals Marketing Company, 2018)

Water Resources Commission Act, 1996 (Act 522)

Ghana's water resources are regulated and managed by the Water Resources Commission (WRC). Ownership and control of all water resources are vested in the President on behalf

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of the people of Ghana. There is no private ownership of water, but the President or WRC may grant rights for water use. All parties and individuals must apply for and be granted a water usepermit before using water. The Act regulates commercial and domestic water use. It backs therequirement or not of an environmental management plan for various water use in mining operations following consultations with the Minerals Commission and the Environmental Protection Agency (McQuilken & Hilson, 2016).

4.2.1.3 Relevant Policies

National Minerals & Mining Policy

This policy intends to provide a comprehensive and proactive mining framework that promotes sustainable development. It also acknowledges the need for "modern regulatory frameworks and appealing terms" to keep investors happy. The policy's requirements apply to both big and small-scale mining. The policy outlines twenty (20) guiding principles for successful mineral resource management. Some other applicable policies concerning sound mineral resources use/management include;

National Environmental Policy

The National Environment Policy was developed due to the implementation of the National Environmental Action Plan. The Plan aims to reorient national development toward more environmentally sustainable programmes and practices by promoting public participation in planning, evaluation, and implementation.

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National Water Policy

The primary challenges identified by the national water policy about mining are the following: balancing competing and conflicting water demands between mining firms and adjacent communities; and the quality of water resources is degrading due to agricultural, housing, commercial, industrial, and mining activities.

National Land Policy

The strategy aims to solve some of the country's core land management issues. The policy establishes the structure and direction for a sustained approach to land ownership, tenure security, land use and development, and environmental conservation.

Minerals and Mining Policy

The goal of the policy is to assist scale miners in improving upon their operations; establish District Offices staffed by Minerals Commission (MC) personnel to give technical assistance to small-scale miners; conduct a geological investigation and demarcation of areas suitable for small-scale mining, and ensure that small-scale mining is reserved for Ghanaian citizens.

Forest and Wildlife Policy

The policy aims at the conservation and sustainable development of forest and wildlife resources for the maintenance of environmental stability and continuous flow of optimum benefits from the socio-cultural and economic goods and services that the forest environment provides to the present and future generations whilst fulfilling Ghana's commitments under international agreements and conventions.

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Environmental Assessment Regulations, 1999 (L.I. 1652) (Environmental Regulations)

Regulation 3 (1) No person shall commence any undertaking specified in Schedule 2 and 5(a) to these Regulations unless there is submitted by the responsible person to the Agency, an environmental impact assessment per these Regulations in respect of the undertaking and an environmental permit issued by the Agency Regulation 23; An undertaking in respect of which a reclamation plan is required shall post a reclamation bond based on an approved work plan.

Other subordinate legislation which provides rigour to the mining sector include;

Minerals and Mining (General) Regulations, 2012 (L.I 2173) Minerals and Mining (Support Services) Regulations, 2012 (L.I 2174).

Minerals and Mining (Compensation and Settlement) Regulations, 2012 (L.I 2175) Minerals and Mining (Licensing) Regulations, 2012 (L.I 2176).

Minerals and Mining (Explosives) Regulations, 2012 (L.I 2177).

Minerals and Mining (Health, Safety, and Technical) Regulations, 2012 (L.I 2182) A list of additional legislation that applies to mining in Ghana is provided below; Minerals and Mining Law, 1986 (PNDCL 153).

Small-scale Mining Act, 1989, also referred to as P.N.D.C.L 218 Minerals Income Investment Fund Act, 2018 (Act 978).

Operational Guidelines for Mineral Exploration in Forest Reserves for Selected Companies, 1997.

Environmental Guidelines for Mining in Production Forest Reserves in Ghana, 2001 Mine Closure and Post closure Policies.

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Guidelines for Corporate Social Responsibility in Mining Communities Compensation Policy and Regulations.

Mining and Environmental Guidelines, 1994.

Natural Resources and Environmental Governance Framework Certification efforts for ASGM in West Africa.

National Action Plan (NAP) on ASGM per Annex C of Minamata Convention on Mercury.

Training Programme for Artisanal and Small-scale Miners Re-categorisation of Mining Licences.

4.3. Participants' Knowledge of Existing Policies and Laws

Findings from the study revealed that some participants have actual knowledge of existing lawsand policies that govern the mining sector of Ghana, and this is evident in the quotes below:

> *"I know of some Mining laws, like the Minerals and Mining (General) Regulations, 2012 (L.I 2173), the Minerals and Mining (Support Services) Regulations, 2012 (L.I 2174), the Mineralsand Mining (Compensation and Resettlement) Regulations, 2012 (L.I 2175) and the Minerals and Mining (Licensing) Regulations, 2012 (L.I 2176)*" (KII, Female, Institution 5)

> *"The Minerals and Mining Policy of Ghana, (2014) seeks to assist small-scale miners in their efforts to operate in a technically, economically, and environmentally sustainable manner through the use of appropriate, safe and affordable techniques in artisanal small-scale mining through education, training and provision of logistics to enhance the corporate governance, efficiency, and safety of their operations"* (KII, Female, Institution 7).

> *"The National Water Policy (2007) has objectives that ensure availability of water for hydropower generation, various industrial and commercial uses, mining operations, water transport and recreational purposes; and adequate protection of*

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water sources in mining and other industrial areas. It also requires environmental management systems that consider the impact of industries on the country's water resources; industries, including mining operations"(KII, Male, Institution 5).

It was also realized that participants know of existing policies and laws concerning mining processes as some stated that:

"If you take the 2006 Act 703, that is the overarching legislation that governs the mining sectorin the country. There's a section in that law that relates to the small-scale mining sector" (KII,Male, Institution 1).

"You can't just stand up and then start digging your backyard, farm or any place at all just because you have heard there is gold or traces of mineral, and then you call it mining, there's awhole lead on the procedure that you have to go through to acquire a license. And people go through that process to acquire a license. Policies and law guide all the activities and processeson mining in Ghana" (KII, Male Institution 3).

4.3.1 Perception of Comprehensiveness of Existing Policies

Exploring participants' perception of the comprehensiveness of existing policies and laws governing small-scale mining in Ghana showed that the policies are indeed comprehensive:

"You will be amazed. I have always said that in my opinion and other colleagues we sometimesmeet on a professional platform, we think on paper, it has some of the best laws when it comesto small-scale mining. If you have the time, you can just take your time and go through LI 2182.You will be blown away by what's in there" (KII, Male, Institution 3).

However, some expressed that, though the policies are comprehensive, there are challenges with effective implementation of the policies:

"Although there exist numerous Mining Laws and policies, they fail to fully address the complexities in the land/tree tenure system, land administration system and conflicting land use and this have culminated into illegal mining" (KII, Male, Institution 6).

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"Some of us who have been following this system, I think the laws and policies are ok. It is the implementation whereby sometimes we have some issues with, if not as for the policies and lawsthey are all ok" (KII, Male, Institution 8).

The study also showed that participants know how existing policies define small-scale miningthrough either describing some requirements, characteristics or features stated in the policies, and this is evident in the quotes below:

"The law talked about the small-scale mining being the preserve of the indigenous Ghanaians.I mean, citizens alone and then also small-scale mining was defined to mean a 25-acre block (minerals commission designated mining area) thus the concession area" (KII, Male, Institution2).

"It is to be mined with simple implements, not sophisticated equipment. The recent minerals andmining (Amendment) Act,2015 (Act 900) also has space for small-scale mining activities and throws more light on its definition" (KII, Male, Institution 4).

"Small-scale mining in the mining policy is described as licensed operations based on a concession not exceeding 25 acres, along with several other pre-qualifications legislated by theMinerals and Mining Act, 2006 (Act 703) where a small-scale mining license applicant: must be a citizen of Ghana and at least 18 years old. The miners operate mostly without a license andin an undesignated zone for illegal SSM. Often use low-level technology and labour-intensive methods to extract minerals even though not the main characteristics. This could be legal with the right documentation" (KII, Female, Institution 5).

Community members also expressed their knowledge of existing policies and laws. Findings showed that they have some knowledge regarding mining rules and regulations. For instance, some community members indicated that:

"Some of the laws are that one needs a permit before they can mine on a piece of land. Also, renew their license every five years, foreigners can invest and support with technology and knowledge, but they are not allowed to engage in small-scale mining activities" (FGD, Male, Miner, Community 2).

"Miners cannot mine in water bodies, or less than 18 years old cannot engage in mining activities, but many guys started mining at an early stage even before 15 years old. No one canmine in a reserved forest" (FGD, Male, Miner, Community 5).

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"One must reclaim the land after mining, but most of the miner's fault this law because they donot reclaim the land and leave the pits open, most especially when that person invested many resources but had less anticipated gold" (FGD, Male, Miner, Community 6).

4.3.2 Institutional Roles in Policy Development

In relation to institutional roles in mining policy initiation, formulation and development in Ghana, the study's findings revealed that institutions are engaged in policy development at various stages.

"Typically, we are engaged when it comes to policy development"(KII, Male, Institution 1).

In addition, it was revealed that some institutions work alongside other institutions and engage in other collaborative efforts in developing policies. For instance, some participants indicated that:

"…in the area of mining, the law mandates proponents to who might have gotten mining concessions from the Ministry of Lands and Natural Resources (MLNR) through the Mineral Commission (MC) to as it is, provides my office with scoping report and then request for an environmental permit before they undertake to mine. So, we give an environmental permit before the commencement of mining. And then following from the monitoring activities, are also to beundertaking by our own and then make sure compliance is also done" (KII, Male, Institution 2).

"Since mining issues are multi-faceted in nature, we collaborate with mining sector agencies inthe development and implementation of mining policies by devising means and strategies to helpprotect the forests from illegal mining activities" (KII, Male, Institution 5).

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4.3.3 Institutional Relationship with Small-scale Miners

The existing relationship between institutions and small-scale miners was also explored. The findings revealed that some institutions have a direct relationship with miners through awareness creation:

"*The association of small-scale miners' creates awareness to its members. We have structured meetings with our members, basically aiming to improve how they go about their mining activities. We share bestpractices. And if there are issues that are common to us, we help them resolve it"* (KII, Male, Institution1).

Some institutions also expressed no existing relationship with miners. This is evident in quotesby some participants below:

> *"Unfortunately, no. our engagements end with coming for the permit and going our way to do our own thing. That's very unfortunate"* (KII, Male, Institution 4).

Another participant also expressed that, though there are no formal communication channels, there is a level of involvement through the regional and district offices.

> "*There are no formal communication channels, but informally small-scale or illegal miners aremostly engaged or communicated to via our Regional and district offices of the Divisions as andwhen it becomes necessary"* (KII, Female, Institution 5).

The study also showed that some institutions are involved with the small-scale mining sector through community and zonal levels and their services, such as supports in land reclamation.

> *"Our institution in collaboration with other institutions helps to ensure that mining is undertakenon a sustainable basis and also supports in undertaking land reclamation and reforestation in mined-out areas"* (KII, Female, Institution 6).

Furthermore, findings from participants at the community level showed that the relationship between the small-scale miners and institutions are mainly based on the regulatory services they perform in the mining sector:

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"Minerals Commission, EPA, Lands Commission, and the Taskforce are made up of the military, police and other security personnel. Sometimes, forestry commission. The district assembly also plays a role in mining" (FGD, Male, Miner, Community 7).

4.4 Gaps Contributing to Illegal Small-scale Mining

This section explores legal, regulatory and other gaps that contribute or lead to illegalities in the small-scale mining sector. Results presented under this section are categorized into the following subthemes: Implementation, Lack of coordination among institutions, low level of education and expertise among small-scale miners, System Challenges, Monitoring and Supervision and Stakeholder engagement.

4.4.1 Implementation

Challenges with implementing mining laws and policies have emerged as one of the major contributing factors to illegal mining activities in Ghana. Findings revealed that, though existing policies and laws cover all mining activities, to some extent, these policies are hardly implemented. This has resulted in the many illegalities occurring in the Small-scale mining sector. For instance, some participants expressed that:

"The law says for someone to use mercury in small-scale mining, the person has to apply to theMC for permission to use mercury, and that person has to receive a response from them beforethey can use. On the contrary, that's not happening. And I can understand why that provision was put in there so that whoever is going to use it can be examined, or that person will be deemed competent in using the substance. And even more, interestingly, the law does not requireyou to use mercury just like that. So again, as I said, the policy is beautifully crafted, but it is amatter of implementation. The question is whether we are implementing it. You know, that's where the challenge is" (KII, Male, Institution 3).

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"Implementation has always been a major headache. To implement laws and policies and thento see to enforcement has been the number one challenge in our institution" (KII, Male, Institution 4).

In addition, participants indicated that the inability of some institutions to enforce mining laws has contributed to the illegalities in the small-scale mining sector.

"Yes, there are guiding principles, but the challenge is with the enforcement of these principles. An example of such a guideline is the prohibition of mining around waterbodies; although somedo not mine around water bodies, they create channels or canals that form these water bodies"(KII, Female, Institution 7).

"…even the position of our security agencies and the judiciary is also a very big challenge. As an officer from the regulatory institution, you may apprehend a wrongdoer; you have no right

unless maybe you apply an administrative sanction, but where the offence borders on criminalityand needs to be, it means that he has that level of the criminal aspect. That becomes the preserveour institution and the judiciary then you don't have the control. It's quite disheartening and discouraging when the culprit is left off the hook. So, it demoralizes officers to continuously monitor and apprehend and then to enforce the laws" (KII, Male, Institution 2).

The study again showed that challenges with the implementation and enforcement of laws are mainly because of how the country's small-scale mining sector is viewed. Notably, it is viewed as a preserve for Ghanaians and their livelihood.

"…the enforcement of the laws when it comes to the large-scale sector is very strict, but at the small-scale sector, we are a bit soft on them. So, mainly because the large-scale sector is seen aswhat the multinationals or foreigners bring their money to invest. So, we hold them in strict compliance with the laws, but when it comes to small-scale sector, it's us Ghanaians, so we go soft on ourselves and then I can understand why we go soft on ourselves because we see it as a livelihood for local communities" (KII, Male, Institution 3).

"I don't think as a country; we have treated small-scale mining as a business. It's mostly seen as a form of livelihood. So, people are allowed to go at it in a manner that is, seemed like a formof livelihood not, as a business that you're holding them to, you know, strictly to all the laws that are in place" (KII, Male, Institution 1).

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Furthermore, some participants revealed that the various regulatory bodies and political will have also contributed to the illegalities in the small-scale mining sector:

> *"Yes, they do, in the sense that institutions and regulatory bodies are responsible for developinglaws and policies to ensure the effective management of the mining sector. However, suppose these same policies and laws fail to capture and address the cross-cutting issues of the sector coupled with a lack of political will to enforce existing rules and regulations. In that case, it is fair to conclude that these institutions and regulatory partly contribute to illegal SSM"* (KII, Male, Institution 6).

4.4.2. Lack of coordination among institutions

The lack of coordination among various mining institutions was also expressed as to why many illegalities exist in the SSM sector. This gap has translated into many effects on resources (water, agriculture lands, etc.) in mining communities. For instance, some participants expressed that:

> *The institutional coordination and integrated approach are very much missing. And that creates grey areas of which miners take advantage. Indeed, it also permeates within the large-scale sector as well. For instance, the agriculture ministry is in charge of agriculture production, but they are not in charge of agricultural lands. They do not control or measure agricultural lands, whether commercial agriculture or subsistence agriculture. So, mining concession may fall within an agricultural production zone and take precedence. That's how come we have most of our cocoa farms been mined to the detriment of the cocoa industry. So, there are no proper land use allocations, there are no boundaries so to speak, and that is very So, serious"* (KII, Male, Institution 4).

> *"You may view it as a small river, but it feeds into larger rivers; once you destroy it, it means you are cutting off the supply line to the bigger rivers. Most frequently, the attention is on the Pra and the Densu's and all that. But their tributaries are left on their own to die slowly. And that is a very serious issue that nobody is averting their minds to. So institutional gaps, yes, the overlapping responsibilities, forestry commission thinks ministry of agriculture will do, ministryof agriculture will think this, so these are areas that do not order well for our coordination"* (KII, Male, Institution 2).

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Moreover, the study revealed that lack of coordination among mining institutions affects the planning of concessions for small-scale miners, which eventually promotes illegal mining.

> *"So, in a scope of all this, the major constraint has been the uncoordinated, unintegrated approach to managing the small-scale mining activities. For instance, it's of the case that a concession may be given out to a small-scale mining applicant, and he may have access to the concession that records to the water resource commission as to whether the water bodies available within the concession are healthy or not, that's the health status of such water bodies.So, the collaboration may not be there"* (KII, Male, Institution 3).

> *"First and foremost, bureaucracies in the acquisition of mining license and the lack ofcollaboration between relevant stakeholders such as the minerals commission and the geological Survey Department during policy decisions"* (KII, Female, Institution 5).

Some participants also expressed that institutions can properly coordinate if revisions are madeto the existing ways that concessions are assigned to miners, and this is illustrated in the quotebelow:

> *"The other thing is the practice that the concessionaire applies to MC and through the MLNR for the concession before the applicants comes to EPA for an environmental permit. I think it should be the other way round. The application should be referred to the EPA for an intern to undertake a preliminary environmental survey. That is where they can bring in the WRC to lookat the water bodies and then the geological services. Then they can give an objection or no objection notice. When the EPA gives no objection notice to MC regarding that particular application, the matter ends there. So, the applicants will not go ahead and waste money and time and all those things. So, it is refused at that level. However, if the EPA decides not to objectto it, they send a notice that no objection, then they can now go ahead and grant the concession.That is where the concessionaire goes back to the EPA with the requisite tools needed, and theapplicant is sure that yes, he is keen to go and work and sure that the concession area is free from all negativities. So, it should start and end with the EPA"* (KII, Male, Institution 2).

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4.4.3 Low level of Education and Expertise Among Miners

A low level of education among miners was also revealed as contributing to illegal mining in the small-scale mining sector. Findings showed that mining institutions are not relaying the principles involved in SSM to the miners on the ground, and this gap has made many miners assume that what they are doing is legal whereas they are illegal. For instance, some participants expressed that,

> *"…But some too it's the education. Sometimes, they feel what they are doing is right when theydon't understand the mining principles. So, if the policy or the institutions who are supposed toguide them are not always around to educate them or show them what to do, they may think theyare doing the right thing. So, we are looking at it from different perspectives. One of the fines he knows that I am doing is wrong. So, at the end of the day, when you intentionally do that, automatically, you've faltered. But some too don't even know. They feel that it is ok so far as I need water to wash and how I will manage myself to get water to do the washing and those things I can do. They don't even know how to create their ponds to wash or to do their washingand those things. So, they will need the institutions to get closer to them and educate them to understand. So, you may have your documents alright, but if you don't even understand the mining dynamics, it will lead you to illegality"* (KII, Male, Institution 8).

> *"…however, other measures of reducing illegal mining are educating the miners on the dos anddon'ts so they will be abreast will current regulations"* (KII, Male, Institution 2).

In addition, a low level of knowledge regarding the dynamics involved in small-scale mining was indicated to be contributing to illegalities, and this is illustrated in the quotes below:

> *"Some of the small-scale miners who even felt that no, let me go in for license they can go in forthe license alright but they don't understand some of the dynamics. So, he can have the license,the land demarcated, and instead of him being on that land because he has a document or paper,they felt that after all, I have a license and leave his actual land and be working on different land. That makes you an illegal person"* (KII, Male, Institution 7).

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"...yeah, and if the miner thinks that his concession area is not that rich but adjacent, closer toa river bed maybe that rich, within the same area but different demarcation, he moves from hisapproved location to the other, it becomes illegality but here's the case, once you confront them they will be brandishing the, 'I have a license, I have a concession license, I have EPA permit,blah, blah, blah. But it is an illegality. The person is not operating within the specified location.But maybe some few metres away from his own" (KII, Male, Institution 4).

Furthermore, the lack of expertise among miners in the small-scale mining sector has contributed to illegalities in small-scale mining.

"So, at the highest level, the person leading the mine themselves is not very, very competent, then it means that all his followers to are likely not to be competent as well. So, they don't knowwhat's expected of them, and they go about it in an illegal practice. So, for instance, the basic PPE, the personal protective equipment, you will find that most of them won't have it. If you visit small-scale mines i.e., surface mining typically requires proper boots. To protect your footagainst a rockfall. So, you know, a heavy object could harm your leg. You're required to wear like a reflector. Put on a proper overall, and you have your hard hat on with your goggles andall of that. But typically, you go there, and they are not properly attired or properly dressed" (KII, Male, Institution 9).

*Sometimes, when they have to use mercury to process the gold, for example, I saw the person mixing mercury to raw gold, which locally they call '**black**' with his hand without gloves. The worst example I saw was someone who wanted to add saliva to it, so the person placed it in themouth and tried to suck it or something to get the kind of shape or form they were looking for. And after, he sorts of spat out the saliva. It's like the last but one process before you get your final gold concentrate that's the name, gold concentrate. And that is very dangerous. So sometimes, they even dump the concentrated waste anywhere in the neighbourhood. All these underscores the deficit of knowledge when it comes to going about the processes"* (KII, Male, Institution 3).

4.4.4. System Challenges

System challenges were also a contributing factor to illegalities in the SSM sector. The study revealed system challenges such as permitting acquisition from mining institutions, which has resulted in so many illegal SSM. For instance, some community members expressed

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that:

"…the procedures in acquiring license are cumbersome, so it scares people from applying for a permit. There are a lot of institutions involved in the permit acquisition process and are not synchronized. They are all done separately (FGD, Male, Miner, Community 5).

You just can't go today and get it today or even within three months, as the MC says. So, if the process keeps long and wastes time, I need to work as a business person. The land, too, is lyingideal. So, if I go and work on it, you will call me an illegal person or miner. Meanwhile, the institution is also not giving me what is required. Not that I don't want to do it, I have applied,and it's delaying. What do I do? Should I sit down for my business to crush? I will go and work.Then at the end of the day, you will call me an illegal person and chase me or seize my tools. You will not listen to my side of the story at that time. You will say where is your paper. You willcome and bring military men you will not listen to the side of my story too (FGD, Male, Miner, Community 3).

"Quite recently, I realized that, when applying for a small-scale mining license, you start fromthe MC, then the MC will give you what we call the license. But the license doesn't give you theright to start operations. It just makes you a concessionaire over the parcel of land that has been registered in your name. But to get to start the operation, you have to get what you call a mine operation permit. Before then, you need to go to the EPA to get an environmental permit.So typically, you go through the motions with EPA and then once you are given the right permit,you come back to the MC, and then you are given the mining permit. Then that gives you the right to start your mining operations. But one component that is missing there should have beenthe water permit, but the WRC should have given that. But what the current practice is, is that once companies get the mining permits, they are expected to go to WRC and apply for a water permit. But most of them, of course, do not go. Our law says that once there is a body of water underground below the water table or surface water, you want to extract water from it, and youneed a permit from the WRC to extract. I know most of our mining activities use a lot of water,so Ideally, they are supposed to go to WRC to apply, but most of them do not do that. So that iswhat accounts for the massive pollution that we see around. So, we know that you had coveredall the backgrounds if we had done things differently before we gave you the mine operating permit. We know you have acquired all the licenses or permits. Then finally, they can issue the mining permit" (KII, Male, Institution 1).

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The findings also revealed that challenges with concessions or mining lands as well as the lack of support for the small-scale miners contribute to illegal mining, and this is evident in the quotes below:

> *"Another one is the large-scale companies taking over the lands of the small-scale miners whoare indigenes, and the small-scale mining is meant for only Ghanaians who don't have access to those lands. So, they feel that fine; if they cannot get places to work, they will encroach on those lands illegally*" (KII, Male, Institution 8).

> *"Because we don't explore before we mine, what we do is try and error. We can mine for a longtime before getting some of the gold. The whole pit will not give any gold on an unlucky moment,but one can make up for all the losses and resources wasted on a lucky day. So, it is luck. Sometimes you can invest a lot of resources and get nothing"* (FGD, Male, Miner, Community1).

4.4.5. Monitoring and Supervision

Issues of monitoring and supervision have also been identified as a major contributing factor to illegalities in small-scale mining. The findings showed that mining institutions do not properly monitor the activities of small-scale miners or those mining illegally, especially in remote, isolated areas.

> *"Of course, you have a license, but in terms of monitoring how well are they are doing, I don'tthink as a country we have done too well, and that accounts for some of the bad practices or thebad outcomes that we tend to see"* (KII, Male, Institution 3)

> *The license given to them requires that from time to time to send reports to them and ask a question on how well they are doing. But unfortunately, that also does not happen. So, they justgo about their activities. And then occasionally we get to hear about what they are doing whenthere's a problem or an issue pops up, but having like constant oversight over what they do, is a no"* (KII, Male, Institution 1).

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In addition, some participants indicated differences in levels of supervision regarding large-scale miners and small-scale miners. This difference has contributed to the illegalities in the small-scale mining sector. For instance, a participant stated that:

> *"... there's a difference between the level of supervision in the small-scale sector and the large-scale mining sector. And of course, that also explains the differences in terms of the outcomes we see. For me, I think that is where the challenges with the sector perhaps because the inspectorate division generally have very well-trained staff, very seasoned professionals who have considerable experience when it comes to large-scale mining itself and because they supervise or regulate that sector, they can transfer the experience to the small-scale mining sector, experiences that they can transfer to the small-scale mining sector as well. But becausethey are not allowed to take any interest in the small-scale sector and is that unit that does it, I think when we ask the inspectorate division to do it, we might get a different result"* (KII, Male, Institution 3).

Moreover, some participants indicated that the limited staff capacity in mining institutions is why the small-scale mining sectors are not properly monitored and supervised.

> *"Yes, there is a gap. Because if you look at the regulators, you can have at least two people, even one officer, maybe with his deputy having about six to eight political/operational districts. Even some can occupy a whole region, with only two personnel. How do they monitor and then supervise these miners? How can that person or two people go around the region with about sixto ten political/operational districts to instruct illegal miners? It will be very difficult"* (KII, Male,Institution 8).

> *"There can be several mining companies working there, but of course, the staff capacity of the MC, when it comes to overseeing the work that is being done, is quite limited. So, it, therefore, becomes very difficult to have effective supervision over the activities of these small-scale miners.So typically, they are left on their own to do whatever they want to do*" (KII, Male, Institution 1).

> *"Some of the institutions responsible for making sure things are done will do not come regularly.I think they are not enough to visit the mining sites in these areas. They lack better vehicles to move about because these areas are very rough and not easily accessible*" (FGD, Male, Miner, Community 6).

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4.4.6. Stakeholder Engagement

The findings from the study revealed that traditional authorities are not being involved in issuesrelating to the mining sectors when they are mostly custodians of community lands:

> *"…and the traditional authorities to I think they are not being involved even if they are not much. Because we allow them, and they are also taking advantage. Some of the education aspects are very low, so they don't understand the whole process and procedures. They also feelthat fine the land belongs to me. So, I allow my people to do their own thing. But when it comesto reality, we disown the people of any involvement or authorisation. When law enforcers comeafter them, the traditional authorities will shy away. So, there is a whole dynamic* (KII, Male, Institution 8).

Some participants further expressed the need for local authorities to be engaged in the land acquisition and policymaking process, which can help curb major illegalities existing in the small-scale mining sector.

> *"The other aspect has to do with the non-involvement or partial involvement of the traditional authorities. I think it's about time we give them enough responsibilities towards the planning and demarcation of concession to be part of the solution to the entire problem. The traditional authorities must be involved in this case"* (KII, Male, Institution 4)

> *"There's another missing link. That's the traditional authority. The traditional rulers are knownto be the custodians of the land. Their participation in the whole licensing regime in the whole process is very minimal or even non-existent. There must be law or regulations that bring themin as active participants so they can pass, buffer or they can be the first point of call for securityand monitoring at their various frontiers"* (KII, Male, Institution 2)

> *"The locals or the traditional authorities should be involved when making policies. They also have a very rich knowledge to bring to bear. When policies are co-produced with the people it is intended for then, adoption becomes very easy, but when it is made from the top without takinginto account or considering the miners, then it will be very difficult to adhere to"* (FGD, Male,Miner, Community 4).

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4.5. Institutional Capacity to Enforce Mining Policies

This section explored the capacity of mining institutions to enforce mining policies. It explored components that can and should be strengthened to enable institutions to effectively curb the illegalities in Ghana's small-scale mining sector and help in its formalisation. Findings under this section are presented under the following themes: Regulatory and Policy level (SSM mining policies- mining lands, permit acquisition, sanctions and reclamation), Structure Level (Personnel, knowledge, Expertise), Process Level (implementation, monitoring and supervision, coordination, stakeholder engagements, and formalisation).

4.5.1 Regulatory and Policy level

Findings under this present theme policy and regulatory issues governing small-scale mining that can and should be enforced by mining institutions to help curb illegalities in the mining sector of Ghana. It was realized that policies such as alternative livelihood for illegal miners are currently in place to help reduce the rate of illegal mining, and this is illustrated in the quote below:

> *"There have been programmes to get an alternative livelihood for the individuals who engage in illegal mining activities. So, these and other measures are already in place. Though we are not there yet, there is still more to do*" (KII, Male, Institution 2)

The findings also revealed the need for the establishment of laws for small-scale mining to be the total preserve for Ghanaians:

> *"We must ensure a law that says that the small-scale must involve only Ghanaians. That should also mean that typical small-scale mining areas are no go areas for foreigners. Foreigners can provide your support services outside the area of the mining area (location)"* (KII, Male, Institution 10).

Moreover, findings revealed that the term "small-scale" as defined in the mining policy of Ghana does not relate to what is currently on the ground, hence the need for an appropriate

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revision. This is illustrated in the quote below:

> *"It has moved from the ASM traditional way that we know, given technology advancement andthe application on the sides. So medium scale, like the medium scale, between the large and small-scale, is what we have now. So why don't we be bold enough and say it is a medium scalemining activity? And then the land scale, the land allocation, instead of 25 acres, why can't wedo say 100 acres"* (KII, Male, Institution 10).

Regarding the use of mercury by small-scale miners, the study revealed that it has health consequences and has not been banned. However, small-scale miners are being educated on the proper use of mercury to reduce its health consequences.

> *"However, information, data and research about the use of mercury are considered to be dangerous to human health and other life forms. So, we are better off if we ban its use. So, we are now teaching the small-scale miners to know the ramifications, educate them, and make them understand the negative use of mercury* (KII, Male, Institution 2).

In addition, the study showed that there is currently no alternative for the use of mercury by small-scale miners; however, measures are being put in place to phase its use gradually:

> *"... the alternative is then directly. But of course, UMAT has been trying to bring up a differenttechnology, but it's not being fully optimized for small-scale miners. So again, the adoption hasbeen quite slow, but another entrepreneur also tried to develop some technology, but that has also not been fully adopted. So, for now, if we ban mercury, what will be the alternative? So, wegradually will have to face it out when the other options are fully adopted*" (KII, Male, Institution 3)

Another participant also stated that:

> *"Currently, the large-scalelarge-scale operators are using cyanide; this is a bit tolerable. And minerals commission has also come out with a technology that can crash the stones and get the gold without applying any chemical. The technology is called the '**gold catcher machine**'. And the gold catcher is more effective and efficient; you can attain 95% of the gold whiles the mercury'sefficiency is about 75%"* (KII, Male, Institution 1).

Issues of permit acquisition also emerged, and some participants indicated that decentralisation

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of the permit acquisition process would help curb the illegalities that currently exist in the SSM sector:

> *"You see, there are some basic things that are needed at the disposal of small-scale miners. Decentralising the whole licensing regime"* (KII, Male, Institution 8).

Furthermore, the study showed that some measures are currently in place to shorten the duration of mining permit acquisition and make it easy for miners to access concessions.

> *"I can understand that maybe the process is a bit tedious. But the MC has done a lot of work inthat space, trying to shorten the duration for acquiring a license. On paper, it's supposed to bewithin three months. Once you put in an application, you should be getting your license within three months. But of course, sometimes it can run a little more than three months. At the MC, they have undertaken several reform initiatives to reduce the time it takes for someone to acquirelicenses. Now you don't need to come to Accra to acquire your license. You can start your process from the district and then go through the process, and then eventually you can get it back"* (KII, Male, Institution 1).

> *"They launched it quite recently, the call it the mining Cadastre. So, there is the mining Cadastre, and it is like a map that tells you where all the concessions are. If I want to apply, I go and look at the Cadastre and plot the coordinates I have on the Cadastre; if it is free, it means that a concession has not been awarded"* (KII, Male, Institution 3).

In addition, some participants expressed the importance of reclamation of lands in the small-scale mining sector and the need for appropriate policy to help in its enforcement. This is illustrated in the quotes below:

> *"The capacity of small-scale miners, the rules are not stringent enough to control the irresponsibility's that sometimes occurs within the operations of the small-scale miners regarding reclaiming of mined lands. This can also lead to illegalities in mining"* (KII, Male, Institution 10).

> *"There is this major issue which is, reclamation bond. The reclamation bond is key if we succeedin this organisation activity. The evidence is clear and available that, with the large-scalelarge-scale miningcommunity or industry, much discipline is achieved and is responsibility towards environmental regulations are also achieved. This is*

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mainly due to the reclamation bond that these companiespost. So, the law allows EPAs to impose this bond on small-scale miners, but they have not beendoing for some reason. So, we hope that the law can be enforced. If the company finishes its operations and does not do the reclamation as is captured in the management plan, commissioning, and all manner of things, then EPA has the power to fall on or recall, call the reclamation bond to undertake those things. So, the checks and balances come in here. This should be introduced in the small-scale mining sector as well to avoid this lapse" (KII, Male, Institution 2).

Furthermore, the study revealed that existing laws need to be strengthened to address current challenges faced in Ghana's mining sector. Some participants revealed that some laws are being strengthened to address current challenges.

"Even though we will say that they are comprehensive, we get to know that some portions havenot been covered through the implementation. So, for instance, you see, if there's illegal mining,even with the Act that we had and the LI, Initially, before 2020, we didn't have laws that wouldlet you be able to confiscate any mining equipment used for illegal mining. But then you go to court, and then you are disabled; you can't do anything. So, later it has to be strengthened. So as time goes on, we see that all those things are strengthened. So, in 2019, Act 995 was also promulgated to be able to strengthen those things then give stiffer punishment" (KII, Male, Institution 2).

4.5.2. Structure Level

At the structure level, findings from the data showed that there is a need for capacity building and provision of adequate human resources for regulatory bodies in the mining sector to function effectively:

"The governments should first and foremost strengthen regulatory systems and empower themwith adequate human resource capacities. To ensure that these systems function effectively, theyshould be free from political interferences and adequately financed" (KII, Male, Institution 6).

"So, the numerical strength of the institutions personnel sometimes doesn't help because, if youcompare the number of personnel all over the country or the offices around and you see the number of people who are in that industry, they need more

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people to at least get closer to them and educate them" (KII, Male, Institution 8).

In addition, the study revealed that some institutions are working on decentralising to regulate activities of small-scale miners effectively:

> *"Before 2018, we had 9 district offices. Currently, we have increased the district offices to 13, we have added about another 18 satellite offices, so that was a gap, and for now we are filling it"* (KII, Male, Institution 9).

Some institutions, however, expressed the need for government support in enforcing mining policies, as addressing issues of illegal mining can be dangerous.

> *"…shaping illegal mining activities became dangerous, so that needed state intervention. Because some of the illegal miners are well-armed, and you can't walk there anyhow. So that'show come we said that illegality is illegality, so if the state could help. And that's how come you see this operation vanguard (see for example Plate), operation others and all those things"* (KII, Male, Institution 10).

Moreover, findings from the study revealed that, though some existing structures are in place to regulate illegal small-scale mining, they need to be strengthened to attain better results.

> *"…So, we have a system that even the law allows our institution to form what we call district mining committee. The DCEs chair this district mining committee with other stakeholders, including chiefs, the police, the assemblymen and other prominent institutional representatives.The traditional authority is part of the committee, and they are supposed to help that officer manage the mining activity there. Because we believe that mining activity is a multi-stakeholderinvolvement, now if an officer sees any illegal activity, aside from talking to the illegal miners,they will report it in writing to the DCE and the regional minister and then report it to the headoffice. The head office sends a copy of the report to the local government minister so that the local government minister also prompts the DCE to help stop the illegal activity. So, the DCE should use the security agency to stop illegal activity. But over time, some of them don't act onit. You write reminders they still don't act on it, so that is why it has to be taken to a national level*" (KII, Male, Institution 9).

Another structure that was realized from the study that can help mining institutions to better address challenges in the small-scale mining sector is the education of people, and this is

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illustrated in the quote below:

> *"…anytime we see illegal activity, our officers are not well equipped to chase people. You can'tjust go and be chasing people. Only when you go, and they are ready to listen to you can educatethem and stop them. But when they become hostile is a problem"* (KII, Male, Institution 9).

> *"Currently we continue to do our education. Education is key. There is even a programme running on GTV, to educate the public on mining activities"* (KII, Male, Institution 10).

4.5.3. Process Level

Implementation of mining policies by institutions was indicated as ways by which illegalities can be curbed in the mining sector, and this is illustrated in the statements below:

> *"Just implement the law for me. Yes. Implement the law to the latter, and we will solve illegal mining in the country"* (KII, Male, Institution 1).

> *"I believe that one pertinent gap that has negatively affected the formalisation of SSM in Ghana is political leniency and lack or weak enforcement of mining rules and regulations"* (KII, Female, Institution 7).

In addition, monitoring and supervision were revealed to be means by which illegalities can be addressed in the small-scale mining sector. Findings revealed that institutions are putting some measures to supervise the small-scale mining sector better.

> *"We are almost there, opening up about 35 operational districts targeting the mining areas where our presences are not there. So, our offices will be closed. Our officers will be seeing feasibility and be around to offer any help they so desire so far as an environmental safeguardis concerned. These are the things that are put in place, and we are at the verge of actualising or getting them operational"* (KII, Male, Institution 2).

The study also showed that coordination among mining institutions would help enforce mining laws which will help formalise the illegal small-scale miners. For instance, some participants

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stated that:

> *"What we ought to be doing now is to make sure we consolidate and all that, integrate them into a proper regime where all other state institutions or related institutions will come on board,then we can get proper coordinating as to what to be done. FC, WRC, MC, geological body of the EPA to form an umbrella, so much depends on us"* (KII, Male, Institution 4).

> *"Ensuring efficient inter-institutional collaboration and representation of relevant stakeholders(especially women) across all sectors"* (KII, Female, Institution 5).

Stakeholder engagement was also revealed as ways by which policies can better be enforced to curb illegal small-scale mining, and this is illustrated in the quotes below:

> *"During policy decisions, regulatory bodies should undertake broad consultations with relevant stakeholder across all sectors (both formal and informal) to improve understanding and challenging perspectives and realities of SSM activities"* (KII, Female, Institution 7).

> *"I have said it over and over. Sometimes like you are in the office, and I am in the field, so youfeel that you will sit in your office, put policies together and come and dump them on me. Me the local person on the ground, you think I don't have anything to think of. And you feel that thepolicy you are bringing will suit me? Meanwhile, the spectacle is also wearing is different. Butif you sit at your corner, make laws, and come and dump those things on me, yes, you will bringit, but implementation will be difficult for you. You see, some of these policies that governmentupon governments normally bring I think they are getting it all wrong because they don't get closer to the people to understand what the people want and their needs. And they are in the field, and they are doing their own thing because some of these big firms or these large-scale companies, they all resort to these local people for their"* (KII, Male, Institution 8).

However, some institutions indicated that measures are being put in place to engage relevant stakeholders:

> *"However, we are on the course of getting things done. The public disclosure of some of these things is already there. That is why I said the local authority, the district assembly, inviting general public criticism as to what to do. We invite stakeholders affected directly or indirectly to develop their environmental concerns to find solutions*

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to the matters. Apart from the scientificand technical deducted, we still listen to people. For instance, in the farming communities, people will use their farmlands; indeed, some settlements are locked, and these are things we look at" (KII, Male, Institution 4).

4.6. Sustainable Development Goals and Mining in Ghana

The study also explored participants' knowledge of mining institutions' roles in achieving Sustainable Development Goals (SDGs). Findings revealed that many mining institutions play various roles that help achieve SDGs. For instance, concerning life on land and underwater, participants expressed that:

"We will also use the SDG 9 to get to our immediate goals. The three major SDGs are climate change, life underwater, and land. And don't forget these are physical environments that we aretalking about, so deforestation, degradation of another land through illegal mining or even proper mining, water bodies destruction and all that becomes the centre peak that is why we are undertaking projects with the world bank, like landscape restoration and small-scale miningprojects and all that, is beyond to link landscaping, land degradation, deforestation and water bodies destruction to illegal mining to see how we can be able to find a common solution" (KII, Male, Institution 2).

"Our institution is strongly committed to regulating the use of forest and wildlife resources, conserving and managing those resources for current and future generations. However, within the mining sector, we play a significant role in the reclamation and reforestation of degraded areas and protecting forests and wildlife from encroachment by illegal miners. This act of protection and sustainable management of forest and wildlife resources can help alleviate poverty by creating forest-dependent livelihoods, contributing to climate action and zero hunger. These contributions are well reflected in the SDGs. Our institution is part of liaison group that oversees mining in production Forest Reserves and thereby ensures compliance of rules and regulations regarding large-scale mining" (KII, Female, Institution 5).

In addition, some participants revealed actions that are they are implementing that contributes to climate change, health and education:

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"So, for instance, we encourage a lot of tree cultivation, maybe just to sort of offset potentiallythe carbon monoxide that would be discharged into the atmosphere from the mining activities, or fumes from, machines that we tend to use, even using both solar and when it is possible to doso" (KII, Male, Institution 9).

"We are big investors in health. If you go to communities, you find out that the companies haveinvested in either the health infrastructure itself or have contributed equipment to the health infrastructure in the community. So, for instance, in the heat of the COVID-19 most companies

bought an ambulance for the Tarkwa government hospital; others also built an isolation centrefor them. Some also built a nursing training school for the community they operate in. Anglo- Gold Ashanti also do programmes on National Malaria Control. Indeed, their programme wastaken and implemented at the national level by NMCP, and even on education we also have a fund set up; currently all the funds go to support UMaT" (KII, Male, Institution 3).

"So, when it comes to education. For instance, every company has a policy that has improved education. We give several scholarships. And yeah, I think I have seen some good results aroundthat. So, I think the education performance and outreach in mining community may be slightly better than non-mining community" (KII, Male, Institution 1).

Findings also revealed that mining institutions have policies in place that contribute to gender equality:

"These days, the heads of the institutions are measured by their ability to increase the female- male ratio in their mines. So even in the universities, women are encouraged to take up coursesin mining, and by the time they take up the STEM courses, they would have developed some interests in mining. Also, we organize career fairs where we introduce them to the mining space.So yeah, we are quite big when it comes to the SDGs" (KII, Male, Institution 9).

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4.7. Community Perception of Illegal Small-scale Mining qualitative results.

This section explored community members' perceptions of small-scale mining and illegalities in the small-scale mining sector. Findings revealed that most community members engage in

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illegal or small-scale mining due to unemployment:

> *"My first experience in mining was when I completed Secondary school and had to stay house till my results are in. Then as a man, I had to do some work to earn a living. There was not anyjob available to be done. Some of my schools' mate introduced me to the mining business. It wasnot easy on our first day, but we managed to do"* (FGD, Male, Miner, Community 2).

> *"No better jobs in these areas apart from the mining activities. Even though it is very risky andtedious, we have to commit to it and do"* (FGD, Male, Miner, Community 3).

Other participants also indicated that engaging in small-scale mining has indeed benefited them.

For instance, a participant stated that:

> *"I got all my properties from mining. I have a car, built my house and motorbike. My kids attenda better school now. So, I have benefited from mining. We are all able to help each other in times of challenges and difficulties"* (FGD, Male, Miner, Community 7).

In addition, community members revealed how mining activities are carried out in the communities. Some indicated that:

> *"We dig the sand from the ground. Sometimes not deep by shallow. Close to the surface of the land. We clear all the plants and take the soil with simple tools"* (FGD, Male, Miner,Community 7).

> *"We dig deep vertical into the land. Sometimes about 100-200 meters. At this depth, then we move horizontally in different directions. We can spend about 3 days underground. We then pack all the soil and stones in sacks and bring them to the surface for processing"* (FGD, Male,Miner, Community 1).

Community members also expressed the challenges they face in the small-scale mining sector. Some revealed that the process of permit acquisition is burdensome; hence they are sometimes tempted to begin mining activities without the permit:

> "*Been chased by a task force and other officials. I applied for the licence, but it took*

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> *me yearswith front and back unnecessary delaying of proceedings. I got fed up and gave up. Because people have already started mining on the plot of land I intend to acquire and have started negotiations with the owner processing. So, I went straight to the grounds and started mining"*(FGD, Male, Miner, Community 3).

Moreover, some believe that the mining institutions do not support small-scale mining miners as they are led or tagged as illegal miners.

> *"Frankly speaking, the institutions do not help us. Even though community mining is, coming together as a group for this parcel of land is not that easy. Because we are tagged as illegal miners even though we mine at designated sites, these institutions always chase us to arrest us or seize our machines"* (FGD, Male, Miner, Community 6).

Others also expressed the temptation to mine close to water bodies due to the resources losses encountered from investing in concessions, which tend to have no gold deposits while the water bodies seem to have lots of mineral deposits:

> *"In some instances, when you are digging and approaching the main road or a place we are not supposed to mine, like close to a water body. That is where you see the signs of plenty depositof gold in the soil. In that case, you might be tempted to move into that area because you have invested many resources and gotten nothing at your designated area processing*" (FGD, Male,Miner, Community 4).

The study also revealed that loss of life and exposure to harmful chemicals, which have numerous health inferences on miners, were expressed as challenges associated with the small-scale mining sector. For instance, a participant stated that:

> *"There are also these dangers associated with mining. These are loss of lives from the pit through the collapse of the pit, being arrested by the task force; sometimes, when you are lucky,they seize your tools, and you pay money before it has been released to you. Mining related illness especially when you go underground for days and loss of lives from other persons through evil or spiritual attacks processing"* (FGD, Male, Miner, Community 6).

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Furthermore, community members expressed possible ways to curtail illegal mining activities in the various mining communities. Some expressed the need for decentralisation of mining institutions:

> *"I think these institutions should set up an office in these mining areas so that their presents canbe felt and guide the miners on safe mining. They should not wait for the harm to because beforethey move in to arrest or chase the miners"* (FGD, Male, Miner, Community 3).

While others propose for the synchronisation of the permit acquisition process:

> *"…they should try and synchronise some of the processes so that once you start the process, you can finish early without moving around and about"* (FGD, Male, Miner, Community 1).

Findings also revealed the need for financial support from the government for the small-scale miners, and this is illustrated in the quote below:

> *"There should be soft loans available for miners to acquire so that they can pay back when they finish mining"* (FGD, Male, Miner, Community 5).

It was interesting to note that some community members expressed the need for enforcement of laws regarding reclamation, and this is evident in a participants' quote below:

> *"There should be a way to force every miner to cover or reclaim the land after mining. Becauseeven the miner might have a permit and follows are procedures correctly but when he finishes and do not reclaim all his activities became illegal, and this situation is very rampant clear in our communities"* (FGD, Male, Miner, Community 2).

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4.7.0 Results of Quantitative Analysis

4.7.1 Citizenship status of Study Quantitative Participants

A few (2.0%) of the respondents were foreigners. Of the eight foreigners interviewed, 4 were fromNigeria, 2 from Togo, 1 from the Ivory coast and 1 from Malawi. Among the 387 Ghanaians interviewed, a majority (56.1%) were natives of the communities they were interviewed from.Among the 170 Ghanaian but non-natives of the interviewed communities, about three-quarters(72.9%) were from the study regions, while 27.1% were from other country regions. (Table 4.3)

4.7.2 Mining Methods used among the Study Respondents

The most common methods of mining method used in the study part were the dig and wash method (40.5%), Alluvial washing plant (33.4%), Changfa method (20.8%) and Underground method (20.3%). Other methods of mining used were chisel and hammer (8.1%), Dredge method (6.1%), Anomabo methods (4.1%) and more blade methods (3.0%). (Figure 4.2 & Table 4.4)

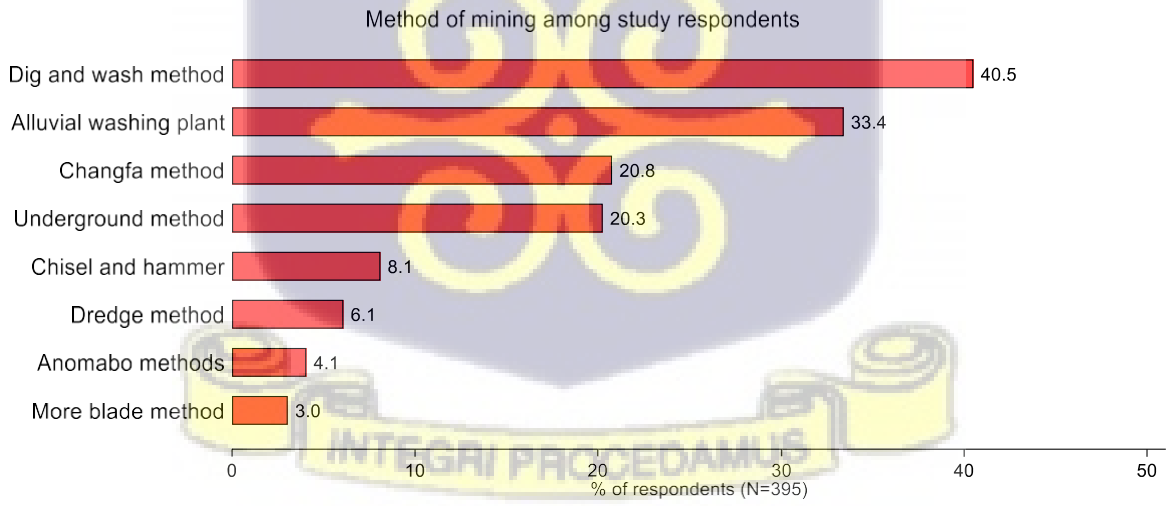

Figure 4.2 Method of mining used among the study respondents

Source: Study Field Survey, 2021

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4.7.3. Main economic activities engaged in before mining

More than a quarter (28.9%) of the respondents were not formally engaged in any economic activities before mining. Around a fifth, (22.0%) of them were formerly engaged in farming, 11.9% engaged in labour work, 10.1% formerly engaged in street hawker or trading, 9.6% formerly engaged in skilled work, 8.1% in Okada rider, 5.8% in other activities and 3.5% in civil works. (Figure 4.3 & Table 4.4)

About a third of the respondents from the Amansie West (33.8%), Atwima Mponua (34.0%), Prestea/Hun valley (29.3%), Talensi (35.0%) and Tarkwa Nsuaem (35.0%) districts were not formerly engaged in any economic activity before mining. Labour work (29.3%) was the common economic activity formerly engaged among Amenfi West respondents. In the Atiwa district, farming (68.0%) was the most economic activity formerly engaged in by the study respondents. The economic activities formerly engaged significantly varied across the districts ($p<0.001$). (Table 4.4)

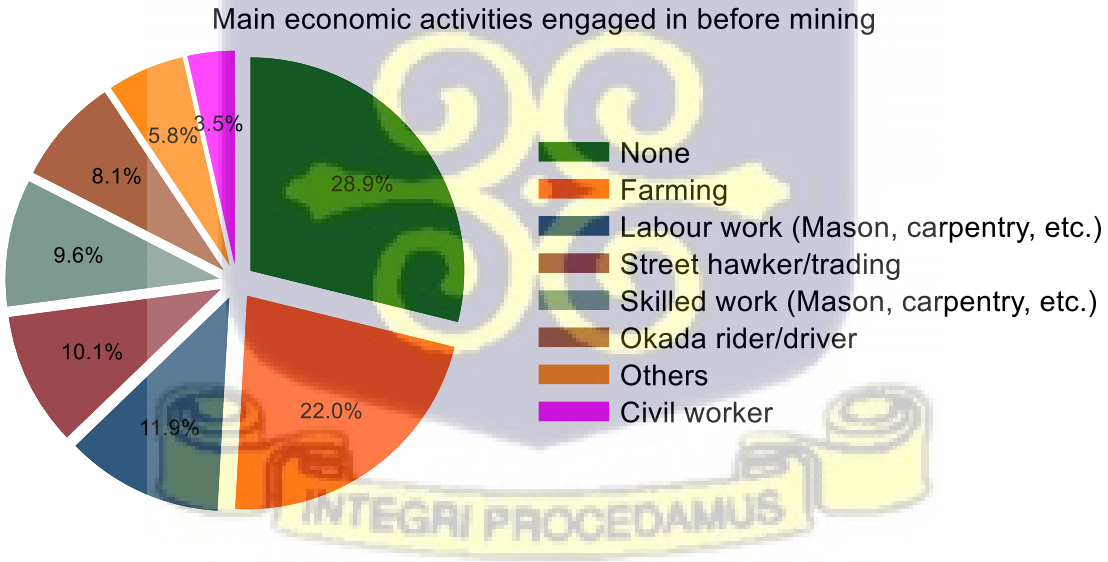

Figure 4.3: Main economic activities previously engaged in before mining

Source: Study Field Survey, 2021

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Current engagement in other economic activities besides mining

Over half (51.6%) of the study respondents were engaged in other economic activitiesbesides mining (Figure 4.4). At the districts level, the majority of respondents from Atiwa (76.0%), Atwima Mponua (58.5%) and Talensi (60.0%) districts were engaged in other economic activities. On the other hand, more than half of respondents from the Amansie West (58.4%), Prestea/Huni Valley (61.0%) and the Tarkwa Nsuaem (67.5%) were notengaged in other economic activities. Aside from mining, current engagement in other economic activities significantly varied across the districts ($p<0.001$). (Table 4.4) Most respondents engaged in farming were also engaged in other economic activities (40.7%). (Figure 4.4 & Table 4.4)

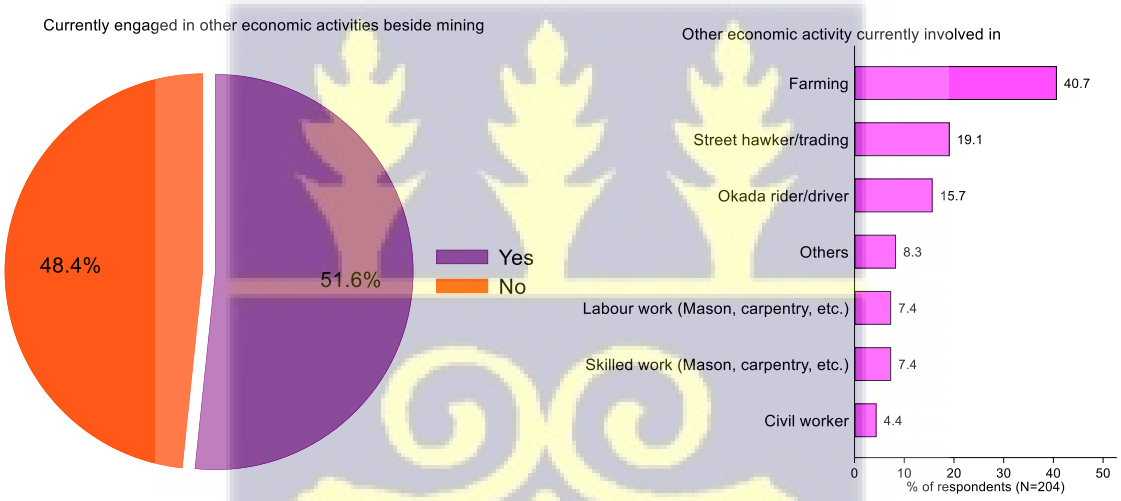

Figure 4.4: Current engagement in other economic activities besides mining

Source: Study Field Survey, 2021.

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4.7.4 Initiation of Study Respondents into Mining

About a third (32.7%) of the study respondents had a family member who worked as a small-scale miner. Among the 129 respondents that had a family member engaged in small-scale \ mining, more than a quarter of them had either one family member (27.9%) or 2 family members (36.4%) also engaged in small-scale mining. (Table 4.5)

Over a fifth of the respondents were introduced into small-scale mining by their family members (23.8%) or work colleagues (23.8%), whilst 17.7% were first introduced by a school friend, 13.7% by community friends. (Figure 4.5 & Table 4.5).

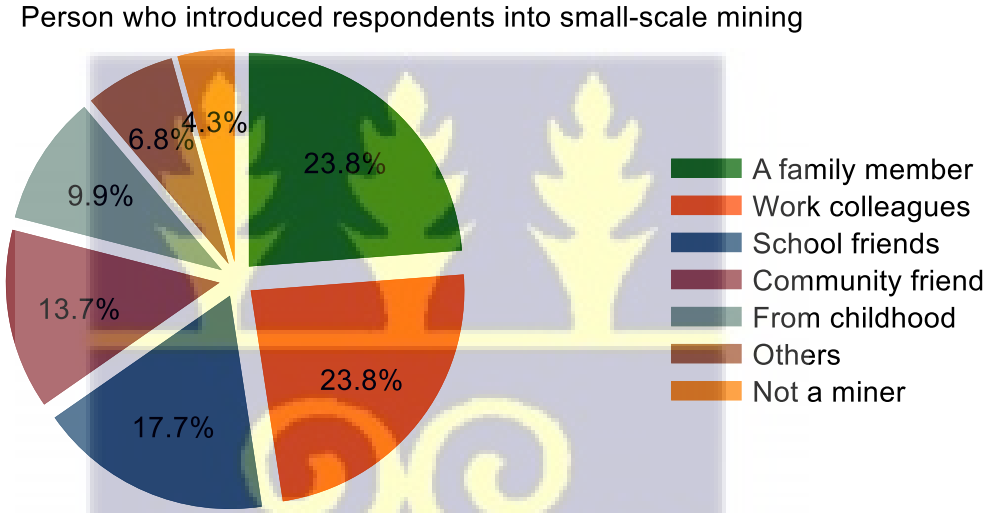

Figure 4.5: Persons' who introduced respondents into small-scale mining

Source: Study Field Survey, 2021

The majority (82.0%) of the respondents joined the small-scale mining for money, and 30.5% were unemployed. (Figure4. 6 & Table 4.5)

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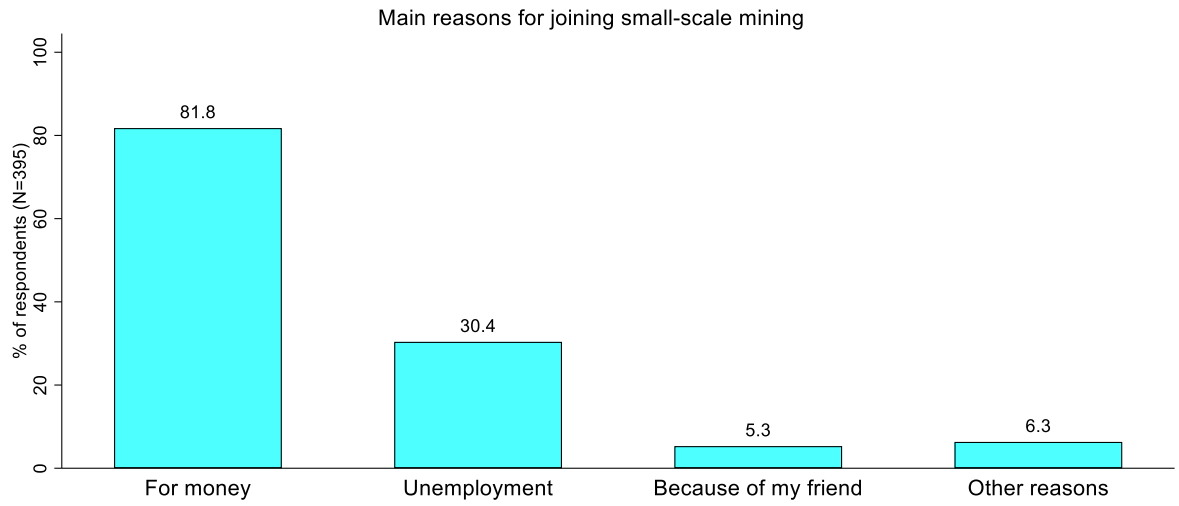

Figure 4.6: Main reasons for joining small scale mining

Source: Study Field Survey, 2021.

Table 4.5 shows the initiation of study participants into small-scale mining across the districts in the study. (Table 4.5).

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Table 4.3: Citizenship status of the study respondents by districts

Variable	Total	Districts						P-value
		Amansie West	Amenfi East	Atiwa	Atwima Mponua	Prestea /Huni Valley	Talensi	Tarkwa Nsuaem	
N	395	77	41	50	106	41	40	40	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Foreigner from another country?									0.35
No	387 (98.0)	76 (98.7)	39 (95.1)	50 (100.0)	103 (97.2)	41 (100.0)	40 (100.0)	38 (95.0)	
Yes	8 (2.0)	1 (1.3)	2 (4.9)	0 (0.0)	3 (2.8)	0 (0.0)	0 (0.0)	2 (5.0)	
Countries of foreigners									0.35
Ivory coast	1 (12.5)	0 (0.0)	1 (50.0)	-	0 (0.0)	-	-	0 (0.0)	
Malawi	1 (12.5)	0 (0.0)	0 (0.0)	-	0 (0.0)	-	-	1 (50.0)	
Nigeria	4 (50.0)	1 (100.0)	1 (50.0)	-	1 (33.3)	-	-	1 (50.0)	
Togo	2 (25.0)	0 (0.0)	0 (0.0)	-	2 (66.7)	-	-	0 (0.0)	
If Ghanaian, a native of the community?									<0.001
No	170 (43.9)	37 (48.7)	18 (46.2)	10 (20.0)	61 (59.2)	18 (43.9)	10 (25.0)	16 (42.1)	
Yes	217 (56.1)	39 (51.3)	21 (53.8)	40 (80.0)	42 (40.8)	23 (56.1)	30 (75.0)	22 (57.9)	
If Ghanaian but non-native of the community, are you from the same region?									0.13
No	46 (27.1)	12 (32.4)	2 (11.1)	3 (30.0)	19 (31.1)	4 (22.2)	5 (50.0)	1 (6.3)	
Yes	124 (72.9)	25 (67.6)	16 (88.9)	7 (70.0)	42 (68.9)	14 (77.8)	5 (50.0)	15 (93.8)	
If non-native Ghanaian from another region, what region are you from?									0.33
Ashanti	1 (2.2)	0 (0.0)	0 (0.0)	1 (33.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Bono	2 (4.3)	0 (0.0)	0 (0.0)	0 (0.0)	2 (10.5)	0 (0.0)	0 (0.0)	0 (0.0)	
Bono East	2 (4.3)	1 (8.3)	0 (0.0)	0 (0.0)	1 (5.3)	0 (0.0)	0 (0.0)	0 (0.0)	
Central	6 (13.0)	3 (25.0)	1 (50.0)	0 (0.0)	1 (5.3)	0 (0.0)	0 (0.0)	1 (100.0)	
Eastern	6 (13.0)	1 (8.3)	1 (50.0)	1 (33.3)	1 (5.3)	1 (25.0)	1 (20.0)	0 (0.0)	
Greater Accra	4 (8.7)	2 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	2 (50.0)	0 (0.0)	0 (0.0)	
North East	2 (4.3)	0 (0.0)	0 (0.0)	0 (0.0)	1 (5.3)	0 (0.0)	1 (20.0)	0 (0.0)	
Northern	7 (15.2)	2 (16.7)	0 (0.0)	1 (33.3)	5 (26.4)	0 (0.0)	0 (0.0)	0 (0.0)	
Savanna Region	4 (4.3)	0 (0.0)	0 (0.0)	0 (0.0)	1 (5.3)	0 (0.0)	0 (0.0)	0 (0.0)	
Upper East	3 (6.5)	0 (0.0)	0 (0.0)	0 (0.0)	3 (15.8)	0 (0.0)	0 (0.0)	0 (0.0)	
Upper West	3 (6.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (5.3)	0 (0.0)	2 (40.0)	0 (0.0)	

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Volta	2 (4.3)	0 (0.0)	0 (0.0)	0 (0.0)	2 (10.5)	0 (0.0)	0 (0.0)	0 (0.0)
Volta region	1 (2.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (20.0)	0 (0.0)
Western	1 (2.2)	1 (8.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Western North	4 (8.7)	2 (16.7)	0 (0.0)	0 (0.0)	2 (10.5)	0 (0.0)	0 (0.0)	0 (0.0)

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Table 4.4: Socio-economic characteristics of study participants by districts

Variables	Total	Amansie West	Amenfi East	Atiwa	Atwima Mponua	Prestea /Huni Valley	Talensi	Tarkwa Nsuaem	p-value
N	395	77	41	50	106	41	40	40	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Methods of small-scale miner (M)									
Dig and wash method	160 (40.5)	29 (37.7)	20 (48.8)	8 (16.0)	58 (54.7)	24 (58.5)	1 (2.5)	20 (50.0)	<0.001
Alluvial washing plant	132 (33.4)	21 (27.3)	14 (34.1)	40 (80.0)	39 (36.8)	10 (24.4)	2 (5.0)	6 (15.0)	<0.001
Changfa method	82 (20.8)	40 (51.9)	10 (24.4)	1 (2.0)	16 (15.1)	8 (19.5)	0 (0.0)	7 (17.5)	<0.001
Underground method	80 (20.3)	0 (0.0)	17 (41.5)	1 (2.0)	3 (2.8)	17 (41.5)	29 (72.5)	13 (32.5)	<0.001
Chisel and hammer	32 (8.1)	0 (0.0)	6 (14.6)	1 (2.0)	0 (0.0)	10 (24.4)	11 (27.5)	4 (10.0)	<0.001
Dredge method	24 (6.1)	1 (1.3)	9 (22.0)	0 (0.0)	4 (3.8)	5 (12.2)	0 (0.0)	5 (12.5)	<0.001
Anomabo methods	16 (4.1)	1 (1.3)	6 (14.6)	0 (0.0)	0 (0.0)	5 (12.2)	0 (0.0)	4 (10.0)	<0.001
More blade method	12 (3.0)	0 (0.0)	3 (7.3)	0 (0.0)	0 (0.0)	3 (7.3)	0 (0.0)	6 (15.0)	<0.001
Role of the respondent.									<0.001
Others	48 (12.2)	12 (15.6)	4 (9.8)	0 (0.0)	16 (15.1)	10 (24.4)	1 (2.5)	5 (12.5)	
Small scale Miner	248 (62.8)	42 (54.5)	33 (80.5)	41 (82.0)	57 (53.8)	18 (43.9)	35 (87.5)	22 (55.0)	
Support worker (security, trader, etc.)	99 (25.1)	23 (29.9)	4 (9.8)	9 (18.0)	33 (31.1)	13 (31.7)	4 (10.0)	13 (32.5)	
Main economic activity before small scale mining									<0.001
None	114 (28.9)	26 (33.8)	8 (19.5)	4 (8.0)	36 (34.0)	12 (29.3)	14 (35.0)	14 (35.0)	
Farming	87 (22.0)	7 (9.1)	8 (19.5)	34 (68.0)	19 (17.9)	5 (12.2)	12 (30.0)	2 (5.0)	
Labour work (Mason, carpentry, etc.)	47 (11.9)	6 (7.8)	12 (29.3)	6 (12.0)	5 (4.7)	7 (17.1)	1 (2.5)	10 (25.0)	
Street hawker/trading	40 (10.1)	8 (10.4)	5 (12.2)	0 (0.0)	9 (8.5)	6 (14.6)	5 (12.5)	7 (17.5)	
Skilled work (Mason, carpentry, etc.)	38 (9.6)	13 (16.9)	1 (2.4)	2 (4.0)	15 (14.2)	4 (9.8)	2 (5.0)	1 (2.5)	
Okada rider/driver	32 (8.1)	4 (5.2)	5 (12.2)	3 (6.0)	12 (11.3)	4 (9.8)	1 (2.5)	3 (7.5)	
Others	23 (5.8)	10 (13.0)	0 (0.0)	1 (2.0)	7 (6.6)	2 (4.9)	1 (2.5)	2 (5.0)	
Civil worker	14 (3.5)	3 (3.9)	2 (4.9)	0 (0.0)	3 (2.8)	1 (2.4)	4 (10.0)	1 (2.5)	
Monthly income from small-scale mining									<0.001
<1000	82 (27.5)	24 (45.3)	7 (23.3)	2 (4.3)	30 (37.0)	9 (31.0)	0 (0.0)	10 (29.4)	
1000-1999	52 (17.4)	8 (15.1)	8 (26.7)	6 (12.8)	17 (21.0)	3 (10.3)	2 (8.3)	8 (23.5)	
2000-2999	63 (21.1)	11 (20.8)	4 (13.3)	3 (6.4)	18 (22.2)	13 (44.8)	8 (33.3)	6 (17.6)	
3000-3999	26 (8.7)	2 (3.8)	7 (23.3)	3 (6.4)	5 (6.2)	3 (10.3)	3 (12.5)	3 (8.8)	
4000-4999	10 (3.4)	1 (1.9)	3 (10.0)	1 (2.1)	1 (1.2)	1 (3.4)	0 (0.0)	3 (8.8)	

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5000-5999	18 (6.0)	3 (5.7)	1 (3.3)	4 (8.5)	3 (3.7)	0 (0.0)	5 (20.8)	2 (5.9)	
6000-9999	32 (10.7)	1 (1.9)	0 (0.0)	23 (48.9)	2 (2.5)	0 (0.0)	4 (16.7)	2 (5.9)	
10000-14999	8 (2.7)	2 (3.8)	0 (0.0)	1 (2.1)	5 (6.2)	0 (0.0)	0 (0.0)	0 (0.0)	
>14999	7 (2.3)	1 (1.9)	0 (0.0)	4 (8.5)	0 (0.0)	0 (0.0)	2 (8.3)	0 (0.0)	
Involvement in other economic activity other than scale mining									<0.001
No	191 (48.4)	45 (58.4)	22 (53.7)	12 (24.0)	44 (41.5)	25 (61.0)	16 (40.0)	27 (67.5)	
Yes	204 (51.6)	32 (41.6)	19 (46.3)	38 (76.0)	62 (58.5)	16 (39.0)	24 (60.0)	13 (32.5)	
Other economic activity currently involved in									0.013
Farming	83 (41.5)	9 (29.0)	5 (26.3)	32 (84.2)	20 (33.3)	2 (13.3)	11 (45.8)	4 (30.8)	
Street hawker/trading	39 (19.5)	6 (19.4)	6 (31.6)	0 (0.0)	10 (16.7)	7 (46.7)	7 (29.2)	3 (23.1)	
Okada rider/driver	32 (16.0)	5 (16.1)	4 (21.1)	3 (7.9)	14 (23.3)	5 (33.3)	0 (0.0)	1 (7.7)	
Others	17 (8.5)	7 (22.6)	0 (0.0)	1 (2.6)	7 (11.7)	0 (0.0)	2 (8.3)	0 (0.0)	
Labour work (Mason, carpentry, etc.)	15 (7.5)	3 (9.7)	4 (21.1)	2 (5.3)	4 (6.7)	1 (6.7)	0 (0.0)	1 (7.7)	
Skilled work (Mason, carpentry, etc.)	15 (7.5)	2 (6.5)	2 (10.5)	0 (0.0)	7 (11.7)	1 (6.7)	1 (4.2)	2 (15.4)	
Civil work	9 (4.5)	0 (0.0)	2 (10.5)	0 (0.0)	1 (1.7)	1 (6.7)	4 (16.7)	1 (7.7)	

Source: Study Field Survey, 2021

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Table 4.5: Initiation of study participants into illegal small-scale mining by districts

Variables	Total	Districts							p-value
		Amansie West	Amenfi East	Atiwa	Atwima Mponua	Prestea /Huni Valley	Talensi	Tarkwa Nsuaem	
N	395	77	41	50	106	41	40	40	
A family member who also works as small-scale miner									0.004
No	266 (67.3)	55 (71.4)	31 (75.6)	30 (60.0)	75 (70.8)	32 (78.0)	27 (67.5)	16 (40.0)	
Yes	129 (32.7)	22 (28.6)	10 (24.4)	20 (40.0)	31 (29.2)	9 (22.0)	13 (32.5)	24 (60.0)	
Number of respondent's family members also in small-scale mining									0.45
1	36 (27.9)	11 (50.0)	3 (30.0)	6 (30.0)	9 (29.0)	1 (11.1)	2 (15.4)	4 (16.7)	
2	47 (36.4)	6 (27.3)	6 (60.0)	8 (40.0)	10 (32.3)	5 (55.6)	5 (38.5)	7 (29.2)	
3	22 (17.1)	3 (13.6)	0 (0.0)	4 (20.0)	5 (16.1)	2 (22.2)	5 (38.5)	3 (12.5)	
5	10 (7.8)	1 (4.5)	1 (10.0)	1 (5.0)	3 (9.7)	0 (0.0)	1 (7.7)	3 (12.5)	
6	2 (1.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.2)	0 (0.0)	0 (0.0)	1 (4.2)	
> 6	12 (9.3)	1 (4.5)	0 (0.0)	1 (5.0)	3 (9.7)	1 (11.1)	0 (0.0)	6 (25.0)	
How respondents were first introduced to small-scale mining									<0.001
A family member	94 (23.8)	13 (16.9)	8 (19.5)	17 (34.0)	20 (18.9)	6 (14.6)	13 (32.5)	17 (42.5)	
Work colleagues	94 (23.8)	9 (11.7)	16 (39.0)	20 (40.0)	11 (10.4)	11 (26.8)	14 (35.0)	13 (32.5)	
School friends	70 (17.7)	12 (15.6)	12 (29.3)	6 (12.0)	11 (10.4)	14 (34.1)	9 (22.5)	6 (15.0)	
Community friend	54 (13.7)	11 (14.3)	2 (4.9)	5 (10.0)	28 (26.4)	3 (7.3)	1 (2.5)	4 (10.0)	
From childhood	39 (9.9)	19 (24.7)	0 (0.0)	0 (0.0)	20 (18.9)	0 (0.0)	0 (0.0)	0 (0.0)	
Not a miner	17 (4.3)	4 (5.2)	2 (4.9)	0 (0.0)	5 (4.7)	3 (7.3)	3 (7.5)	0 (0.0)	
Others	27 (6.8)	9 (11.7)	1 (2.4)	2 (4.0)	11 (10.4)	4 (9.8)	0 (0.0)	0 (0.0)	
Main reasons for joining small scale mining									
For money	323 (82.0)	65 (84.4)	35 (85.4)	40 (81.6)	89 (84.0)	28 (68.3)	27 (67.5)	39 (97.5)	0.005
Unemployed	120 (30.5)	36 (46.8)	12 (29.3)	13 (26.5)	24 (22.6)	11 (26.8)	11 (27.5)	13 (32.5)	0.035
Because of my friend	21 (5.3)	2 (2.6)	3 (7.3)	1 (2.0)	2 (1.9)	4 (9.8)	4 (10.0)	5 (12.5)	0.054
Others	25 (6.3)	4 (5.2)	3 (7.3)	1 (2.0)	7 (6.6)	6 (14.6)	4 (10.0)	0 (0.0)	0.120

Source: Study Field Survey, 2021

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Table 4.6: Dangers and other small scale mining related factors by districts

Variables	Total	Districts							p-value
		Amansie West	Amenfi East	Atiwa	Atwima Mponua	Prestea /Huni Valley	Talensi	Tarkwa Nsuaem	
N	395	77	41	50	106	41	40	40	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Dangers faced as a small-scale miner									
Loss of lives from the pit	288 (75.4)	60 (80.0)	32 (78.0)	39 (78.0)	68 (66.7)	27 (67.5)	34 (91.9)	28 (75.7)	0.059
Loss of lives from other persons	201 (52.6)	33 (44.0)	24 (58.5)	22 (44.0)	55 (53.9)	21 (52.5)	19 (51.4)	27 (73.0)	0.1
Being arrested	266 (69.6)	63 (84.0)	31 (75.6)	26 (52.0)	88 (86.3)	27 (67.5)	6 (16.2)	25 (67.6)	<0.001
Mining related illnesses	211 (55.2)	30 (40.0)	25 (61.0)	26 (52.0)	54 (52.9)	21 (52.5)	32 (86.5)	23 (62.2)	<0.001
Others	40 (10.5)	4 (5.3)	3 (7.3)	1 (2.0)	22 (21.6)	3 (7.5)	3 (8.1)	4 (10.8)	0.002
Makes payments (in the form of bribery) to any public official									<0.001
No	217 (54.9)	15 (19.5)	31 (75.6)	44 (88.0)	27 (25.5)	30 (73.2)	37 (92.5)	33 (82.5)	
Yes	178 (45.1)	62 (80.5)	10 (24.4)	6 (12.0)	79 (74.5)	11 (26.8)	3 (7.5)	7 (17.5)	
If yes, what type of public officials do you make such payment to?									<0.001
The police	153 (86.0)	59 (95.2)	4 (40.0)	3 (50.0)	76 (96.2)	4 (36.4)	3 (100.0)	4 (57.1)	
The military	120 (67.4)	57 (91.9)	3 (30.0)	2 (33.3)	52 (65.8)	1 (9.1)	0 (0.0)	5 (71.4)	
The galamsey	93 (52.2)	30 (48.4)	6 (60.0)	2 (33.3)	45 (57.0)	5 (45.5)	0 (0.0)	5 (71.4)	
District asse	98 (55.1)	37 (59.7)	6 (60.0)	3 (50.0)	45 (57.0)	2 (18.2)	0 (0.0)	5 (71.4)	
A chief	76 (42.7)	23 (37.1)	3 (30.0)	3 (50.0)	38 (48.1)	6 (54.5)	1 (33.3)	2 (28.6)	
Others	27 (15.2)	12 (19.4)	0 (0.0)	1 (16.7)	14 (17.7)	0 (0.0)	0 (0.0)	0 (0.0)	
Reducing the activities of small scale (illegal) miners is the right thing to do									<0.001
No	260 (65.8)	65 (84.4)	17 (41.5)	23 (46.0)	88 (83.0)	20 (48.8)	28 (70.0)	19 (47.5)	
Yes	135 (34.2)	12 (15.6)	24 (58.5)	27 (54.0)	18 (17.0)	21 (51.2)	12 (30.0)	21 (52.5)	
Plan on leaving the small scale mining activities any time soon									<0.001
No	208 (52.7)	44 (57.1)	18 (43.9)	30 (60.0)	42 (39.6)	23 (56.1)	32 (80.0)	19 (47.5)	
Yes	187 (47.3)	33 (42.9)	23 (56.1)	20 (40.0)	64 (60.4)	18 (43.9)	8 (20.0)	21 (52.5)	
How soon do you plan on leaving the small scale mining activities?									<0.001
In 10 years	34 (8.6)	5 (6.5)	5 (12.2)	5 (10.0)	4 (3.8)	1 (2.4)	5 (12.5)	9 (22.5)	

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In 2 years	56 (14.2)	11 (14.3)	5 (12.2)	11 (22.0)	23 (21.7)	2 (4.9)	0 (0.0)	4 (10.0)
In 5 years	64 (16.2)	10 (13.0)	6 (14.6)	9 (18.0)	21 (19.8)	11 (26.8)	0 (0.0)	7 (17.5)
In a year time	47 (11.9)	5 (6.5)	9 (22.0)	7 (14.0)	9 (8.5)	10 (24.4)	2 (5.0)	5 (12.5)
More than 10 years,	31 (7.8)	11 (14.3)	7 (17.1)	1 (2.0)	5 (4.7)	4 (9.8)	2 (5.0)	1 (2.5)
Never	93 (23.5)	16 (20.8)	6 (14.6)	15 (30.0)	19 (17.9)	9 (22.0)	22 (55.0)	6 (15.0)
Others	70 (17.7)	19 (24.7)	3 (7.3)	2 (4.0)	25 (23.6)	4 (9.8)	9 (22.5)	8 (20.0)

Source: Study Field Survey, 2021

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Table 4.7: Perception of Small-Scale Miners of the effect of illegal mining on the environment by districts

Variables	Total	Districts							p-value
		Amansie West	Amenfi East	Atiwa	Atwima Mponua	Prestea /Huni Valley	Talensi	Tarkwa Nsuaem	
N	395	77	41	50	106	41	40	40	
Small scale illegal mining …	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
... leads to water pollution.									0.065
No	60 (15.2)	16 (20.8)	3 (7.3)	5 (10.0)	17 (16.0)	3 (7.3)	11 (27.5)	5 (12.5)	
Yes	335 (84.8)	61 (79.2)	38 (92.7)	45 (90.0)	89 (84.0)	38 (92.7)	29 (72.5)	35 (87.5)	
... leads to agricultural depletion.									0.32
No	63 (15.9)	16 (20.8)	3 (7.3)	5 (10.0)	19 (17.9)	5 (12.2)	9 (22.5)	6 (15.0)	
Yes	332 (84.1)	61 (79.2)	38 (92.7)	45 (90.0)	87 (82.1)	36 (87.8)	31 (77.5)	34 (85.0)	
... leads to extinctions of aquatic lives.									0.018
No	81 (20.5)	22 (28.6)	5 (12.2)	6 (12.0)	27 (25.5)	4 (9.8)	12 (30.0)	5 (12.5)	
Yes	314 (79.5)	55 (71.4)	36 (87.8)	44 (88.0)	79 (74.5)	37 (90.2)	28 (70.0)	35 (87.5)	
... leads to injury and death.									0.090
No	70 (17.7)	22 (28.6)	3 (7.3)	7 (14.0)	19 (17.9)	5 (12.2)	8 (20.0)	6 (15.0)	
Yes	325 (82.3)	55 (71.4)	38 (92.7)	43 (86.0)	87 (82.1)	36 (87.8)	32 (80.0)	34 (85.0)	
... has negative implications on the health of people within the community									<0.001
No	132 (33.4)	45 (58.4)	4 (9.8)	11 (22.0)	52 (49.1)	5 (12.2)	8 (20.0)	7 (17.5)	
Yes	263 (66.6)	32 (41.6)	37 (90.2)	39 (78.0)	54 (50.9)	36 (87.8)	32 (80.0)	33 (82.5)	
... leads to air pollution.									<0.001
No	176 (44.6)	56 (72.7)	5 (12.2)	16 (32.0)	77 (72.6)	7 (17.1)	5 (12.5)	10 (25.0)	
Yes	219 (55.4)	21 (27.3)	36 (87.8)	34 (68.0)	29 (27.4)	34 (82.9)	35 (87.5)	30 (75.0)	
... leads to noise pollution.									<0.001
No	138 (34.9)	44 (57.1)	5 (12.2)	8 (16.0)	58 (54.7)	6 (14.6)	8 (20.0)	9 (22.5)	
Yes	257 (65.1)	33 (42.9)	36 (87.8)	42 (84.0)	48 (45.3)	35 (85.4)	32 (80.0)	31 (77.5)	
... leads to deforestation and habitat destruction which harms endangered species in the forest									<0.001
No	71 (18.0)	21 (27.3)	3 (7.3)	4 (8.0)	30 (28.3)	3 (7.3)	4 (10.0)	6 (15.0)	
Yes	324 (82.0)	56 (72.7)	38 (92.7)	46 (92.0)	76 (71.7)	38 (92.7)	36 (90.0)	34 (85.0)	
... has a long-term negative effect on the livelihood of people in the community									<0.001
No	144 (36.5)	47 (61.0)	3 (7.3)	13 (26.0)	59 (55.7)	8 (19.5)	5 (12.5)	9 (22.5)	
Yes	251 (63.5)	30 (39.0)	38 (92.7)	37 (74.0)	47 (44.3)	33 (80.5)	35 (87.5)	31 (77.5)	

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… has a long-term health effect on small scale miners.									<0.001
No	104 (26.3)	41 (53.2)	4 (9.8)	9 (18.0)	34 (32.1)	5 (12.2)	3 (7.5)	8 (20.0)	
Yes	291 (73.7)	36 (46.8)	37 (90.2)	41 (82.0)	72 (67.9)	36 (87.8)	37 (92.5)	32 (80.0)	

Source: Study Field Survey, 2021

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Table 4.8: Bivariate and Multivariable analysis of factors associated with the awareness level of the effect of illegal small-scale miners in Ghana

	Bivariate analysis of the awareness level of the effect of illegal small-scale mining in Ghana				Multivariable binary logistic regression model of factors associated with high awareness level on the effect of illegal small-scale mining	
Factor	**Total N**	**Low awareness level n (%)**	**High awareness level n (%)**	**chi-square P-value**	**AOR [95% CI]**	**P-value**
N	395	188 (47.6)	207 (52.4)			
District				<0.001		
Amenfi East	41	7 (17.1)	34 (82.9)		1.00 [reference]	
Amansie West	77	60 (77.9)	17 (22.1)		0.02 [0.01, 0.09]	<0.001
Atiwa	50	14 (28.0)	36 (72.0)		0.30 [0.08, 1.15]	0.079
Atwima Mponua	106	79 (74.5)	27 (25.5)		0.03 [0.01, 0.12]	<0.001
Prestea /Huni Valley	41	7 (17.1)	34 (82.9)		0.92 [0.22, 3.90]	0.910
Talensi	40	12 (30.0)	28 (70.0)		0.13 [0.03, 0.55]	0.006
Tarkwa Nsuaem	40	9 (22.5)	31 (77.5)		0.79 [0.19, 3.30]	0.751
Age group				0.021		
15-19	12	6 (50.0)	6 (50.0)		0.28 [0.02, 3.41]	0.318
20-29	166	94 (56.6)	72 (43.4)		0.33 [0.10, 1.13]	0.077
30-39	114	50 (43.9)	64 (56.1)		0.88 [0.33, 2.34]	0.804
40-49	65	26 (40.0)	39 (60.0)		0.55 [0.21, 1.48]	0.240
50 and above	38	12 (31.6)	26 (68.4)		1.00 [reference]	
Sex of respondents				0.950		
Female	74	35 (47.3)	39 (52.7)		1.00 [reference]	
Male	321	153 (47.7)	168 (52.3)		1.55 [0.56, 4.31]	0.401
Marital status				0.280		
Currently Married	190	84 (44.2)	106 (55.8)		1.00 [reference]	
Formerly Married	26	11 (42.3)	15 (57.7)		0.48 [0.15, 1.53]	0.215
Never Married	179	93 (52.0)	86 (48.0)		0.54 [0.22, 1.28]	0.162
Highest level of education				<0.001		
No formal education	19	9 (47.4)	10 (52.6)		0.14 [0.03, 0.67]	0.014
Primary	60	39 (65.0)	21 (35.0)		0.15 [0.04, 0.50]	0.002
JHS/JSS/ Middle School	136	75 (55.1)	61 (44.9)		0.28 [0.10, 0.77]	0.014
SHS/SSS/VOC./TECH.	109	55 (50.5)	54 (49.5)		0.25 [0.09, 0.69]	0.007
Tertiary	71	10 (14.1)	61 (85.9)		1.00 [reference]	
Household size				0.500		

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1-4	83	44 (53.0)	39 (47.0)		1.00 [reference]	
5-9	177	80 (45.2)	97 (54.8)		3.04 [1.29, 7.20]	0.011
10+	135	64 (47.4)	71 (52.6)		6.76 [2.38, 19.24]	<0.001
Number of dependents				0.030		
None	55	33 (60.0)	22 (40.0)		1.00 [reference]	
1-4	121	58 (47.9)	63 (52.1)		1.05 [0.38, 2.91]	0.923
5-9	76	39 (51.3)	37 (48.7)		0.52 [0.16, 1.73]	0.285
10+	97	35 (36.1)	62 (63.9)		0.66 [0.20, 2.21]	0.496
Relationship to the household head				0.130		
Household head	181	87 (48.1)	94 (51.9)		1.00 [reference]	
Child of HH	116	61 (52.6)	55 (47.4)		1.05 [0.42, 2.61]	0.915
Spouse	37	19 (51.4)	18 (48.6)		0.84 [0.23, 3.05]	0.786
Others	61	21 (34.4)	40 (65.6)		1.06 [0.35, 3.19]	0.919
Citizenship status				0.003		
Native of community	217	87 (40.1)	130 (59.9)		1.00 [reference]	
Ghanaian native of region	124	65 (52.4)	59 (47.6)		0.60 [0.30, 1.18]	0.141
Ghanaian native of another region	46	31 (67.4)	15 (32.6)		0.34 [0.13, 0.88]	0.026
Foreigners	8	5 (62.5)	3 (37.5)		0.56 [0.07, 4.45]	0.584
Role of the respondent in mining				0.390		
Others	48	22 (45.8)	26 (54.2)		1.00 [reference]	
Small scale Miner	248	113 (45.6)	135 (54.4)		0.40 [0.14, 1.12]	0.082
Support worker (security, trader, etc.	99	53 (53.5)	46 (46.5)		0.60 [0.20, 1.80]	0.365

Source: Study Field Survey, 2021

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Table 4.9: Awareness of the policies and laws governing small-scale mining

		Districts							
Variables	**Total**	**Amansie West**	**Amenfi East**	**Atiwa**	**Atwima Mponua**	**Prestea /Huni Valley**	**Talensi**	**Tarkwa Nsuaem**	**p-value**
N	395	77	41	50	106	41	40	40	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Foreigners allowed to be engaged in small scale mining	93 (23.5)	11 (14.3)	14 (34.1)	7 (14.0)	17 (16.0)	15 (36.6)	15 (37.5)	14 (35.0)	<0.001
Miners can mine in the water bodies?	47 (11.9)	6 (7.8)	5 (12.2)	7 (14.0)	8 (7.5)	10 (24.4)	6 (15.0)	5 (12.5)	0.13
Less than 18 years old can engaged in mining activities.	93 (23.5)	20 (26.0)	8 (19.5)	8 (16.0)	29 (27.4)	11 (26.8)	11 (27.5)	6 (15.0)	0.51
Anyone can mine in a reversed forest	64 (16.2)	20 (26.0)	4 (9.8)	7 (14.0)	16 (15.1)	7 (17.1)	5 (12.5)	5 (12.5)	0.26
One can mine within 100meter (buffer) from water bodies if there is a lot of gold in that zone	135 (34.2)	29 (37.7)	5 (12.2)	18 (36.0)	61 (57.5)	10 (24.4)	8 (20.0)	4 (10.0)	<0.001
I have flawed the law if I export my gold mined and sold by myself	196 (49.6)	45 (58.4)	18 (43.9)	31 (62.0)	45 (42.5)	18 (43.9)	23 (57.5)	16 (40.0)	0.083
A miner can use mercury to mine for more gold	191 (48.4)	48 (62.3)	12 (29.3)	27 (54.0)	58 (54.7)	13 (31.7)	24 (60.0)	9 (22.5)	<0.001
I need a permit before I can mine on a piece of land	329 (83.3)	74 (96.1)	30 (73.2)	40 (80.0)	100 (94.3)	24 (58.5)	39 (97.5)	22 (55.0)	<0.001
I have to reclaim (cover) the land after mining	338 (85.6)	74 (96.1)	29 (70.7)	44 (88.0)	106 (100.0)	23 (56.1)	40 (100.0)	22 (55.0)	<0.001
Any person can mine without a mining lease	93 (23.5)	17 (22.1)	10 (24.4)	11 (22.0)	23 (21.7)	11 (26.8)	14 (35.0)	7 (17.5)	0.63
I have to do reconnaissance & prospecting before mining	315 (79.7)	71 (92.2)	28 (68.3)	42 (84.0)	94 (88.7)	25 (61.0)	33 (82.5)	22 (55.0)	<0.001
One must renew licenses every five years	328 (83.0)	72 (93.5)	30 (73.2)	44 (88.0)	95 (89.6)	25 (61.0)	37 (92.5)	25 (62.5)	<0.001
I must pay royalties to the state on my revenue acquired through my mining activities	323 (81.8)	77 (100.0)	28 (68.3)	44 (88.0)	96 (90.6)	24 (58.5)	31 (77.5)	23 (57.5)	<0.001
Small scale mining is permitted only in Minerals Commission-designated zones	252 (63.8)	43 (55.8)	26 (63.4)	39 (78.0)	57 (53.8)	25 (61.0)	38 (95.0)	24 (60.0)	<0.001

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It is lawful for Minerals Commission's District Office to supervise and monitor small scale mining activities and operations	346 (87.6)	75 (97.4)	29 (70.7)	45 (90.0)	104 (98.1)	28 (68.3)	38 (95.0)	27 (67.5)	<0.001
It is lawful for Minerals Commission's District Office to coach and teach small scale miners to conduct successful and efficient mining operations	355 (89.9)	77 (100.0)	32 (78.0)	46 (92.0)	104 (98.1)	29 (70.7)	39 (97.5)	28 (70.0)	<0.001

NOTE: Frequency and percentage of respondents that responded in the affirmative (Yes)

Source: Study Field Survey, 2021

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Table 4.10: Bivariate and Multivariable analysis of factors associated with the awareness level laws and policies governing small scale mining in Ghana

	Bivariate analysis of the awareness level of the laws and policies governing small scale mining in Ghana				Multivariable binary logistic regression model of factors associated with high awareness level	
	Total	Low awareness level	High awareness level	chi-square		
Factor	**N**	**n (%)**	**n (%)**	**P-value**	**AOR [95% CI]**	**P-value**
N	395	56 (14.2)	339 (85.8)			
District				<0.001		
Atwima Mponua	106	5 (4.7)	101 (95.3)		1.00 [reference]	
Amansie West	77	3 (3.9)	74 (96.1)		0.64 [0.11, 3.78]	0.620
Amenfi East	41	9 (22.0)	32 (78.0)		0.06 [0.01, 0.45]	0.007
Atiwa	50	5 (10.0)	45 (90.0)		0.04 [0.00, 0.30]	0.002
Prestea /Huni Valley	41	16 (39.0)	25 (61.0)		0.04 [0.01, 0.26]	0.001
Talensi	40	3 (7.5)	37 (92.5)		0.04 [0.00, 0.47]	0.010
Tarkwa Nsuaem	40	15 (37.5)	25 (62.5)		0.04 [0.00, 0.34]	0.003
Age group				0.006		
15-19	12	5 (41.7)	7 (58.3)		0.04 [0.00, 0.66]	0.024
20-29	166	30 (18.1)	136 (81.9)		0.32 [0.07, 1.46]	0.142
30-39	114	9 (7.9)	105 (92.1)		1.00 [reference]	
40-49	65	6 (9.2)	59 (90.8)		0.71 [0.11, 4.64]	0.724
50 and above	38	6 (15.8)	32 (84.2)		0.06 [0.01, 0.35]	0.002
Sex of study respondent				0.860		
Female	74	10 (13.5)	64 (86.5)		1.00 [reference]	
Male	321	46 (14.3)	275 (85.7)		0.70 [0.16, 3.17]	0.645
Marital status				<0.001		
Currently Married	190	14 (7.4)	176 (92.6)		1.00 [reference]	
Formerly Married	26	7 (26.9)	19 (73.1)		0.10 [0.02, 0.52]	0.006
Never Married	179	35 (19.6)	144 (80.4)		0.22 [0.05, 0.93]	0.040
Highest level of Education				0.008		
JHS/JSS/ Middle School	136	12 (8.8)	124 (91.2)		3.55 [0.43, 29.33]	0.240
No formal education	19	2 (10.5)	17 (89.5)		1.00 [reference]	
Primary	60	6 (10.0)	54 (90.0)		1.09 [0.12, 10.13]	0.940
SHS/SSS/VOC./TECH.	109	17 (15.6)	92 (84.4)		1.50 [0.20, 11.11]	0.690
Tertiary	71	19 (26.8)	52 (73.2)		5.60 [0.53, 59.71]	0.153
Household size				<0.001		

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1-4	83	17 (20.5)	66 (79.5)		1.00 [reference]	
5-9	177	12 (6.8)	165 (93.2)		2.12 [0.63, 7.20]	0.228
10+	135	27 (20.0)	108 (80.0)		1.53 [0.32, 7.31]	0.595
Number of dependents				0.058		
None	55	6 (10.9)	49 (89.1)		1.00 [reference]	
1-4	121	18 (14.9)	103 (85.1)		0.58 [0.15, 2.32]	0.442
5-9	76	6 (7.9)	70 (92.1)		1.10 [0.16, 7.63]	0.922
10+	97	4 (4.1)	93 (95.9)		4.26 [0.51, 35.21]	0.179
Relationship to the household head				0.280		
Household head	181	20 (11.0)	161 (89.0)		1.00 [reference]	
Child of HH	116	22 (19.0)	94 (81.0)		3.83 [0.83, 17.69]	0.086
Spouse	37	6 (16.2)	31 (83.8)		0.51 [0.08, 3.16]	0.466
Others	61	8 (13.1)	53 (86.9)		28.42 [2.74, 294.51]	0.005
Citizenship status				0.001		
Native of community	217	22 (10.1)	195 (89.9)		1.00 [reference]	
Ghanaian native of region	124	28 (22.6)	96 (77.4)		0.30 [0.09, 0.96]	0.043
Ghanaian native of another region	46	3 (6.5)	43 (93.5)		0.86 [0.14, 5.22]	0.870
Foreigners	8	3 (37.5)	5 (62.5)		0.01 [0.00, 0.13]	<0.001
Role of the respondent in mining				0.001		
Others	48	14 (29.2)	34 (70.8)		1.00 [reference]	
Small scale Miner	248	25 (10.1)	223 (89.9)		2.75 [0.43, 17.47]	0.283
Support worker (security, trader, etc.	99	17 (17.2)	82 (82.8)		0.72 [0.12, 4.42]	0.720

Source: Study Field Survey, 2021

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Table 4.11: Perception of small-scale miners on the best management of environmental and health impact of mining in Ghana by districts

		Districts							
Variables	**Total**	**Amansie West**	**Amenfi East**	**Atiwa**	**Atwima Mponua**	**Prestea /Huni Valley**	**Talensi**	**Tarkwa Nsuaem**	**p-value**
N	395	77	41	50	106	40	40	41	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Collaboration among government agencies.									0.078
No	21 (5.3)	8 (10.4)	1 (2.4)	3 (6.0)	2 (1.9)	0 (0.0)	3 (7.5)	4 (9.8)	
Yes	374 (94.7)	69 (89.6)	40 (97.6)	47 (94.0)	104 (98.1)	40 (100.0)	37 (92.5)	37 (90.2)	
Formation of small-scale miner's association.									0.004
No	26 (6.6)	5 (6.5)	3 (7.3)	5 (10.0)	1 (0.9)	0 (0.0)	5 (12.5)	7 (17.1)	
Yes	369 (93.4)	72 (93.5)	38 (92.7)	45 (90.0)	105 (99.1)	40 (100.0)	35 (87.5)	34 (82.9)	
Provision of alternative water sources.									0.036
No	55 (13.9)	15 (19.5)	1 (2.4)	8 (16.0)	19 (17.9)	1 (2.5)	7 (17.5)	4 (9.8)	
Yes	340 (86.1)	62 (80.5)	40 (97.6)	42 (84.0)	87 (82.1)	39 (97.5)	33 (82.5)	37 (90.2)	
Education on environmental hazards.									0.012
No	46 (11.6)	15 (19.5)	2 (4.9)	3 (6.0)	18 (17.0)	0 (0.0)	4 (10.0)	4 (9.8)	
Yes	349 (88.4)	62 (80.5)	39 (95.1)	47 (94.0)	88 (83.0)	40 (100.0)	36 (90.0)	37 (90.2)	
Education on health hazards.									0.005
No	51 (12.9)	17 (22.1)	1 (2.4)	4 (8.0)	20 (18.9)	1 (2.5)	4 (10.0)	4 (9.8)	
Yes	344 (87.1)	60 (77.9)	40 (97.6)	46 (92.0)	86 (81.1)	39 (97.5)	36 (90.0)	37 (90.2)	

Source: Study Field Survey, 2021.

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4.7.5 Dangers and other small-scale mining-related factors

The majority of the respondents reported facing some dangers as small-scale miners. Loss of lives from the pit (72.9%), being arrested (67.3%), mining-related illness (53.4%), and loss of lives from other persons (50.9%) were some dangers common among the small-scale miners. (Figure 4.7 & Table 4.6)

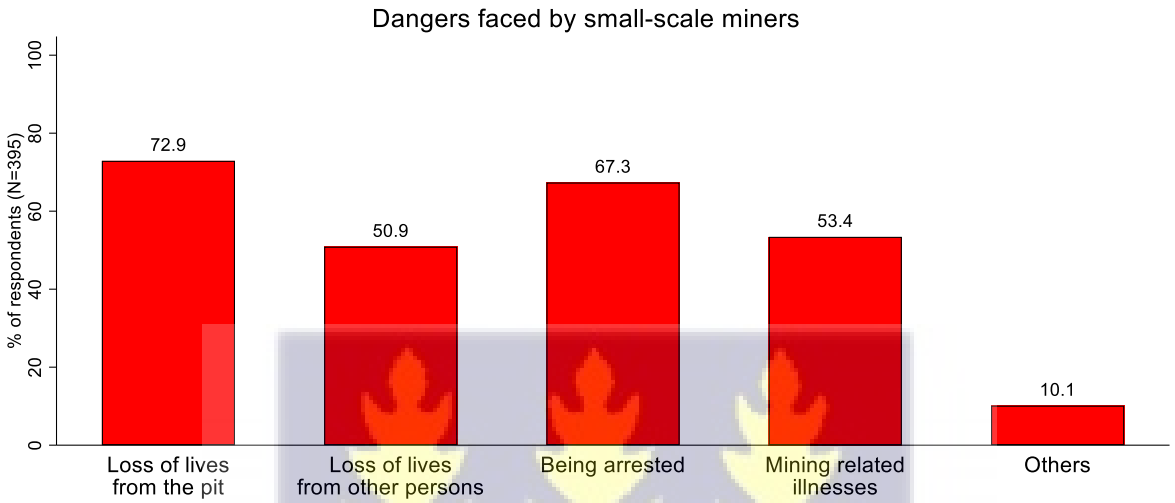

Figure 4:7: Dangers faced by illegal small scale miners

Source: Study Field Survey, 2021

Less than half (45.1%) of the respondents also reported making payments in the form of bribes toofficials. Among the 178 respondents who pay bribes to officials, the majority of them makes such bribe payments to the police (85.0%), the military (67.4%), the galamsey task force (52.2%) and the district assembly members (55.1%). (Figure 4.8 & Table 4.6).

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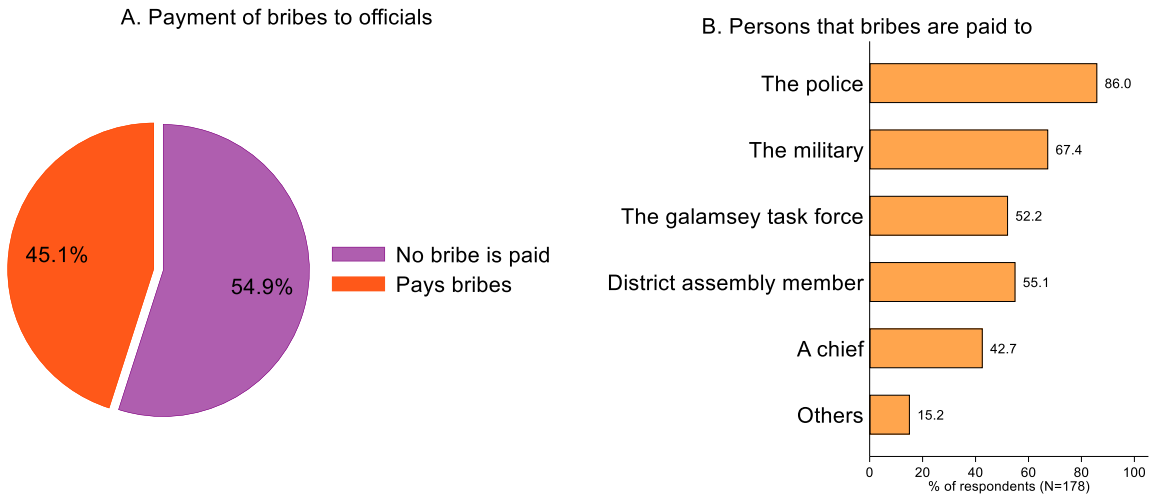

Figure 4.8: Payments of bribes to officials

Source: Study Field Survey, 2021

4.7.6 Perception of small-scale miners on the effect of illegal mining

Most of the participants were aware that small-scale mining leads to water pollution (84.8%), agricultural depletion (84.1%), extinction of aquatic animals (79.5%), injury and death (82.3%), negative health implications on miners (66.6%), air pollution (55.4%), noise pollution(65.1%), deforestation and habitat destruction (82.0%), long term negative effect on livelihood(63.5%) and long-term health effect on miners (73.7%). (Figure 4.9 & Table 4.7).

Table 4.7 shows the small-scale miners' perception of the effect of illegal mining on the environment across the districts. (Figure 4. 9 & Table 4.7)

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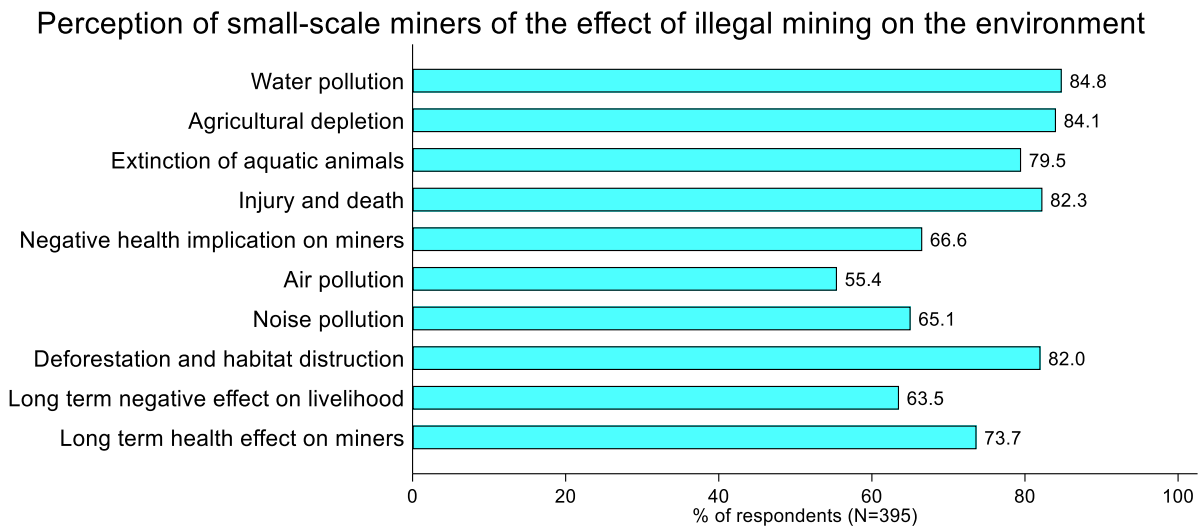

Figure 4.9: Effect of illegal mining on the environment

Source: Study Field Survey, 2021

4.7.7 Awareness level of illegal small-scale miners on the negative effect of illegal small-scale mining on the environment

The respondents' assessment showed that more than half (52.4%) of the respondents had a high awareness level of the negative effect of illegal small-scale mining on the environment. (Figure 4.9). High awareness level on the negative effect of illegal small-scale mining was highest in the Amenfi East district (82.9%) and Prestea/Huni Valley district (82.9%) and was lowest in the Amansie West (22.1%) and the Atwima Mponua (25.5%) districts (Figure 4.10).

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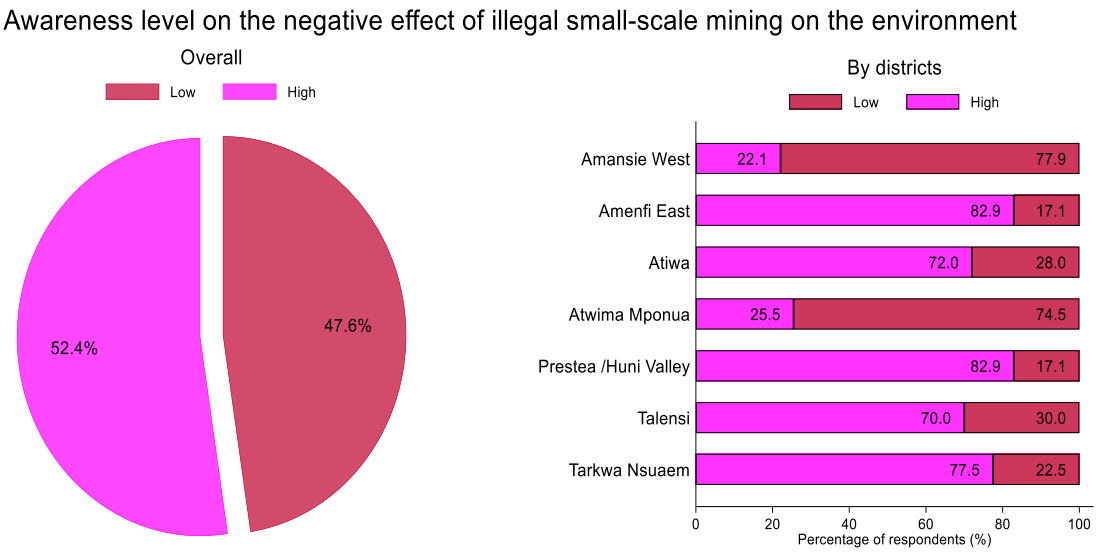

Figure 4.10: The awareness level of illegal small scale miners on the negative effect of illegal small scale mining on the environment

Source: Study Field Survey, 2021

4.7.8 Bivariate and multivariate analysis of factors associated with the awareness level of the effect of illegal small-scale miners in Ghana

Table 4.8 shows the bivariate analysis of the association between the socio-demographic characteristics of study participants and the awareness level of illegal small-scale mining on the environment. The districts ($p<0.001$), the age group ($p=0.021$), the highest level ofeducation ($p<0.001$, number of dependents ($p=0.030$) and the citizenship status ($p=0.003$) of the study respondent were significantly associated with the level of awareness of the effect of illegal small-scale mining on the environment from the bivariate analysis. (Table 4.8)

From the multivariate analysis, the adjusted odds of the high awareness level on the effect of illegal small-scale mining were significantly lower among respondents from the Amansie West (AOR: 0.02, 95% CI: 0.01-0.09, $p<0.001$), Atwima Mponua (AOR: 0.03, 95% CI: 0.01-0.12,

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p<0.001) and the Talensi districts (AOR: 0.13, 95% CI: 0.03-0.55, p=0.006). (Table 4.8).

Compared to respondents with tertiary level of education, the adjusted odds of high awareness level on the effect of illegal small-scale mining were significantly lower among those with no formal education (AOR: 0.14, 95% CI: 0.03-0.67, p=0.014), primary education (AOR: 0.15, 95% CI: 0.04-0.50, p=0.002), JHS/SHS/middle school (AOR: 0.28, 95% CI: 0.10-0.77, p=0.014), SHS/SSS/vocational or technical school (AOR: 0.25, 95% CI: 0.09-0.69, p=0.007). (Table 4.8)

High-level awareness on the effect of illegal small-scale mining was significantly higher among respondents coming from households with 5-9 members (AOR: 3.04, 95% CI: 1.29-7.20, p=0.011) and 10 or more members (AOR: 6.76, 95% CI: 2.38-19.24, p<0.001) compared to respondents coming from households with less than 4 members. (Table 4.8).

4.7.9 Awareness of the policies and laws governing small-scale mining among respondents

The majority of the respondents were aware that it was lawful for the minerals commission's district office to coach small-scale miners to conduct efficient mining operations (89.9%) and supervise and monitor small-scale mining activities (87.6%). The majority of the respondents were also aware that one must reclaim the land after mining (85.6%), that one needs a permit before they can mine on a piece of land (83.3%), renew their license every five years (83.0%). (Figure 4.11)

About a quarter of the respondents' also thought foreigners were allowed to engage in small-scale mining (23.5%) or miners can mine in water bodies (11.9%), or than less than 18 years old can engage in mining activities (23.5%) or that anyone can mine in a reserved forest (16.2%). (Figure 4.11)

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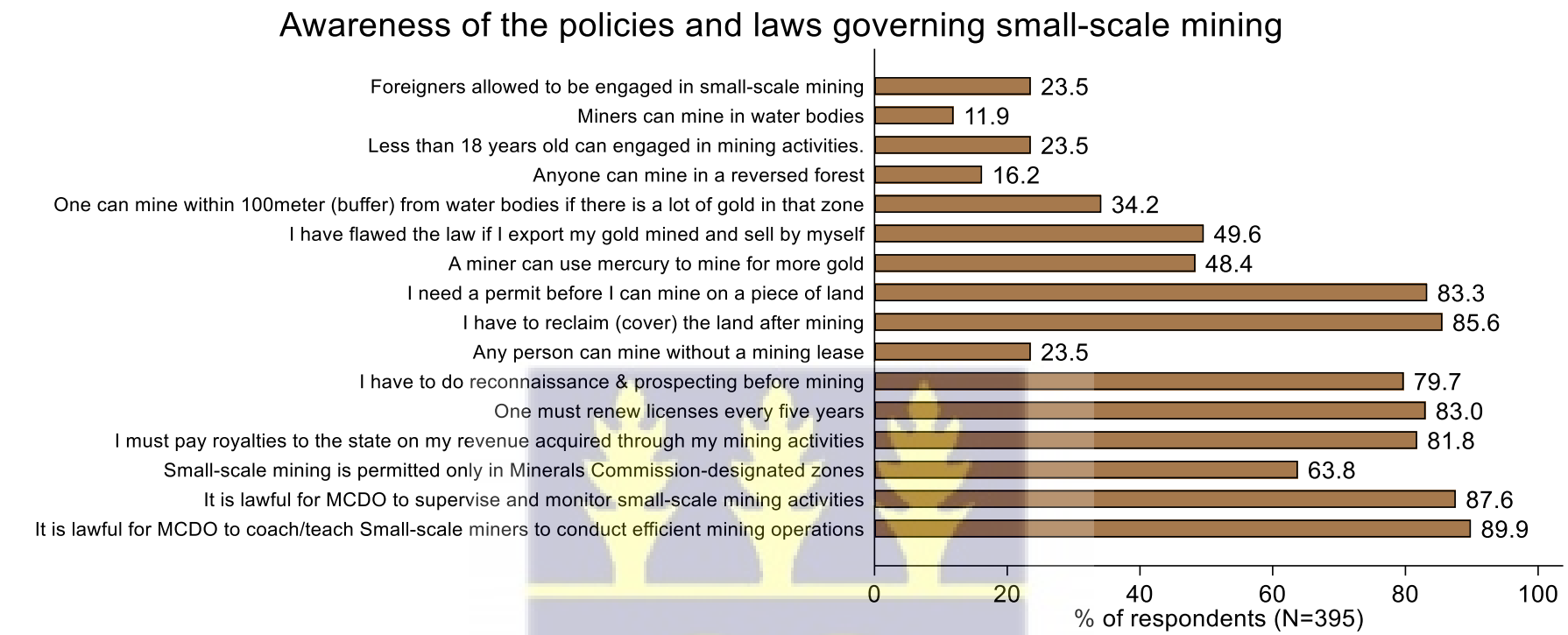

MCDO: Minerals Commission's District Office

Figure 4.11: Awareness of the policies and laws governing small scale mining among respondents

Source: Study Field Survey, 2021

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4.7.10. Awareness level of illegal small-scale miners on the laws and policies governing small-scale mining in Ghana

The respondents' assessment showed a high majority (85.8%) of the respondents had a high awareness of the laws and policies governing small-scale mining in Ghana. (Figure 4.12). High awareness level on the laws and policies governing small-scale mining in Ghana was highest in the Amenfi West (96.1%), Atwima Mponua (95.3%) and the Talensi (92.5%) districts and was lowest in the Prestea/Huni Valley (61.0%) and the Tarkwa Nsuaem (62.5%) districts (Figure 4.12).

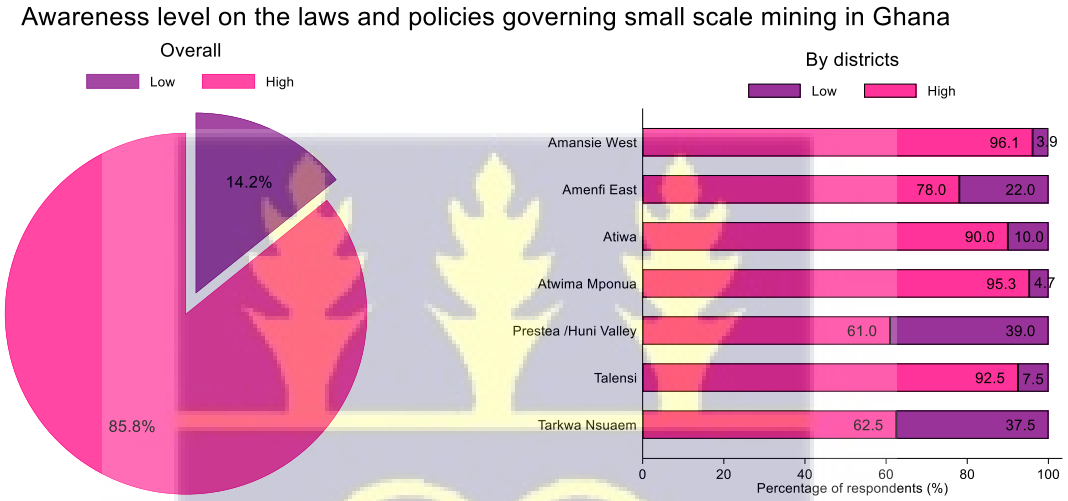

Figure 4.12: Awareness level on the laws and policies governing illegal small scale mining in Ghana

Source: Study Field Survey, 2021

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4.7.11 Bivariate and multivariate analysis of factors associated with the awareness levelof small-scale mining laws and policies in Ghana.

Table 4.10 show the bivariate analysis of the association between the socio-demographic characteristics of study participants and the awareness level of the laws and policies governing small-scale mining in Ghana. The districts (p<0.001), the age group (p=0.006), marital status (p<0.001), the highest level of education (p=0.008), household size (p<0.001), citizenship status (p=0.001) and the role in mining (p=0001) of the study respondent were significantly associated with the level of awareness of the laws and policies governing small-scale mining in Ghana from the bivariate analysis. (Table 4.10)

From the multivariate analysis, the adjusted odds of high awareness level on the effect of illegal small-scale mining were significantly lower among respondents from the Amenfi East (AOR: 0.06, 95% CI: 0.01-0.45, p=0.007), Atiwa (AOR: 0.04, 95% CI: 0.00-0.30, p=0.002), Prestea/Huni valley (AOR: 0.04, 95% CI: 0.01-0.26, p=0.001), Talensi (AOR: 0.04, 95% CI: 0.00-0.47, p=0.010) and Tarkwa Nsuaem (AOR: 0.04, 95% CI: 0.00-0.34, p=0.003). (Table 4.10)

Compared to respondents aged 30-39 years, the adjusted odds of high-level awareness on the laws and policies governing small-scale mining in Ghana was low among those aged 15-19 years (AOR: 0.04, 95% CI: 0.00-0.66, p=0.024) and those aged 50 and above (AOR: 0.06, 95% CI: 0.01-0.35, p=0.002). (Table 4.10)

Compared to respondents with tertiary level of education, the adjusted odds of high awareness level on the effect of illegal small-scale mining were significantly lower among those with no formal education (AOR: 0.14, 95% CI: 0.03-0.67, p=0.014), primary education (AOR: 0.15, 95% CI: 0.04-0.50, p=0.002), JHS/SHS/middle school (AOR: 0.28, 95% CI: 0.10-0.77,

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p=0.014), SHS/SSS/vocational or technical school (AOR: 0.25, 95% CI: 0.09-0.69, p=0.007). (Table 4.10)

High-level awareness on the effect of illegal small-scale mining was significantly higher among respondents coming from households with 5-9 members (AOR: 3.04, 95% CI: 1.29-7.20, p=0.011) and 10 or more members (AOR: 6.76, 95% CI: 2.38-19.24, p<0.001) compared to respondents coming from households with less than 4 members. (Table 4.10)

Compared to respondents who were currently married, high-level awareness of the laws and policies governing small-scale mining in Ghana was low among those who were formerly married (AOR: 0.10, 95% CI: 0.02-0.52, p=0.006) and those who had never married (AOR: 0.22, 95% CI: 0.05-0.93, p=0.040). (Table 4.10)

Compared to respondents who were natives of the communities they were interviewed, the adjusted odds of high-level awareness on the laws and policies governing small-scale mining in Ghana was significantly low among those Ghanaian from the same region (AOR: 0.30, 95%CI: 0.09-0.96, p=0.043) and foreigners (AOR: 0.01, 95% CI: 0.00-0.13, p<0.001).

4.7.12 Perception of respondents on the best management of environmental and health impact of mining

The majority of the respondents had suggestions of some best ways of managing the environmental and health impact in the communities. Collaboration among the government and agencies (94.7%) was the most identified among the respondents, followed by theformation of small-scale miners' association (93.4%), education on environmental hazards (88.4%) and provision of alternative water sources (86.1%). (Figure 4.13 & Table 4.11).

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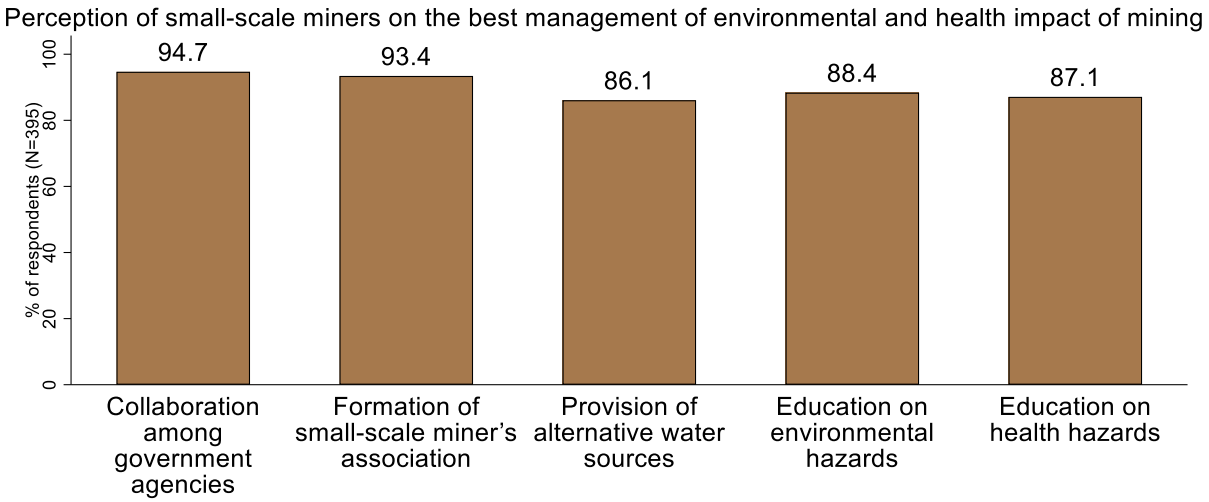

Figure 4.13: Best management of environmental and health impact of mining

Source: Study Field Survey, 2021.

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Table 4.12: PRISMA on Ghana's mining policy/legislation outlook.

Author/Year of Publication	Study Aim/Objective	Methodology	Key research outcomes (results and conclusions)
Bansah et al., 2018	Assess socioeconomic and environmental linkages in ASM to enhance stakeholders' views and discussions in improving sustainable practices	Mixed-Methods	Assesses the socioeconomic and environmental effects of ASM in Ghana. Employment options remain limited, leading to a situation of high reliance on ASM within rural Ghana. The incidence of ASM is responsible for facilitating teenage pregnancy, truancy, environmental pollution, and child labour. Water quality analysis revealed high turbidity, high manganese, and iron content resulting in a 500% water quality index, making water unsafe to drink. Economic, political, social, regulatory, and technological factors constitute the main drivers for the informal ASM; hence, formalisation is needful to produce positive socioeconomic impacts and safeguard the environment.
Ofori & Ofori 2018	Seeks to gain more understanding of illegal small-scale mining in Ghana via application of a social justice theoretical framework	Qualitative	The existing misrecognition of illegal small-scale miners reinforce "that there is a strong opinion by the government, media and large-scale mining companies that portray Galamsey miners as villains instead of citizens with rights to participate" (p. 364). The ongoing misrecognition has created social injustice, which, among other things, drives economic disempowerment. Therefore, a rethinking of the approaches to understanding the purpose(s) of engaging in illegal small scale mining activities has become imperative.
Bai et al., (2017)	Provides analytical insights for determining the optimal green technology implementation techniques in the mining industry.	Quantitative	The research provides information and assistance for green technology adoption in Ghana to promote sustainable environmental management in mining.
Hilson et al., 2017	Assess how laws, regulatory frameworks, and donor objectives hinder SSM from		There is a growing interest in reimagining the development interventions for SSM due to its contribution to economic development. Governments in Ghana and Niger 'fashion' bureaucratic hurdles which inhibit ease of ASM formalisation. Land titling in SSM

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	becoming formalised in Sub-Saharan Africa.	Qualitative	remains a challenge. SSM formalisation requires in-depth consideration of local inputs/realities backed by a rethinking of development approaches to achieve transformational livelihood improvements for SSM stakeholders.
Kervankiran et al., 2016	Examines the dynamics of how "modernised" economy structure influences access to and control of gold resources while assessing related sustainable development impacts.	Qualitative	The study identifies gaps in mining policy implementation and the continued marginalisation of illegal small scale mining communities. The authors recommend a multifaceted, more encompassing, and collaboration-oriented approach to sustainably tackling illegal mining.
Kumi 2014	Explores the legal provisions of acquiring land from and compensating communities and attributed community expectations.	Mixed methods	The national legal framework on compensation does not meet international standards. As a result, agreeing on mutual compensation regimes remains largely problematic, further worsened by the inability of locals to carry out negotiations on their own due to a lack of critical skills.
Darimani et al. (2013)	Evaluates environmental governance effectiveness in gold mines of Ghana and the characteristics of the consequences it delivers for people and the environment.	Mixed Methods Approach	Environmental impact assessments, environmental permitting standards, and voluntary agreements such as corporate responsibility guidelines and the UN Global Compact Programmes implemented to preserve the environment have proven effective and valuable to people and natural resource management. However, an evaluation of some policy elements is required.
Okyere 2013	Explores adopted mechanisms by mining firms/mine operators in managing community disputes	Qualitative	Mining impacts the cultural and social dimensions of communities. However, dispute resolution mechanisms remain overly formal and not responsive to local contexts. The author proposes a stakeholder engagement framework that focuses on society as a critical stakeholder at the national level. A more responsive social and cultural dispute resolution

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	concerning losses and gains of locals within communities.		framework is proposed. Re-conceptualisation of conflict situations as an avenue for negotiation to allow sustainable community-based livelihood enhancement interventions is essential.
Armah et al. (2011)	Examines the regulations governing the Ghanaian mining industry's corporate environmental practices/actions.	Qualitative	The Akoben framework allows mining firms to disclose their environmental performance publicly. However, the existing environmental protection regime (ACT 703 of 2006) falls short of international standards. The most serious environmental issue in the study region is water contamination. Another vital issue is a lack of inclusivity in resource governance. There are also isolated cases of human rights violations.
Hilson & Clifford (2010)	Provides viewpoints on the subject of mercury contamination and the progress achieved in addressing it thus far.	Conceptual	Miners have not warmly familiarised themselves with the use of mercury equipment like retorts. It is critical to have a better knowledge of how these mercury equipment functions. Alternative livelihoods have been proposed to encourage small scale miners to leave the mines/mining pits.
Nyame (2010)	Examines the policy issues around mercury usage in Ghana's ASM.	Conceptual	Initiatives to reduce mercury pollution have not yielded the anticipated outcomes. Using radio and other communication means to disseminate information about the detrimental consequences of mercury use in mining might help to educate and sensitise relevant stakeholders. In addition, stakeholder collaborations might aid in the implementation of mercury enforcement initiatives in the ASM industry.
Bawa (2010)	The paper discusses mercury contamination and details two intervention programmes that have been implemented to solve it.	Conceptual	In 1993, metal retorts were introduced to mitigate the mercury problem, but miners did not receive them well. Therefore, it is still necessary to provide education, training, and public awareness to relevant stakeholders to reduce mercury contamination.

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Hilson & Banchirigah (2009)	Critiques Alternative Livelihood Programme implementation approach in mining communities.	Qualitative	Authors call for a comprehensive relook at Alternative Livelihood Programme (ALP) design and implementation mainly due to the surge in illegal small scale mining. Assumptions by ALP implementers of the suitability of ALPs do not reflect beneficiary/stakeholder expectations/ economic outlook. Furthermore, ALP implementation assumptions have not yielded intended results due to existing poverty scenarios.
Hilson et al., (2007)	Critiques the Ghanaian gold mining industry's mercury pollution abatement method and examines the ramifications of the failed mercury policy.	Conceptual	According to the mercury law, mercury use for mining must follow good mining practices (PNDCL 217). Illegal miners are usually excluded from discussions and decision-making by the government. Illegal miners, on the other hand, are the ones who make the most use of mercury. The study demonstrates that miners have just a rudimentary understanding of mercury's danger. To solve the problem, community-based methods to use mercury should be employed.
Hilson & Nyame (2006)	Examines indigenous accounts and crucial stakeholder viewpoints on mining in forest reserves of Ghana.	Qualitative	To conserve forest reserves, Ghana has implemented EIAs, forest and wildlife regulations. According to the government, processing and disposal of tailings must occur outside the boundaries of forest reserves. However, stakeholder dissatisfaction with mining in forest reserves is widespread.

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4.8. Summary of Key Findings

Table 4.13 Summary key findings of the objectives of this study

Objective	Methods	Key Finding
Existing Policies and Laws Governing Small Scale Mining	Systematic Review and Qualitative	• Awareness about existing policies and laws governing small scale mining is relatively high among most respondents. • Existing policies and laws governing small scale mining encompass; Environmental Management; Mining Policy/Regulation Implementation; Stakeholder Engagement; Human Rights Protection/Social Justice, SSM Formalisation; Conflict Resolution/Compensation; Land Acquisition/Titling, and Alternative Livelihood Programmes/Alternative Employment. • The mining legal governance framework possesses adequate provisions that satisfy the Sustainable Mining Analytical Framework and promote SDG achievement. • The Mercury Law, PNDCL 217, 1989 requires a more comprehensive reassessment of its scope. • Small scale mining governance regimes fail to recognize and prioritize the complexities of small-scale miners and the SSM sector at large, resulting in ineffective reclamation bond implementation, for instance, at the SSM level.
Legal and Regulatory		

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Weaknesses or Gaps Contributing to Illegal Small scale Mining	Qualitative	• Some provisions of the legal and regulatory governance framework for SSM are facilitative factors for illegal SSM activities. • Knowledge about mining regulation among foreigners is not commendable. • There is difficulty among some sections of small scale miners in accessing assistance from regulatory bodies. • Small scale license and permit acquisition processes are cumbersome and time-consuming. • In some cases, regulators' enforcement capacity is limited, as observed concerning arresting and prosecuting illegal small-scale miners.
Institutional Capacity to Enforce Mining Policies and Legislations	Qualitative	• Regulatory institutions remain largely uncoordinated and unintegrated. • Traditional authorities are mostly marginalized in SSM formalisation processes, including permitting, licensing, concessionary planning. • The monitoring and supervisory capacity of relevant institutions remain low. • Small scale miners lack the education and expertise to facilitate sustainable SSM.
Other Factors Encouraging Illegal Mining despite the Legal and Regulatory Regimes	Qualitative	• The existing legal mining governance regime is not backed by robust political commitment. • SSM has, over the years, mainly been viewed by regulators as a means of

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		'livelihood' and not 'business' as is with large scale mining. • The police, military, 'galamsey' task force, and district offices continue to receive small scale miners' bribes. • The harsh realities of unemployment continue to facilitate illegal small-scale mining. • Alternative livelihood projects must match the revenue generation margins of SSM as huge SSM revenues encourage community interest despite harsh environmental and health impacts. • Most small-scale miners mine close to water bodies due to large gold deposits • The SSM sector stakeholders require further decentralization of mining regulation institutions. They also support a call for stricter implementation of land reclamation legislation.
Community Perception on Illegal Small-scale Mining	Qualitative and Quantitative	

Source: Study Data Collection, 2021.

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CHAPTER FIVE

DISCUSSION

5.1 Existing Policies and Laws Governing Small-scale Mining

Numerous policies and laws characterized the Ghanaian mining sector (Adu-Baffuor et al., 2021; Tuokuu et al., 2019; Tuokuu 2019). These constitute a framework of policies, principal, and general enactments that implement mining sector governance. The policies and principal enactments take precedence for ensuring transparency, accountability, and evaluation. On the other hand, the general legal framework provides further rigour for sector efficacy.

The National Minerals & Mining Policy, National Environmental Policy, Mineral and Mining Act, 2006 (Act 703), Minerals and Mining (Amendment) Act, 2019 (Act 995), Mineral and Mining (Amendment) Act, 2015 (Act 900), Minerals Commission Act, 1993 (Act 450), Environmental Protection Agency Act, 1994 (Act 490), Forestry Commission Act, 1999 (Act 571), and Water Resources Commission Act, 1996 (Act 522) constitute relevant policies, principal, and general enactments applicable to Ghana's small-scale mining sector.

This study adopted the Sustainable Mining Analytical Framework to examine relevant policies, principal, and general enactments governing SSM in Ghana and indicates that the legal arrangement in the Ghanaian small-scale mining sector amply exhibits characteristics of sustainable development (Tuokuu et al., 2019; Hatcher, 2012; Slack, 2012; Franks et al., 2011; Bush, 2010; Pegg, 2006). Participants of the KIIs indicated that the level of policy and law comprehensiveness/scope governing SSM activities is above average, highlighting their continued participation in and consideration of submissions during mining policy and law development. Other provisions of the mining legal

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governance framework which underscore its sustainability considerations as indicated by this study include sound environmental management directives and, more recently, harsher punitive measures for poor mining practices such as non-commitment to land reclamation requirements and the destruction of forests and water bodies.

Findings from this study show that the relevant policies, principal, and general enactments governing SSM in Ghana address pertinent issues, including sustainable mining practices, rudimentary technology application, and illegal business dealings. The National Minerals & Mining Policy, for instance, seeks to provide a comprehensive and proactive mining framework that promotes sustainable development. It recognizes the need for "modern regulatory frameworks and appealing terms," which drive investor confidence and interest. These provisions are supported by the Mineral and Mining Act, 2006 (Act 703), which is the overarching legislation/regulation in Ghana's mining sector, and formerly known as the Minerals and Mining Act, 1986 (PNDCL 153) – the first mining-specific legislation of Ghana (Akabzaa, 2009). Having undergone three amendments/reviews (2010, 2015, and 2019), the efficiency and effectiveness of the Act have seen commendable improvements geared towards environmental safeguarding and socio-economic interventions (Ghana Chamber of Mines, 2019; Tuokuu, 2019). The Act currently provides stiffer punitive measures for poor mining practices such as forest degradation and failure to honour reclamation commitments, among others.

Additionally, the Environmental Protection Agency Act, 1994 (Act 490), also facilitates the implementation of sustainable mining regimes within the SSM sector. The Act institutionalizes the agency's legal mandate to ensure compliance of all investments and undertakings (including mining) with established Environmental Assessment procedures in planning and executing development projects, including compliance concerning any existing processes. It is essential to mention that findings

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from this study showed that the EPA (and other regulatory institutions) carries out its mandate as put forward by Act 490 to promote the achievement of the Sustainable Development Goals (SDGs). As revealed by this study, the EPA, via its mandate, mainly helps to achieve SDG 3 (good health and well-being), SDG 13 (climate action), and SDG 15 (Conserve, restore, and promote the sustainable use of terrestrial ecosystems; manage forests sustainably; battle desertification; and halt and reverse land degradation and biodiversity loss).

Furthermore, this study presented an array of important themes derived from literature analyses (Table 3.5), which examined the comprehensiveness/scope of existing policies and laws governing SSM. The themes are; Environmental Management; Mining Policy/Regulation Implementation; Stakeholder Engagement; Human Rights Protection/Social Justice; SSM Formalisation; Conflict Resolution/Compensation; Land Acquisition/Titling; and Alternative Livelihood Programmes/Alternative Employment (Bansah et al., 2018; Ofori & Ofori 2018; Bai et al., 2017; Hilson et al., 2017; Kervankiran et al., 2016; Kumi 2014; Darimani et al., 2013; Okyere 2013; Armah et al., 2011; Hilson & Clifford 2010; Nyame 2010; Bawa 2010; Hilson & Banchirigah 2009; Hilson et al., 2007; Hilson & Nyame 2006). Arguably, this study indicates that the existing laws and policies governing SSM in Ghana highlight most of these themes. For instance, the Water Resources Commission Act, 1996 (Act 522) – a relevant general enactment for the SSM sector – clearly defines/outlines; the ownership regime of water resources across the country, including those affected by mining activities, permitting procedures, environmental management development, regularisation of commercial and domestic water use, policy development and implementation, and institutional collaboration (McQuilken & Hilson, 2016). Additionally, the Minerals and Mining Policy also seeks to assist miners in improving upon their operations; provide technical assistance to small-scale miners by

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establishing District Offices staffed by Minerals Commission personnel; conduct a geological investigation and demarcation of areas suitable for small-scale mining, and ensure that Ghanaian citizens strictly undertake small-scale mining.

Mercury use in the Ghanaian SSM sector remains a critical issue that receives attention from a mining legal framework perspective (Bawa, 2010; Hilson and Clifford, 2010). The Mercury Law, PNDCL 217, 1989 allows small-scale miners to use some amount of mercury to extract gold under the strict supervision of relevant agencies, mainly the EPA and the Mineral Commission. This study revealed an adequate level of awareness among small-scale miners on the PNDCL 217, 1989 (48%) provisions. All the same, there have been incidences of mercury pollution in most gold mining communities (Bawa, 2010; Nyame, 2010), attributable mainly to SSM activities (Tuokou et al., 2019; Hilson et al., 2007). This study revealed that the provisions of the PNDCL 217, 1989 on the use of mercury do not serve a sustainable mining objective within the SSM sector. As argued by a respondent, the provisions of the law, despite its well-meaning direction, seems to allow for ambiguities, as the 'realistic determination' of what quantity of mercury or the application process of such amounts, for instance, by small-scale miners, satisfies demands of sustainable mining practice. In their studies, Hilson and Clifford (2010) and Hilson et al. (2007) highlighted the incidence of the exclusion of illegal miners from deliberations that seek to facilitate sustainable mercury use and mining at large. They also argued that the high presence of illicit small-scale miners hinders mercury using regularisation. This study revealed similar findings as an assessment of the awareness of the legal provisions of PNDCL 217, 1989 among small-scale miners did not translate into on-the- ground sound environmental management practices. Through the lens of the Stakeholder Theory applied to this study's conceptual framework – Small-scale Mining Sector Formalisation – the Mercury Law requires a more comprehensive reassessment of its scope. The

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reassessment should consider the intricacies of legislative applications in the modern era of mining governance, especially since it is still in use and find a more sustainable and efficient alternative.

5.2 Legal and Regulatory Weaknesses or Gaps Contributing to Illegal Small-scale Mining.

Studies have demonstrated within the past few decades the pressing issue of legal and regulatory inconsistencies in the small-scale mining sector in Ghana leading to a high incidence of illegal actions, especially "galamsey." As a result, a call for a reconceptualization of the need to formalize or set activities of the SSM sector in Ghana on a sustainable path remains topical (Bansah et al., 2018; Hilson et al., 2017; Hilson et al., 2007). The need to improve sustainable SSM is critical despite the scope of legal arrangements governing the SSM sector in Ghana.

In line with the study conducted by Adu-Baffour et al. (2021), this study evaluated the intricacies of small-scale mining through the applicable legislative and regulatory framework lens. According to Adu-Baffour et al. (2021), small-scale mining governance regimes fail to recognize and prioritize the complexities of small-scale miners and the SSM sector at large. Evidentially, this study revealed that the SSM sector adopts most of its governing legislation and regulations from those usually aimed at the large-scale industry. The adoption means there may be continual scenarios of 'contextual incompatibility' regarding the practicality and success of legislative and regulatory governance implementation efforts at the SSM sector level. As shown by this study, a noteworthy example of such a case is the issue of the reclamation bond implementation at the SSM level. As part of the licensing process, Ghanaian regulations require mining businesses to post a bond (in the form of a financial instrument) with the authorities (minerals commission and environmental protection agency). The legislation requires the regulators to keep the financial instrument as insurance until the mining companies complete the reclamation operations in the mining sites. Reclamation bonds shift part of the

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risk of environmental degradation from the general public to mining firms. Once the regulators keep the reclamation bond, mining companies and regulators bear responsibility for sustainable mining. The law envisions the reclamation bond to make financial resources available for reclamation if mining companies fail to clean up the site. However, this study shows that small-scale mining companies have not effectively realized this vision. The inability of small-scale mining companies to financially fulfil their reclamation bond obligations is attributable to the poor calculation of direct reclamation costs (land use, ecological restoration, and regulation of acid mine drainage) and indirect reclamation costs (mobilization and demobilization of equipment from mining sites). Study results further indicate that the licensing regime for the small-scale mining companies under the Minerals and Mining Act 2006 (Act 703) is relaxed on reclamation bonds. Small-scale mining companies do not successfully prepare mining plans that explain the process of land reclamation to return the land to productive use after mining. Due to the inability to enforce the reclamation bonds among small-scale mining companies, conventional reclamation efforts such as backfilling and regrading mine sites, replenishing topsoil, and developing a vegetative cover to fulfil the land management requirements remain abandoned. As argued by a respondent, this challenge is almost non-existent within the large-scalelarge-scale industry. Still, it remains persistent at the SSM level due to inconsistencies in regulatory governance regimes, which have failed to understand the happenings on the ground among small-scale miners especially. In this vein, there exists a gap in ensuring Regulation 23 of the Environmental Assessment Regulations of the EPA – Funds for Reclamation – is successfully implemented.

Some legal and regulatory provisions governing SSM are facilitative factors for illegal activities within the SSM sector. As revealed by this study, the sophisticated machinery used for SSM activities on a legally agreed small-scale concession of 25 acres can exhaust available mineral deposits within a year

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despite the possession of a five (5) year mining license. This means the tendency for small-scale miners to venture into unauthorized areas in a quest to make use of their licenses often procured at huge costs. This is in line with findings from studies conducted by Boafo et al. (2019), Boafo (2019), and Crawford et al. (2015), which have indicated the incidence of some Ghanaian small-scale mining licensees enticing outsiders, mainly Chinese, to engage in SSM illegally. This means that Ghanaian miners take advantage of the legal and regulatory benefits to propagate illegalities.

On the other hand, the study showed that traditional authorities regarded as custodians of lands in Ghana have almost no role in licensing regimes for mining concessions. This occurrence inhibits their capacity to contribute to curbing illegalities within the SSM sector despite their direct links or interaction with illegal mining and its effects at large. These findings show weaknesses in the SSM legislative and regulatory framework, which further indicates the relatively slow pace of adaptive capacity among critical actors, decision-makers, and so on within the SSM sector.

This study showed that knowledge about mining provisions across various small-scale mining sites/communities selected for this study was above average; Amenfi West (96.1%), Atwima Mponua (95.3%), and the Talensi (92.5%) districts and was lowest in the Prestea/Huni Valley (61.0%) and the Tarkwa Nsuaem (62.5%) districts. However, a stark revelation via this study indicates that most foreigners engaged in small-scale mining (an illegal scenario) are not aware of mining policies and laws (62.5%). It is essential to mention that despite the encouraging findings of an above-average level of awareness regarding the mining governance framework, the reality on the ground concerning sustainable actions is nothing worth commending. For instance, some small-scale miners have expressed willingness to adopt sustainable mining practices but cannot reach the officials of the Minerals Commission, among others, in most cases. Furthermore, the study revealed this is worsened

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by the cumbersome process of acquiring licenses to mine. These findings indicate loopholes in the governance regime and fall in line with ongoings hampering effectual formalisation of the SSM sector as argued by Bansah et al. (2018), Hilson et al. (2017), Ministry of Lands and Natural Resources (2017), and Hilson et al., (2007).

Other issues remain pertinent to promoting illegal small-scale mining in Ghana. This study revealed that from a regulator's standpoint, the power to arrest, for instance, is not within the remit of the EPA nor the Minerals Commission. Thus, practically enforcing laws to curb illegal SSM remains challenged. It is essential to know that these bodies cannot prosecute except the Office of the Attorney General of Ghana or the Police. The implementation of Operation Vanguard, which led to the arrest of 1,129 illegal miners and the destruction of 7,000 illicit mining equipment, is a profound example of the inability of regulatory bodies to undertake prosecution actions without external assistance (Adu-Baffuor et al., 2021; Pein, 2018). Based on the findings of this study, it is arguable that there is an ongoing challenge of achieving transparency and accountability within the SSM sector due mainly to the non-formal nature of the industry. In agreement with similar studies by Meznaric et al. (2021), Owusu et al. (2019), Ministry of Lands and Natural Resources (2017), Kervankiran et al., 2016; and Minerals Commission (2015), this study reveals that sustainable SSM efforts despite the current fight against illegal SSM, remain less reaching. Arguably, this study makes a strong case on the issue

of tax evasion within the SSM sector borrowing from the current trend of the sector's poor reclamation bond implementation regimes. The finding agrees with studies by Adu-Baffuor et al. (2021) and Boateng (2018).

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5.3 Institutional Capacity to Enforce Mining Policies and Legislations

The Sustainable Mining Analytical Framework put forward by this study highlights the underlying importance of institutional capacity as a critical impetus in driving best behaviour regarding mining activities (Kumi et al., 2020; Tuokuu et al., 2019; Bryman 2016). Following an assessment of the complexities of institutional capacity vis-à-vis behavioural change dynamics within the SSM sector (Ofori and Ofori 2018; Hilson et al., 2017), this study revealed that the current regime of institutional coordination is worth exploring. This finding aligns with Tuokuu et al., (2019) study, which assessed environmental policy in Ghana's gold mining sector. This study showed a largely uncoordinated institutional regime among critical stakeholders, including the EPA, Minerals Commission, Forestry Commission, Water Resources Commission, and Ministry of Lands and Natural Resources, among others. For instance, in the current dispensation of events, a prospective small-scale miner first applies to the Minerals Commission through the Ministry of Lands and Natural Resources for concession rights before the applicant proceeds to the EPA for an environmental permit. Arguably, this process, as highlighted by experts involved in this study, is not effective and proactive. The poor coordination and unintegrated system among relevant institutions have negatively affected, for instance, the interface between mining and forestry as experts confirmed situations where forest reserves under the preserve of the Forestry Commission have been transformed into mining sites following permitting by the Minerals Commission. The coordination challenge has created 'grey areas' that small-scale miners exploit. Additionally, coordination inconsistencies generally lead to cumbersome processes for license acquisition and land titling, among others (Bansah et al., 2018; Hilson et al., 2017), which deter many small-scale miners from engaging in sustainable mining practices. These issues further hamper progress regarding SSM sector formalisation efforts.

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Findings from this study reveal the complexities of the institution of traditional authority within the land tenure nexus of SSM in Ghana and highlight the importance of traditional institutions as critical stakeholders for driving sustainable mining practices. A study by Adu-Baffuor et al. (2021) shares similar views on the position of chiefs, opinion leaders, and other relevant actors at the local governance level, indicating that a well-functioning traditional institution can help "to enforce strict compliance to regulations by miners at the rural community level," which can contribute to sustainable environmental SSM practices. This study showed that the current governance regime of licensing, concession planning, and administration for SSM, for instance, has led to a high marginalisation of traditional authorities. Most experts consulted for this study raised this issue, highlighting the additional challenges faced, including lack of initiative or interest in policy formulation and implementation by some chiefs and opinion leaders. These findings are in dissonance with the Stakeholder Theory applied to this study (McGrath & Whitty, 2017; Matuleviciene & Stravinskiene, 2015). The dissonance results from the partial 'tokenism' associated with the traditional institutional role in SSM regulation, as critical stakeholders capable of influencing mining policy implementation do not possess the power. Consequentially, this threatens the New Institutional Economics Theory (Chhotray & Stoker, 2009; Lissowska, 2006; Herath, 2005), employed for this study as efforts to formalize the small-scale mining industry remains challenged by the gap of the weak traditional institutional system. Additionally, this study revealed the issue of uncoordinated activities between traditional authorities and some regulatory institutions, citing the displeasure of some chiefs and opinion leaders following concession allocations. Such occurrences hinder progress from a System Theory perspective (Chikere, & Nwoka, 2015; Ng et al., 2009; Weinberg, 2001; Leighninger, 1978) as critical constituents of the more considerable whole of regulators lack the required regard, hence, the influence due them.

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The policies, principal, and general enactments governing SSM in Ghana mandate the various regulatory institutions to monitor SSM industry activities effectively and efficiently (Tuokuu et al., 2019; Boateng, 2018; McQuilken & Hilson, 2016). This study revealed that the monitoring and supervision capacity of institutions responsible for sustainable SSM remains insufficient. For instance, there is a gap in achieving good reporting practices at the institutional level. This study revealed that most small-scale industry players do not produce and submit reports on environmental monitoring, among others, as required by the tenets of their acquired licenses. In rare cases where this is done, results from this study throw light on the relatively slow response rate by regulatory agencies, which more often than not hinder operations of small-scale miners. It is essential to mention that SSM and its accompanying regulatory requirements such as monitoring and supervision form a complex system that requires the input of well-trained personnel (Adu-Baffuor et al., 2021). As shown by this study's findings, there exists a challenge of achieving the needful knowledge transfer and adaptation from the large-scale industry into the small-scale sector. This situation exacerbates current industry-related challenges, including practical engagement approaches, capacity building for small-scale miners, and others. Arguably, Ghana's SSM industry has seen some noteworthy initiatives geared at boosting the overall outlook of monitoring and supervisory capacity, such as Operation Vanguard, media call outs, among others. However, findings from this study reveal the ongoing 'challenge of numbers' regarding the adequacy of qualified personnel, which is agreed to by studies including Adu-Baffuor et al. (2021) and Tuokuu (2019). This study showed, in some cases, about two (2) regulatory officers are in charge of approximately five (5) political mining districts in some parts of the country. This situation puts a strain on the efficacy of monitoring and supervisory activities, which further weakens efforts at promoting sustainable SSM.

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5.4 Other Factors Encouraging Illegal Mining in Spite of the Legal and Regulatory Regimes.

This study showed that most small-scale miners are poorly educated and lack the expertise required to facilitate sustainable SSM. The lack of education and knowledge, further worsened by the existing challenge of the low-capacity building by regulatory institutions for small-scale miners, as revealed by this study, often create a gap of assumption of appropriate actions by small-scale miners. Thus, most small-scale miners believe that their actions constitute acceptable behaviour, whereas they do not. This results in legal, regulatory framework implementation challenges as critical stakeholders (small-scale miners) lack an in-depth understanding of allowable actions within their sector. In their studies, Azumah et al. (2020) and Boateng (2018) revealed similar findings citing the future challenges that this circumstance may bring forth. The capacity gap among small-scale miners also underscores the need to enhance approaches in greening the SSM sector via technology adoption, as revealed by the findings of this study. According to this study's findings, the dig and wash method (40.5%), alluvial washing plant (33.4%), changfa method (20.8%), and underground method (20.3%) constitute some common mining approaches employed by small-scale miners. Evidentially, these methods do not safeguard the environment and create numerous health problems (53.4%) for miners and mining communities at large. Therefore, it is imperative to consider more sustainable technological options to enhance sustainable SSM, as Bai et al. (2017) argued.

The political will exhibited over the years by various governments in tackling the menace of illegal SSM, as revealed by this study's findings, has not yielded the desired results. This study showed that the legal mining governance regime is not backed by robust political commitment, which seeks to curb SSM illegalities and enhance sustainable SSM strongly. This gap may be attributable to numerous reasons, including scoring political points to win or maintain power. A study by Boateng (2018) that

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examined the effects of small-scale and illegal mining on the environment argued that the lack of enforcement of rules and regulations by relevant institutions, further hindered by the growing incidence of corrupt chiefs and opinion leaders, provide a justifiable cause to reassess the political commitment regarding SSM regularisation. As revealed by this study's findings, it is arguable that efforts to combat illegal small-scale mining within the ongoing political dispensation shall produce short-lived results and further threaten the rigour of the implementation outlook of Ghana's SSM regulatory framework.

In exploring the implementation gaps associated with SSM regulation, this study revealed that SSM has, over the years, mainly been viewed by regulators as a means of 'livelihood' and not 'business' as is with large-scale mining. Thus, SSM has been perceived as providing Ghanaians with the opportunity to improve their socio-economic status within the various communities where such prospects lie. Some experts in this study via KIIs argued that this situation prevents regulatory agencies from fully applying the SSM legal governance framework provisions (Hilson et al., 2017). In this vein, the opportunity to engage in unsustainable practices such as the destruction of farmlands, pollution of water bodies, among others, remains available for exploitation. This challenge hampers progress with SSM formalisation and underpins the need to rethink SSM approaches in general, as argued by Hilson et al. (2017).

As revealed by this study, the menace of illegal business dealings continues to nullify progress despite applicable legal and regulatory regimes. Findings from this study showed that small-scale miners pay bribes to the police (85.0%), the military (67.4%), the 'galamsey' task force (52.2%), and the district assembly members (55.1%). According to Boateng (2018), the activities of corrupt regulatory institutions and stakeholders will continue to affect sustainable SSM poorly.

INTEGRI PROCEDAMUS

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5.5 Community Perception on Illegal Small-scale Mining

To further understand the views of small-scale miners and SSM communities, this study assessed perceptions of SSM illegalities across SSM communities. The assessment allowed for a 'view from the small-scale miners' seat', which aligns with recommendations put forward by Ofori and Ofori (2018) in their study, which sought to understand illegal small-scale mining in Ghana via the application of a social justice theoretical framework.

Findings from this study via FGDs revealed that despite efforts to combat illegal small-scale mining, many SSM communities grapple with the harsh realities of unemployment which pushes the majority to engage in such activities. This finding is similar to arguments put forward in Zindzy's (2018) studies. Respondents involved in this study lamented the high unavailability of other revenue-generating opportunities within SSM communities. As revealed by FGDs for this study, many community respondents indicated their willingness to opt for other safer and equally paying ventures if such choices are available. According to some community members, the dangers often associated with illegal small-scale mining include loss of lives from the pit (72.9%), persistent arrests (67.3%), mining-related illness (53.4%), and loss of lives from other persons (50.9%), continue to serve as threats they would prefer to not encounter in their quest to seek employment.

Additionally, this study revealed that another critical reason most SSM communities continue to engage in SSM is the high financial benefits associated with the activity (81.8%). This finding was reiterated via FDGs, during which observations of laudable socio-economic improvements, including completed construction projects, improved quality of children's education, and community support via contributions during emergencies, among others, were made. This finding indicated the need for a comprehensive relook at Alternative Livelihood Programme (ALP) design and implementation, as

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argued by Hilson and Banchirigah (2009), to ensure community members are not lured by the financial gains of illegal SSM at the detriment of human health and the environment.

Furthermore, this study revealed that small-scale miners often mine near water bodies due to large gold deposits, which is often not the case with allocated concessions. Community members through FDGs indicated that their major finds usually occur near water bodies, which has created a scenario of perpetually desiring to undertake SSM close to water bodies. Consequentially, the majority of respondents agreed their activities contribute to water pollution (84.8%), agricultural depletion (84.1%), and extinction of aquatic animals (79.5%). This finding is in accord with a study undertaken by Bansah et al. (2018). Water quality analysis revealed high turbidity, manganese, and iron content, resulting in a 500% water quality index, making water unsafe to drink.

Community members, via this study, revealed the harsh realities they face in interacting with regulatory institutions due to being labelled illegal miners. For instance, the FGDs for this study showed that attempts to secure regulatory bodies hamper mining blocks under the community mining initiative due to the tag attributed to small-scale miners. This challenge has resulted in wrongful arrests and humiliation as put forward by FDG discussants. In their study, Ofori and Ofori (2018) argued that the existing misrecognition of illegal small-scale miners reinforces “that there ii is a strong opinion by the government, media and large-scalelarge-scale mining companies that portray Galamsey miners [largely small-scale miner] as villains instead of citizens with rights to participate” (Ofori, & Ofori, 2018, p. 364).They further argued that the ongoing misrecognition had created social injustice, which, among other things, drives economic disempowerment.

Concerning support for sustainable SSM, this study revealed that community members argue for the

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decentralisation of mining regulatory institutions. This study showed that the need to create more offices within SSM communities remains critical. It is important to improve the presence of regulatory agencies on the ground to ensure practical improvements in SSM activities. Additionally, the study revealed the need to enforce laws and regulations regarding land reclamation needs to be strengthened. This assertion was put forward by FDG discussants for this study, highlighting the common practice of not reclaiming mined lands despite possessing genuine permits by most small-scale miners. Arguably, these findings are in line with those brought forward by studies including Adu-Baffuor et al. (2021), Tuokuu et al. (2019), and Boateng (2018) about adopting practices that seek to drive effective and efficient SSM.

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CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Summary

Applicable and feasible workable policies and laws are essential mechanisms for resolving most of the challenges plaguing the small-scale mining sub-sector. These policies and laws are critical for improving stakeholder interactions and streamlining small-scale mining activities. The research basically looked at the inadequacies in current small-scale mining policies and laws.

Several policies and laws are meant to govern small-scale mining in Ghana. Notable among them are; the 1992 Ghanaian Constitutions (Articles 36, 41, and 257), the Minerals and Mining (Amendment) Act, 2019 (Act 995), and the Minerals Commission Act, 450 (1993). Other general laws or regulations include the Environmental Protection Agency Act of 1994 (Act 490), the Forestry Commission Act of 1999 (Act 571), the Minerals Development Fund Act of 2016 (Act 912), the Local Government Act of 1993 (Act 462), the Income Tax Act of 2015 (Act 896), the Precious Minerals Marketing Company Act of 1989 (PNDCL 219), and the Water Resources Commission Act of 1996 (Act 522). In addition, relevant policies for the small-scale mining industry include the National Minerals & Mining Policy, National Environment Policy, National Water Policy, National Land Policy, Forest and Wildlife Policy, Environmental Assessment Regulations, 1999 (L.I. 1652), National Alternative Employment and Livelihood Program, and others. The findings revealed that, even though several policies and laws govern small-scale mining, the business is still mostly unregulated. Many local stakeholders are unaware of the small-scale mining industry's policies and regulations. On the other hand, institutional stakeholders are aware of current laws and policies in the small-scale mining business.

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Furthermore, the findings indicated insufficient coordination among institutional parties in creating and implementing small-scale mining policies and laws. Local stakeholders, such as miners, local governments, chiefs, and community members, are not consulted in developing and implementing small-scale mining policies and laws in Ghana. As a result, there has been an upsurge in illegal small-scale mining around the nation.

Notwithstanding the multiple rules and legislation in Ghana's small-scale mining business, illicit small-scale mining operations have been on ascendency throughout the previous two decades. The problem might not be visible in the past years owing to the usage of primitive tools and technologies, which limited the consequences of the illicit miners on the environment. Nevertheless, heavy earthmoving machinery and dangerous chemicals and the active participation of Chines citizens illegally in small-scale mining in tandem with unscrupulous Ghanaians have raised the alarm over the efficiency of the legal and regulatory frameworks on a small-scale mining industry. Therefore, the study intended to identify legal and regulatory deficiencies or loopholes that led to Ghana's illicit small-scale mining.

The legal and regulatory deficiencies have impeded efforts to standardize and control all small-scale mining industry functions. The results indicated that most of the legal and regulatory processes, such as the policies, acts, and regulations are obsolete. The majority of these rules and policies were formulated between the 1980s and early 2000s, where complexity in the illicit small-scale mining was extremely modest. The antiquated legal and regulatory frameworks have not adequately captured the ever-growing intricacies of illegal operations in Ghana's small-scale mining industry.

Moreover, the results demonstrated numerous problems in implementing appropriate legal and regulatory systems to license, control, and maintain the operations in the small-scale mining industry.

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Most laws and policies include the Mercury Law, 1989, PNDC Law 217, Small-scale Gold Mining Law 1989, PNDC Law 128. Minerals and Mining Laws as modified are exceedingly tricky to apply on the field. The obstacles in using legal and regulatory processes are apparent in unnecessary court delays in the prosecution of unlawful miners. Again, the inadequacies in legal and regulatory systems are visible because the state has not fully recognized small-scale mining as a sound-structured commercial entity like the one-district one-factory but as a source of livelihood for the local people.

Furthermore, the gap in the legal and regulatory procedures is noted in the lack of coordination and collaboration among institutional actors. The creation of policies and regulations for the small-scale mining sector regulation is not created to integrate with other policies and laws to impact one another, promote synergy, and reduce policy and legal conflicts. Relevant institutions to enhance sustainability in the mining industry act in isolation without properly coordinating their duties. One entity's actions and choices do not consider actions and decisions made by other institutions owing to insufficient coordination. The results reveal that the inadequate coordination in the legal and regulatory procedures has resulted in duplication of efforts, failure to mobilize other institutions to fight illegal mining comprehensively, and policy contradiction.

Ministry of Environment, Science, Technology, and Innovation, Ministry of Lands and Natural Resources, Ministry of Finance, Parliament, Chiefs, community members, small-scale miners, district assemblies, Civil Society Organizations and Non-Governmental Organizations, Minerals Commission, Environmental Protection Agency, Forestry Commission, Water Resource Commission, Security agencies (military and police) and Lands Commission are some of the stakeholders in the small-scale mining industry. The findings found that agencies regulating small-scale mining activities lack the human, technical, and material resources needed to combat illegal mining successfully. In many regions

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where illegal small-scale mining occurs, the Mineral Commission and the EPA, which are directly involved in streamlining small-scale mining operations, do not have offices in the local communities where the mining takes place. The findings also indicated that financial allocation is insufficient to enable successful operations at the local level. Furthermore, some officers in charge of streamlining the activities of small-scale miners participate in unethical acts, allowing illegal mining to flourish in Ghana. There is also a significant level of favouritism for some Ghanaians who engage in illegal mining because law enforcement authorities are linked to the illegal miners in the communities. Again, the agencies tasked with preventing illegal mining among Ghana's small-scale miners lack oversight and monitoring.

Illegal mining thrives for various reasons that go beyond institutional and legal systems. The findings revealed that a shortage of job possibilities in mining towns leads to many people engaging in illegal mining. The results showed that, other than farming, most mining areas had no other employment-generating activity. Because such regions lack factories, many young people are forced to engage in illegal mining. As a result, the youth resort to unlawful mining to support their families.

Furthermore, many mining villages have an abysmal educational level, which affects their ability to read and comprehend the hazards of illegal mining. Many illegal miners do not understand why their operations are classed as illegal mining. They believe that because the land belongs to them, they have the right to mine on it. They do not think that the state owns all natural resources in Ghana. Furthermore, agriculture has not appealed to the youth, primarily interested in illegal mining. The findings indicated that most illegal miners are unwilling to engage in farming since their revenue from mining substantially surpasses that of agriculture. The procedures for obtaining a small-scale mining license in Ghana are lengthy and arduous. It causes much irritation among residents trying to legitimize their

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illegal mining businesses.

Despite the institutional stakeholders' unfavourable perceptions of illegal mining as a cause for environmental degradation, local actors engaging in illegal mining see it as a source of money and subsistence. Fortunately, as the study's methodology and findings show, most community people and miners are well aware of the detrimental effects of illegal mining. However, in the Amansie West, Atwima Mponua, Talensi districts, and community miners with lower education levels, understanding the results of unlawful small-scale mining were limited. The findings showed that illegal mining significantly impacts Ghana's capacity to meet the 2030 Sustainable Development Goals. Illegal mining has been revealed to cause water pollution, agricultural depletion, extinction of aquatic animals, injury and death, adverse health effects on miners, air pollution, noise pollution, deforestation and habitat destruction, and long-term negative effects on livelihood and health in mining communities. The findings revealed that most residents in mining villages are unaware of Ghana's numerous mining rules and regulations.

6.2 Conclusion

6.2.1 Existing Policies and Laws Governing Small-scale Mining

This study assessed these legal governance frameworks' existing policies and laws governing SSM and stakeholder awareness levels. Most respondents exhibited a relatively high awareness of existing policies and laws governing small-scale mining. Furthermore, applying the Sustainable Analytical Mining Framework revealed that existing policies and laws governing small-scale mining contain provisions that encompass; Environmental Management; Mining Policy/Regulation Implementation;

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Stakeholder Engagement; Human Rights Protection/Social Justice; SSM Formalisation; Conflict Resolution/Compensation; Land Acquisition/Titling; and Alternative Livelihood Programmes/Alternative Employment.

Additionally, this study put forward that the mining legal governance framework possesses adequate provisions that promote SDG achievement. Among others, SDG 3 (good health and well-being), SDG 13 (climate action), and SDG 15 (conserve, restore, and promote the sustainable use of terrestrial ecosystems; manage forests sustainably; battle desertification; and halt and reverse land degradation and biodiversity loss) constitute goals which are facilitated by most mining regulatory bodies such as the EPA.

This study showed that the Mercury Law, PNDCL 217, 1989 requires a more comprehensive reassessment of its scope in a quest to enhance sustainable SSM. This study argues that this remains critical as the high awareness levels observed among small-scale miners regarding mining laws and policies did not reflect on-the-ground sound environmental management practices. This study further revealed that the reassessment must take cognizance of SSM dynamics over the years and foreseeable future.

6.2.2 Legal and Regulatory Weaknesses or Gaps Contributing to Illegal Small-scale Mining

Small-scale mining governance regimes fail to recognize and prioritize the complexities of small-scale miners and the SSM sector. This gap creates numerous issues, including ineffective reclamation bond implementation. For instance, regulatory agencies lack a comprehensive outlook of the many reasons underpinning deviations from rightful actions by small-scale miners concerning SSM. Also, some provisions of the legal and regulatory governance framework for SSM are facilitative factors for illegal

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SSM activities. This study highlighted the incidence of small-scale miners wrongfully using permits on illegally acquired concessions following exhaustion of mineral deposits on legally allocated concessions due to its five (5) year validity period and resource-intensive requirements for its acquisition.

Knowledge about mining regulation among foreigners is not commendable. Despite the illegalities of foreign involvement in SSM as captured by the National Minerals and Mining Policy, most foreigners involved in this study were not knowledgeable about Ghana's mining laws and policies.

Also, small-scale miners encounter difficulties while seeking assistance from regulatory bodies. In some cases, officials of the Minerals Commission are not easily accessible despite the willingness of small-scale miners to adopt sustainable SSM practices. Furthermore, small-scale license and permit acquisition processes are cumbersome and time-consuming. The overwhelmingly burdensome processes for permit acquisition often deter small-scale miners from being interested in such activities.

This study revealed that regulators' enforcement capacity is limited in some cases. The capacity challenge is observable in, for example, arresting and prosecuting illegal small-scale miners. In such cases, as seen with Operation Vanguard, regulatory agencies fall on security agencies or sectors for the needed support. As a result, the effectiveness and efficiency of regulatory agencies to practically enforce legal governance frameworks for sustainable SSM remains undermined.

6.2.3 Institutional Capacity to Enforce Mining Policies and Legislations

Regulatory institutions remain largely uncoordinated and unintegrated. More importantly, this challenge contributes to small-scale miners' burdened nature of permit and license acquisition processes. It also retards time efficiency as procedural arrangements for service provisions (e.g., permit)

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simultaneously require repeated engagements with numerous institutions.

Also, this study argues that traditional authorities are mostly marginalized in SSM formalisation processes, including permitting, licensing, and concessionary planning. The marginalization issue can be attributed to the weak coordination and integration of roles and responsibilities at the regulatory level. Chiefs, opinion leaders, and other relevant local governance stakeholders represent SSM formalisation and sustainability players.

The monitoring and supervisory capacity of relevant institutions remain low. There is a lack of effective reporting mechanisms between small-scale miners and regulatory agencies regarding environmental assessments. The SSM sector also faces knowledge transfer challenges among regulators for sound environmental management. There exists the challenge of low numbers of adequately trained regulatory officers as monitoring, and supervisory personnel are almost non-existent in some districts.

6.2.4 Other Factors Encouraging Illegal Mining in Spite of the Legal and Regulatory Regimes

Small-scale miners lack the education and expertise to facilitate sustainable SSM. As a result, small-scale miners often assume their actions are right and acceptable, even though this may not be the case. The poor understanding of allowable actions within the SSM sector among small-scale miners facilitates illegal SSM.

The existing legal mining governance regime is not backed by robust political commitment. The study argues that the government's soft position on curbing illegal mining may be attributable to attempts to win or maintain power. The political will challenge exacerbated by corrupt chiefs, opinion leaders, and other local governance actors.

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SSM has, over the years, mainly been viewed by regulators as a means of 'livelihood' and not 'business' as is with large-scale mining. Due to this perception, regulators sometimes do not apply the full scope of regulatory provisions to ensure effectual enforcement of legal requirements. Consequentially, an avenue to engage in small-scale mining illegally and at the detriment of the environment, among others, is created.

The police, military, 'galamsey' task force, and district offices continue to receive small-scale miners' bribes. Contrary to expectations, some security personnel tasked to enforce strict punitive measures to curb poor mining practices are engaged in illegal dealings with the perpetrators of illegal SSM. Facilitating illegal dealings within the SSM sector undermines SSM sector formalisation efforts.

6.2.5 Community Perception on Illegal Small-scale Mining

The harsh realities of unemployment continue to facilitate illegal small-scale mining. As long as community members within SSM areas do not find beneficial employment opportunities, they shall engage in SSM despite associated environmental and health implications. It is noteworthy to mention that most respondents are displeased with the lack of employment opportunities plaguing their communities.

Alternative livelihood projects must match the revenue generation margins of SSM as huge SSM revenues encourage community interest in SSM. As argued by this study, most respondents engage in and encourage others to undertake SSM due to its high financial benefits. The study showed improvements in socio-economic status spanning education and construction, among others, due to SSM.

Most small-scale miners mine close to water bodies due to large gold deposits. Mining concessions

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often do not possess large volumes of gold deposits; hence, miners view them as a non-lucrative option. Small-scale miners agree the practice is illegal and contributes to water pollution, agricultural depletion, and extinction of aquatic animals.

Small-scale miners require further decentralization of mining regulation institutions. Respondents reiterated the importance of the improved presence of various regulatory agencies within the mining communities to enhance ease of access and timely interventions geared at sustainable SSM. They also support a call for stricter implementation of land reclamation legislation.

6.3 Recommendations

This section provides some key recommendations regarding this study's results, discussion, and conclusion.

Firstly, with a sense of urgency, regulatory agencies must push for strict enforcement of reclamation legal governance frameworks at the SSM sector level. Reclamation bond commitments as captured by Regulation 23 of the Environmental Assessment Regulations of the EPA – Funds for Reclamation should be enforced to the latter to ensure and enhance accountability and best practice. Additionally, the EPA and Minerals Commission should supervise and penalise small-scale miners who refuse to reclaim mined concessions. Government and citizens at large shall benefit socio-economically from such interventions due to the resultant environmental, health, and financial gains.

Secondly, there is the need for regulatory agencies and governments to rethink approaches to permitting and licensing regimes. This study reiterated the illegal circumstances created by small-scale miners due to prolonged permit access against actual mining duration. Regulatory agencies and government must assess current SSM value-chain dynamics to curb the 'temptation' of wrongful permit use. The

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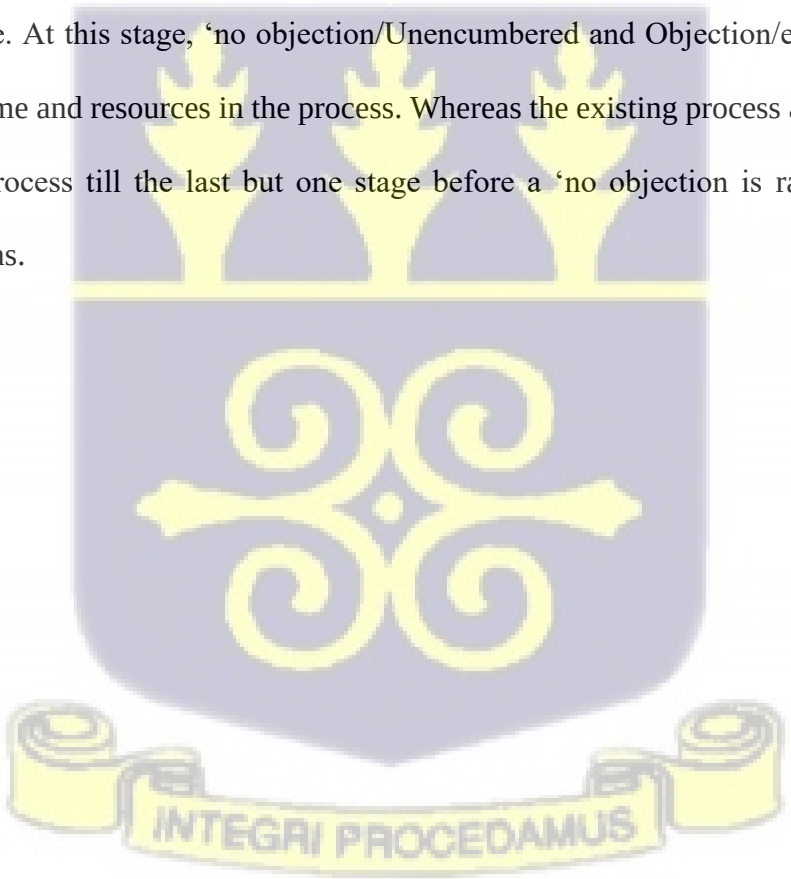
assessment shall help understand critical permitting grey areas that small-scale miners exploit. A good point to begin such an assessment will be the technological or mining setup available to small-scale miners against prospective gold deposits. A comprehensive outlook of critical permitting grey areas will also help tackle the incidence of Ghanaians' wrongful use of permits to facilitate illegal activities of foreigners, especially Chinese. Furthermore, it will help address the challenge of mining close to water bodies under the excuse of possessing a permit or license. However, rethinking permitting and licensing regimes should aim to understand the complexities of small-scale miners' behaviour and the SSM sector in general. In view of this recommendation, the study recommends a proposed mining permit acquisition process diagram figure 6.2 of the existing figure 6.1. The proposed permit acquisition process (figure 6.2) brings on board the various stakeholders [MC, GSA, EPA and WRS] during the physical search stage. At this stage, 'no objection/Unencumbered and Objection/encumbered flagged prevent a waste of time and resources in the process. Whereas the existing process allows for the client to go through the process till the last but one stage before a 'no objection is raised by the earlier mentioned institutions.



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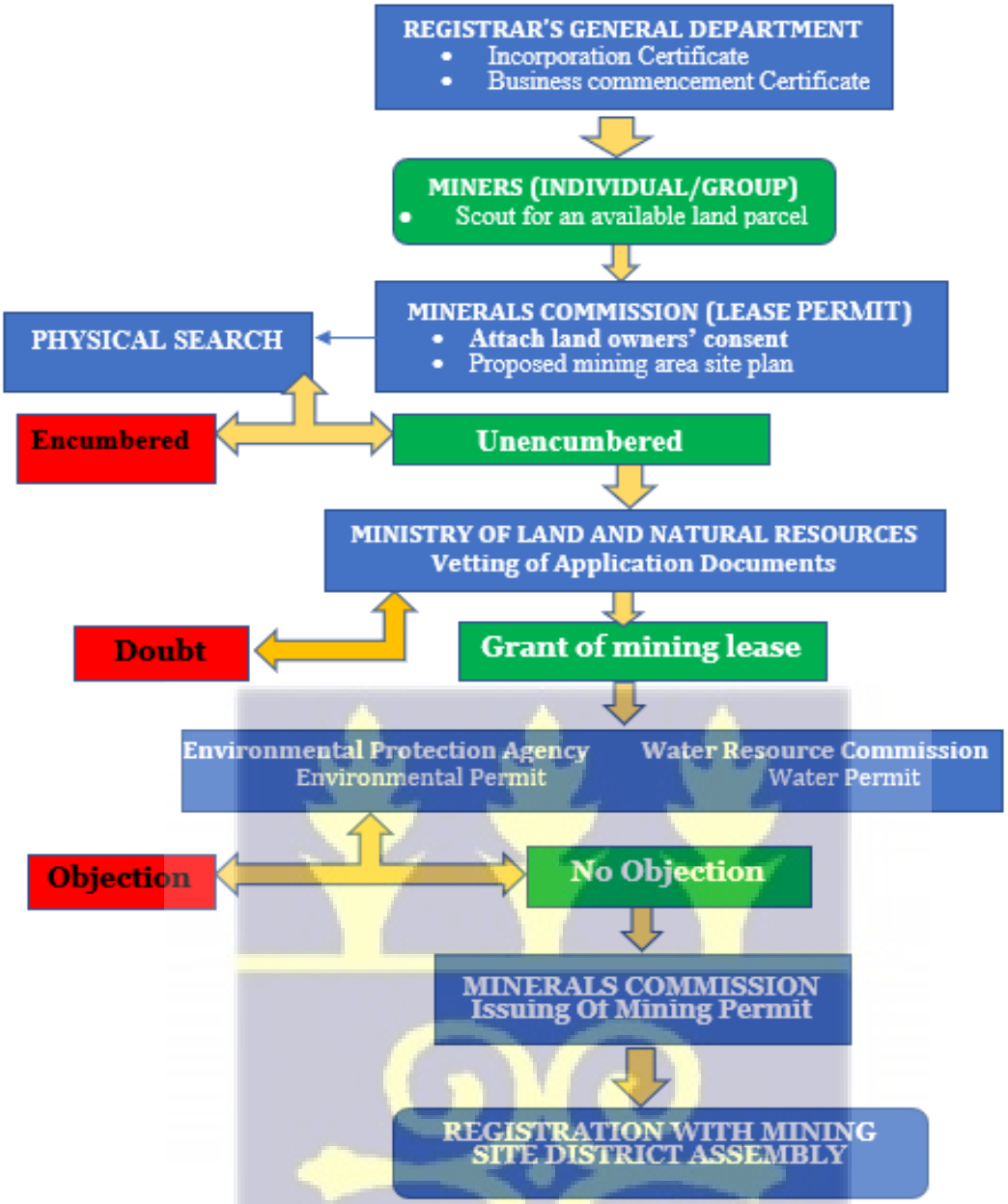

Figure 6.1: Existing mining permit acquisition process diagram

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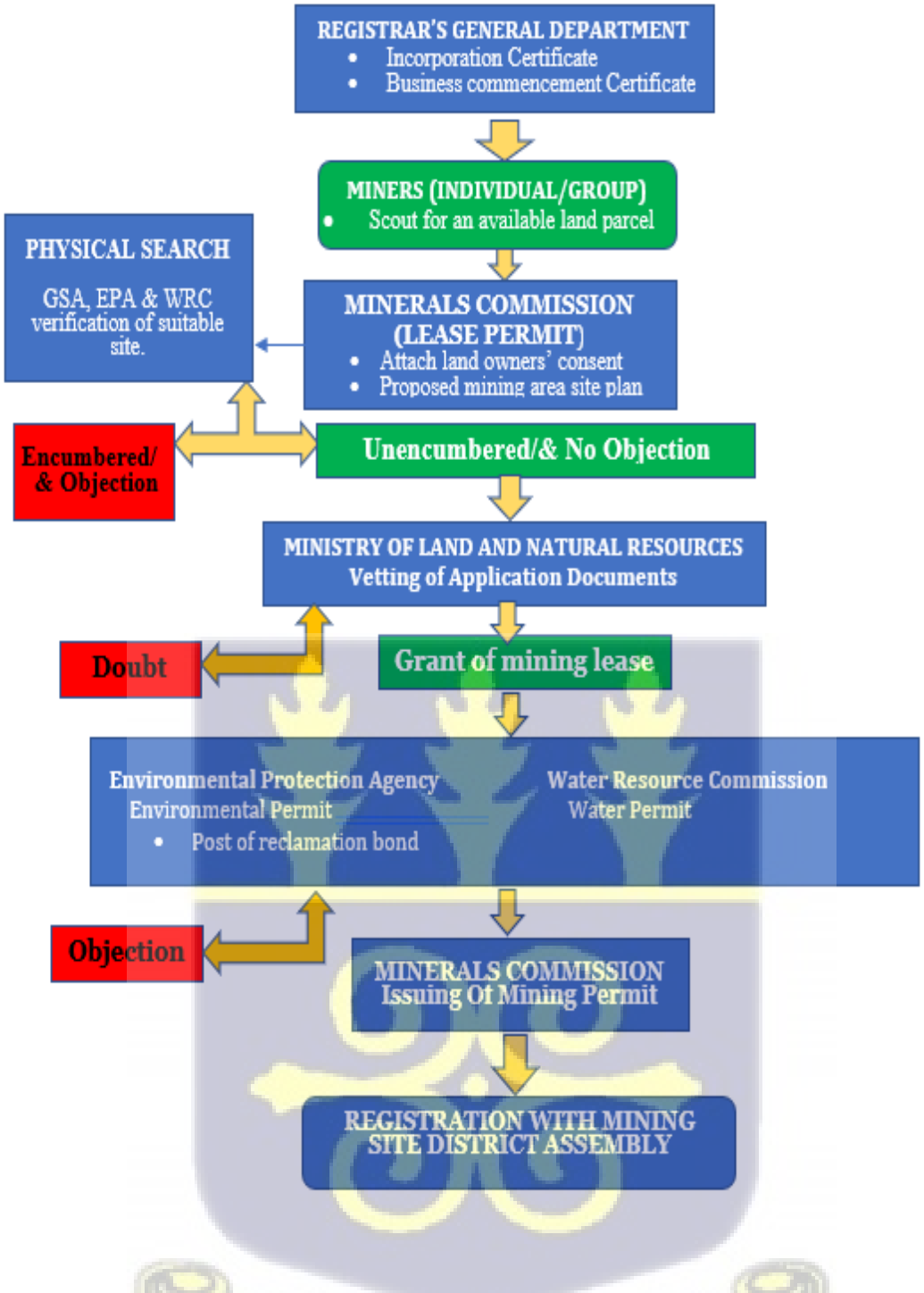

Figure 6.2: Proposed mining permit acquisition process diagram

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In furtherance to rethinking approaches to small-scale mining permitting and licensing regimes, this study recommends a reduction of small-scale mining permitting and licensing duration from five years to two years. This study shows that the duration of mining rights as against 'actual' required periods for mining is not in accord. Numerous issues (addressed above) arise due to the disconnect between how long a small-scale miner possesses rights to mine against the quantity of gold available per allocated concession. By reducing the period of effectiveness of permits and licenses to practically observed and workable durations, a simple but efficient way of preventing its associated challenges (mainly permit misuse by Ghanaians for foreign mining engagements), can be largely curbed. In instances where the permitting and licensing duration reduction may prove a challenge, this study calls for a stakeholders' consultative approach to developing a refined typology of mining – medium scale mining. Medium scale mining shall primarily focus on increasing mining concession sizes from the 25-acre block allocation, as is the case with small-scale mining, to a minimum of 100 acres. It shall ensure that the technological capacity of small-scale miners regarding accessible gold deposits can yield sustainable operational outcomes within allowable permitting and licensing validity periods. However, this reassessment of mining concessionary allocation must employ the current Community Mining Scheme framework provisions to ensure best practice and sustainable results.

Thirdly, critical institutions such as the EPA, Minerals Commission, and Lands Commission, among others, must promptly review coordination mechanisms. The cumbersome nature of permitting and licensing processes, often characterized by ignorable bureaucratic hurdles, only exacerbate illegalities within the SSM sector. To boost small-scale miners' interest in supporting the formalisation of the SSM sector, business transactions of all kinds must be timely, straightforward, and accessible. A well-coordinated mechanism among regulatory agencies provides the required impetus for comprehensive

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delivery of requirements of mandates. By so doing, institutions do not have differing views or judgments about projects, hence, facilitating effective enforcement actions. Also, a review of the coordination arrangements for SSM mining regulation shall help tackle traditional authorities' marginalization challenge. Their proper integration into the bigger scheme of regulatory actions shall allow for more practical approaches to combating illegal SSM as a sense of ownership and power to influence SSM projects becomes available.

Also, the steps and procedures in acquiring a mining license and permits need to be reformed. The practice norm that the concessionaire applies to MC and through the MLNR before the applicants come to the EPA for an environmental permit should be modified. It is recommended that; the application should be referred to the EPA for an intern to undertake the preliminary environmental survey. That is where they can bring in the WRC to look at the water bodies and then the geological services. At this stage, an objection or no objection notice can be raised. When the EPA gives no objection notice (greenlight) to MC as to that particular application, the whole process can start. The applicants will not waste money and time through all the process later to be rejected on environmental concerns. However, if the EPA decides not to object to it, they send a notice of a no objection, then they can now go ahead and grant the concession. That is where the concessionaire can go back to the EPA with the requisite tools needed. In this way, the concession area will be free from all negativities. The study recommends a modification in the procedures of license application.

Again, there is a need to improve capacity-building initiatives among small-scale miners. Largely, poor education and expertise among small-scale miners regarding sustainable mining practices threaten sound environmental mining practices within the SSM sector. It is in the interest of Ghanaians if regulatory agencies intensify capacity-building activities on the ‘dos and don’ts’ of SSM among small-

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scale miners. It prevents, among others, cases of wrongful acts perceived as right from a miner's viewpoint. It also allows for evaluating workable technologies that can green the SSM value chain. The capacity-building process serves as an opportunity to implicitly undertake a needs assessment, which shall help regulators develop and implement adaptable (and not 'perceived to be adoptable') interventions for small-scale miners across the country. Logistical, human and financial resources must be made available to ensure the success of such initiatives.

Lastly, governmental interventions which seek to push small-scale miners onto other streams of income generation should considerably match the revenue-generating capacity of SSM. Despite its associated dangers, many engage in SSM due to the possible financial benefits one may gain. In seeking to migrate small-scale miners sustainably onto Alternative Livelihood Programmes, critical actors should reconceptualize these interventions' benefits or profit margins. It is crucial to provide a worthy financial justification to small-scale miners about why quitting an unsustainable mining business and opting for environmentally-friendly livelihood options is gainful. Furthermore, achieving practicality concerning alternative livelihoods provides a scalable solution that may be adaptable in other mining communities resulting in increased environmental well-being and overall community health.

6.4 The study's contribution

The study's contribution to the scientific body of knowledge may be classified into two categories based on the findings: theoretical and empirical contributions.

6.4.1 The study's contributions to the theory

Theoretical and conceptual concerns related to policies, laws, and small-scale mining have been examined first. A large amount of literature has been evaluated in the framework of policies,

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regulations, and mining in the small-scale mining business. Though the policies, laws, and small-scale mining principles have been updated and scientifically recognized, they are not universal. The study's abstract concepts are unique and practical since they include important challenges and aspects in the small-scale mining sector in developing nations like Ghana.

By developing a standardized test on legal and regulatory weaknesses or gaps that may have led to illegal small-scale mining, institutional capacity to enforce mining policies and legislations, other factors encouraging illegal mining despite legal and regulatory regimes, and community perceptions of illegal small-scale mining, the study has made significant contributions. The study successfully adapted previously created and evaluated scales to fit the Ghanaian circumstances. On the other hand, these scales are unique in that the research has changed and included new dimensions and indications. The scales were created in response to recent developments in the global and Ghanaian small-scale mining industries. The scales that have been designed will aid in the improvement of small-scale mining in Ghana. The scales have been confirmed to be dependable after passing a comprehensive reliability test. It improves the scales' capacity to adopt and implement in other developing nations.

Policies and laws in Ghana's small-scale mining business were examined practically and thoroughly. The review was based on factual data and findings from other research and all Ghanaian laws and regulations. All aspects of small-scale mining have been recorded. The study took a comprehensive approach to examining Ghana's small-scale mining industry's policies and laws. This highlighted the complexities that impact the long-term viability of small-scale mining in Ghana.

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6.4.2 Contribution to the empirical literature.

An initiative introduced in the study is the identification of indicators of policies and regulations, institutional arrangements, factors influencing illegal mining, and community perceptions of illegal mining in the small-scale mining industry from the perspectives of institutional and local stakeholders. The adequacy and breadth of the items on the numerous indications of illegal small-scale mining are eye-opening and can serve as a springboard for future investigation.

The results are also applicable to empirical research. It is crucial to identify the perspectives of both national and local parties involved in small-scale mining. These viewpoints are critical in strengthening Ghana's small-scale mining industry. The study's findings on the numerous elements that promote illegal small-scale mining provide a solid platform for further research.

6.5 Suggestions for further study

Based on the findings, the study suggests the following to guide further studies:

1. Further research should be conducted to investigate the effects of legal and policy gaps on the government's overall effectiveness and sustainability efforts to improve the operations of the small-scale industry.

2. Further studies also need to be carried out to explore innovative ways to improve stakeholder engagement in the small-scale mining industry.

3. Studies can be conducted on why local miners find it difficult to understand and appreciate legal and policies frameworks in the small-scale mining industry.

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There are differences in the perception of institutional stakeholders and community members on illegal mining that requires further examination.

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APPENDICES

Appendix 1: Map of Tarkwa Nsuaem Municipality

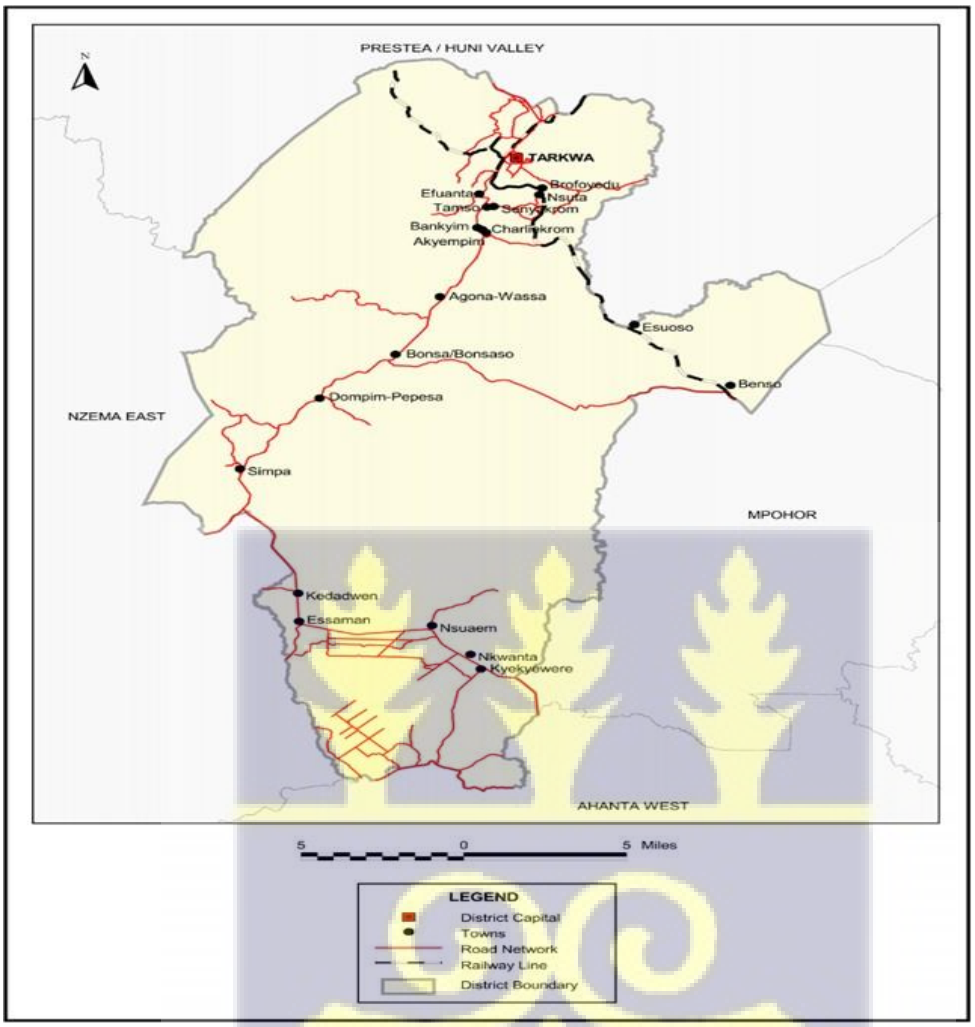

Figure I: Map of Tarkwa Nsuaem Municipal

Source: GSS, 2014a.

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Appendix 2: Map of Prestea Huni-Valley Municipal Municipality

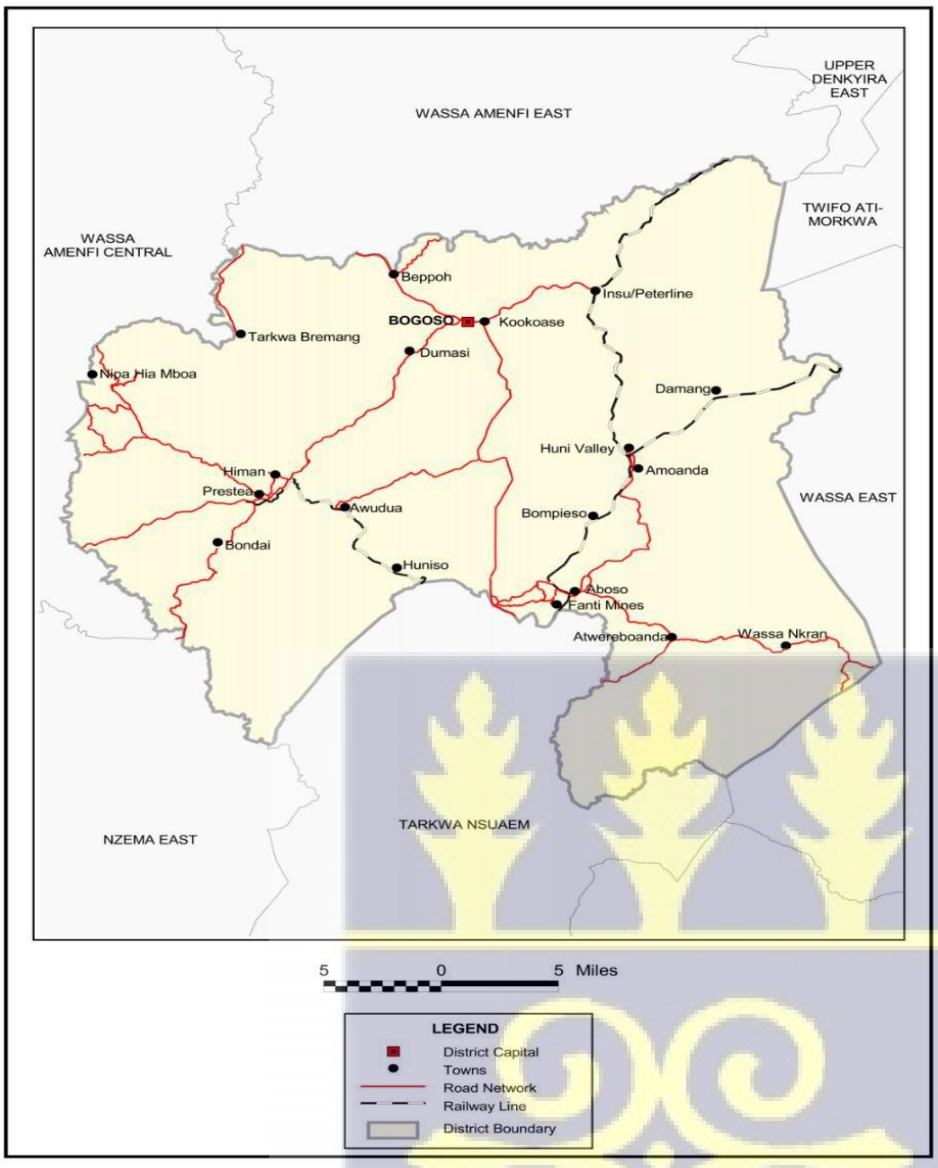

Figure II: Map of Prestea Huni-Valley Municipality

Source: GSS, 2014b.

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Appendix 3: Map of Wassa Amenfi East Municipality

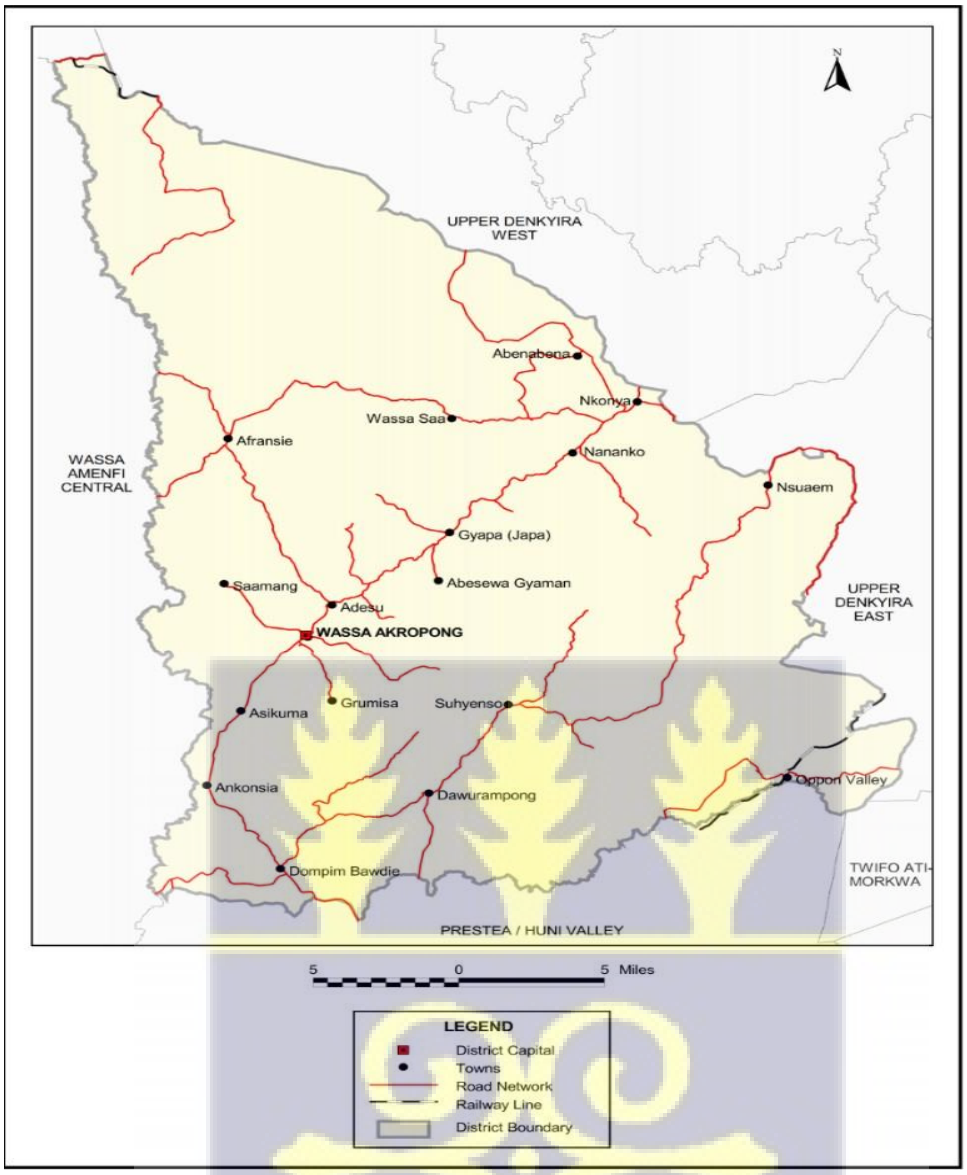

Figure III: Map of Wassa Amenfi East Municipality

Source: GSS, 2014c

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Appendix 4: Map of Atiwa District.

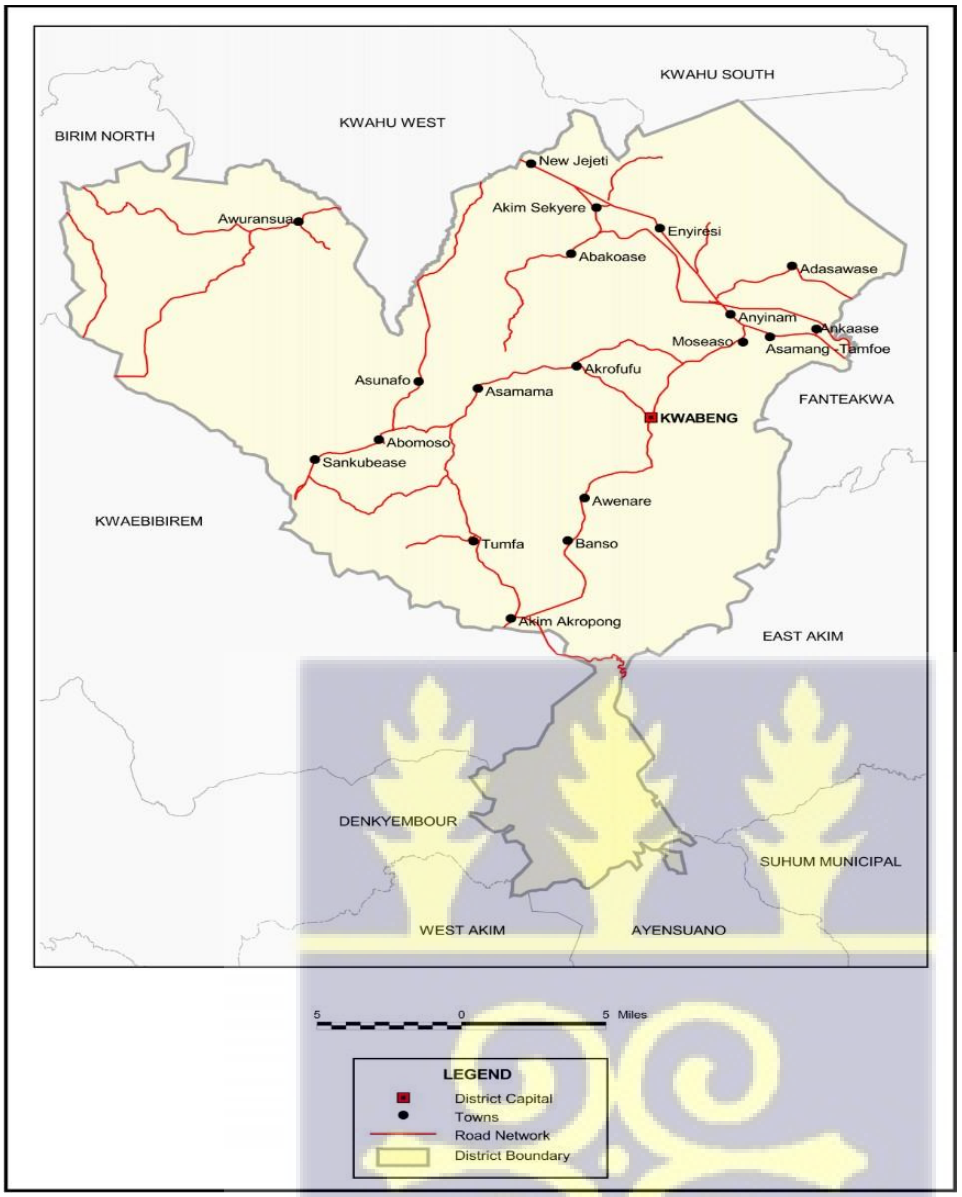

Figure IV: Map of Atiwa District.

Source: (GSS, 2014d)

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Appendix 5: Map of Atwima Mponua District.

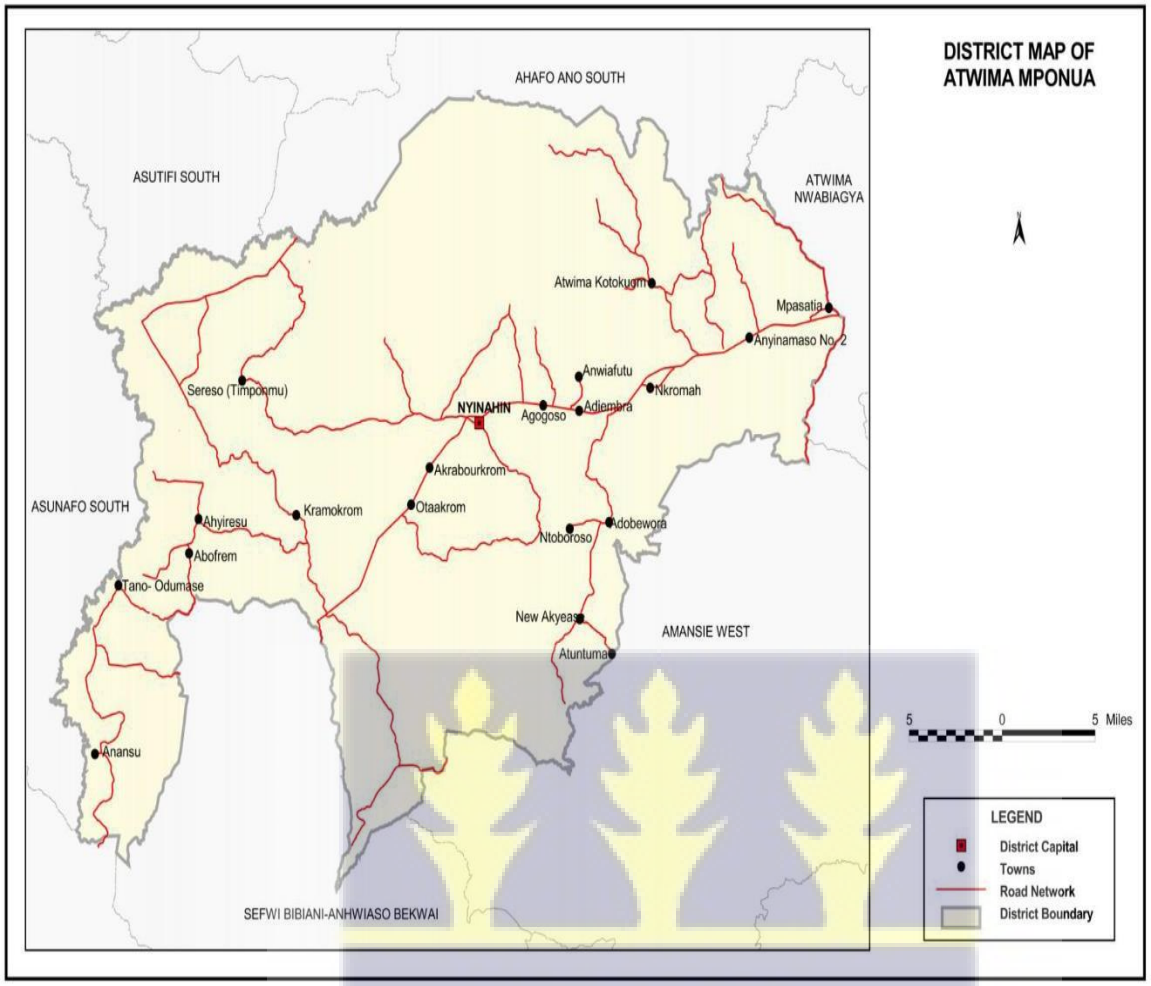

Figure V: Map of Atwima Mponua District.

Source: GSS, 2014e

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Appendix 6: Map of Amansie West District

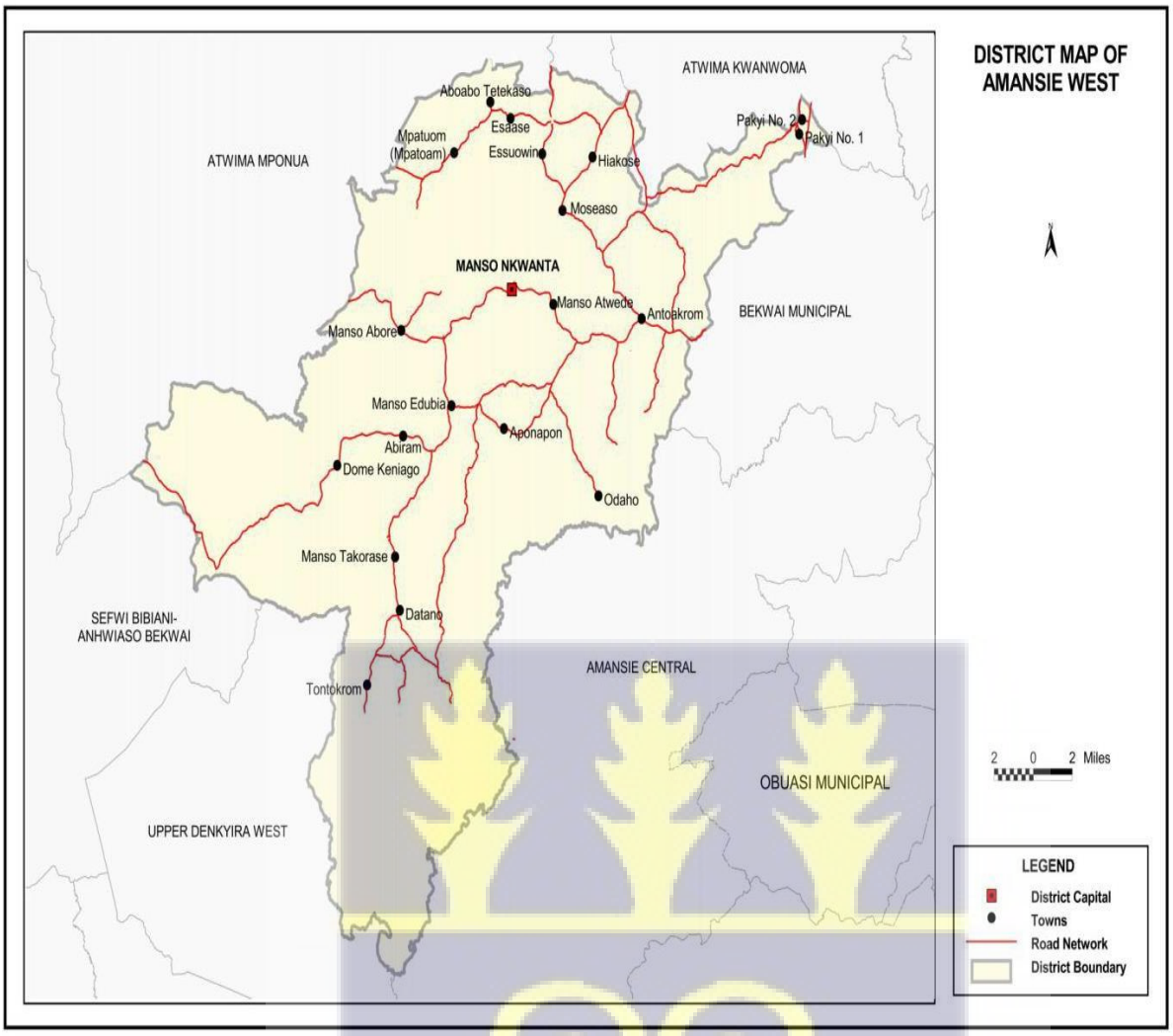

Figure VI: Map of Amansie West District.

Source: GSS, 2014f

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Appendix 7: Map of Talensi District

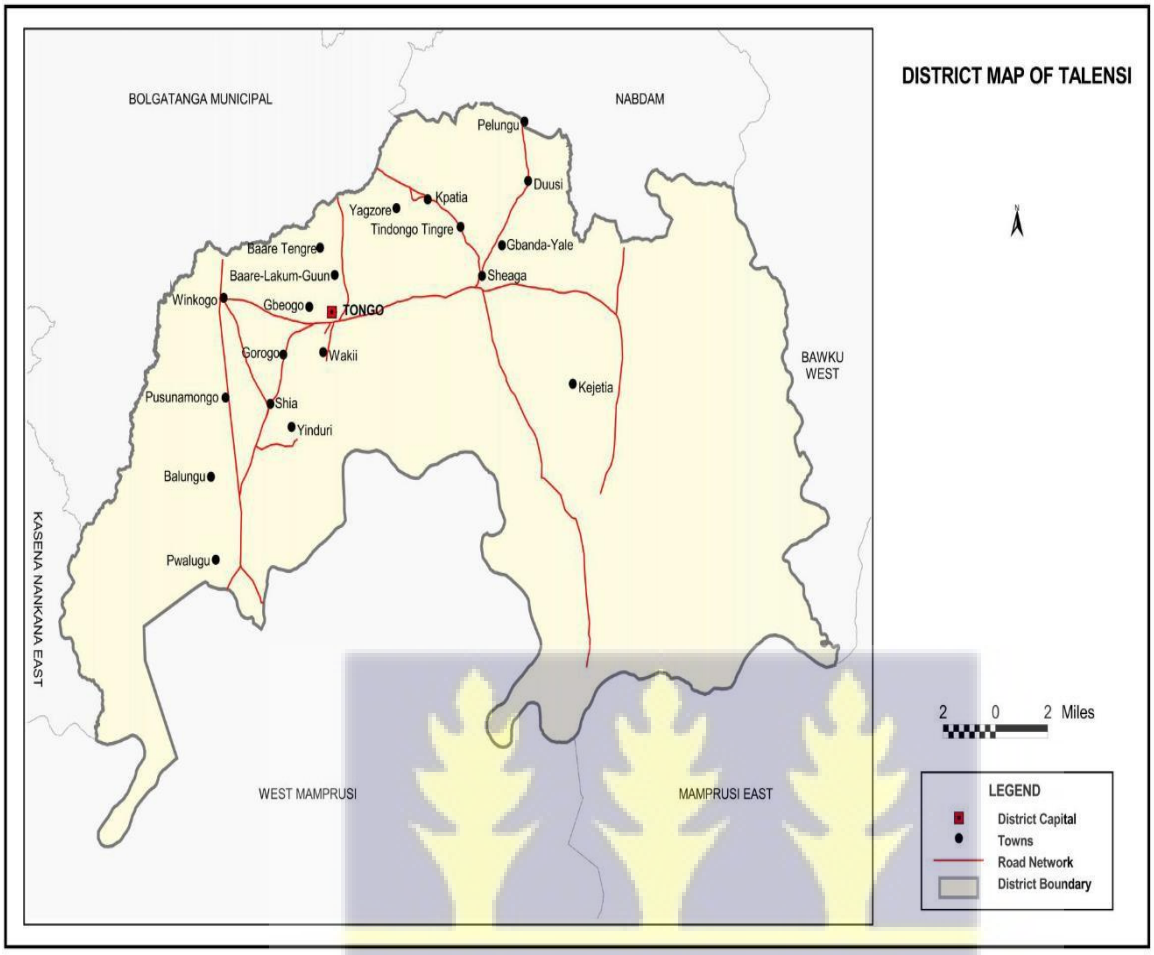

Figure VII: Map of Talensi District.

Source: GSS, 2014g

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Appendix 8: Focus Group Discussion Guide

Policy And Legal Challenges That Promote Illegal Small-scale Gold Mining and Hinders Its Formalisation in Ghana.

Focus Group Discussion Guide (Illegal Small-scale Miners) [Duration: 30-45minutes]

Date:___/____/ ___ **Translator / recorder name: _____**

Town/Community/District: _____

Note-taker:_____

Location: _____

Start time: ____: ____ **End time: ____: ____**

Number of male participants: _____

Number of female participants: _____

Pseudonyms / IDs for participants and seating chart

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Introduction

A. **Demographic data**: Participant number, age, length of stay within the sector, location, ethnic group, religion, the highest level of education attained, occupation/role (specify), marital status. (NB: To be completed on a separate sheet)

B. **Introduction** (Researcher's name, institution, and purpose for the FGD), sign the consent form.

C. **Ice breaker**: Ask participants about their wish for something good for the remaining months in 2021 and why they wish for that

1. What was your first experience in mining? (Tease out: date, venue, type of mining, etc.)
2. How do you carry out your mining activities? (Tease out: activities of the miners, equipment used, chemicals used, sources of water, mining sites)
3. Why do you engage in mining? (Tease out: motivation of miners)
4. Has mining helped you in any way? (Tease out: benefits)
5. What are some of the challenges in your mining activities?
6. How do your mining activities affect development? (Environment, social, economic (smuggling of gold, non-payment of tax, undervaluation))
7. What are some of the laws and policies regulating your activities? (Let them describe)
8. What do you think are affecting the implementation of these laws and policies?
9. What are the institutions that regulate your mining activities?
10. What are some of the functions they perform?
11. What do you think are affecting their performance?
12. How have these laws and institutions assisted you in your mining activities?

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13. What do you think can be done to attract all illegal miners to small-scale mining? [policy, institutional, support,]

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Appendix 9: Interview Guide.

Policy And Legal Challenges That Promote Illegal Small-scale Gold Mining and Hinders Its Formalisation in Ghana.

In-depth Interview and Key Informant Interview Guides (Policymakers, CSOs, Regulators and Enforcers) [Duration: 30-45minutes]

Name of Facilitator: ……

Location/Region: ……...

Date: …….

Time: Started…… Ended……

Introduction

A. **Introduction**: (Researcher's name, representative and purpose for the IDI/KII)

My name is.....I am a Research officer for Hon. Kokofu working on the research in relation to SSM. Today I would like to have a conversation with you. As you are you aware, they have been laws and policy to regulate activities of SSM however, the country still observes illegalities in the mining industry, which has so many negative effects on the environment and the lives of community members. So, we will be having a conversation regarding Policy and Legal Challenges That Promote Illegal Small-scale Gold Mining and Hinders Its Formalisation in Ghana.

We will only share the information we learn today in a general way and in a way that does not reveal your identity as a participant. With your permission, I would be recording our

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conversation. I really want to hear what you have to say and want you to feel comfortable in answering questions however you want to. There are no right or wrong answers.

The interview should last for [insert amount of time].

Please do you have any questions before we begin?

Demographic data:

i. Participant ID number…….

ii. Age (Give range)

…….

iii. The highest level of education attained……

iv. Institution……

v. Position in institution (specify)……

vi. Length of stay within the sector……...

vii. Marital status……

Knowledge of Existing Policies and Laws Governing Small-scale Mining (SSM)

i. Can you please tell me the role your institution plays in mining policy development and implementation in Ghana?

[**Probe** for institution-related roles and their expected responsibilities in SSM]

ii. Please what specific policies and laws govern SSM activities in Ghana.

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[**Probe** for policy name/title, the purpose of the policy, year in existence, how thementioned specific policy is currently being implemented]

iii. How would you describe the scope/comprehensiveness of SSM policies and laws in Ghana?

[**Probe** for how broad the policy is if it captures important factors within the mining sector and its effectiveness etc.]

iv. Please tell me about the relationship between your institution and small-scale miners in Ghana?

Perception about Policy and Legal Gaps Contributing to illegal mining

i. How does the mining policy in Ghana describe illegal and SSM?

[**Probe** for misrecognition such as small-scale miners being viewed as villains or illegaletc.]

ii. In your view, do you think institutions and regulatory bodies in the mining sector contribute to illegal SSM?

[**Probe** for specific gaps and challenges that contribute to illegal and SSM in Ghana]

iii. Are there guiding principles within the mining policy of Ghana to ensure and promote safe mining of mineral resources in Ghana? Please tell me about them

[**Probe** for how adaptable they are, if the implementation of these guidelines is effective,what the bottlenecks in the implementation of these guidelines are]

iv. What do you think about the mining policy and institutional contributions to illegal and SSM?

[**Probe** for legal gaps that may have contributed to SSM, such as delay in acquiring legal documents, etc.)

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Perception about Institutional Weaknesses in illegal mining management and Formalisation

i. What views do you have regarding illegal SSM formalisation in Ghana?

[**Probe** for benefits of SSM such as economic, reduction of illegal activities that destroys community lands and water bodies etc.]

ii. Please tell me about institutional challenges that are affecting illegal SSM formalisation in Ghana?

[**Probe** for institution-specific challenges based in interviewee's institution that hindersSSM formalisation]

iii. Can you please tell me about the communication channel between your institution and small-scale miners/illegal miners in Ghana?

[Probe for existing means of communication between regulatory bodies and SSM/illegal miners, how effective they are etc.]

iv. What are your views on current measures being put in place to combat illegal mining in Ghana?

[**Probe** for specific measures, their effectiveness and challenges, their sustainability etc.]

v. In your view, what institutional gaps exist in illegal SSM and affects its formalisation in Ghana?

Knowledge of Sustainable Development Goals and link to SSM policy in Ghana

i. Please, what roles does your institution play in achieving Sustainable Development Goals within the mining sector of Ghana?

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[**Probe** for specific SDGs that relate more to the mining sector, e.g., SGD 9, 11, 13 and 15]

ii. Do you think the current state of Ghana's mining sector can contribute to achieving SDGs?

[**Probe** further]

iii. Can you tell me about how the mining policies in Ghana protect safe mining in communities? How are these policies implemented?

[**Probe** for instances such as appropriate compensation from land acquisition, public disclosure of environmental performance by mining companies, not mining close to water bodies, not using harmful chemicals in mining]

iv. What other ways do you think the mining sector in Ghana can work towards achieving SDGs

[Recommendation]

Recommendations on addressing institutional gaps and SSM formalisation in Ghana

i. What do you think can be done about institutional challenges and gaps in SSM management?

ii. What measures do you think the government can put in place to address institutional gaps contributing to illegal mining? [Specify any specific gaps that were earlier mentioned]

iii. How do you think illegal M can be formalised in Ghana (mining institution of Ghana)?

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THANK YOU FOR YOUR TIME AND CONTRIBUTION!!!

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Appendix 10: Questionnaire

No	Questions	Responses
	SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS	
1.	Region	[1] Ashanti [2] Eastern [3] Western [4] Upper East region
2.	District	***If Ashanti Region*** [1] Atwima Mponua [2] Amansie West ***If Eastern Region*** [3] Atiwa ***If Western Region:*** [4] Tarkwa Nsuaem [5] Amenfi East [6] Prestea /Huni Valley ***If Upper East Region***

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		[5] Talensi
3.	Community	……..
4.	What is the age of study respondents in completed years?	…….
5.	Sex of study respondents	[1] Male [2] Female
6.	Marital status	[1] Never married [2] Currently married [3] Formerly married
7.	Highest level of education	[1] No formal education [2] Primary [3] JHS/JSS/ Middle School [4] SHS/SSS/VOC./TECH. [5] Tertiary
8.	School drop-out?	[1] Yes [2] No
9.	Household size	…….
10.	Number of dependents	…….

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11.	Relationship to the household head	[1] Household head (HH) [2] Spouse of HH [3] Child of HH [4] Parent of HH [5] No Relationship [6] Others (Specify) ……
12.	Are you a foreigner from another country?	[1] Yes [2] No

13.	If a foreigner, what country are you from?	……..
14.	If not a foreigner, are you a native of the community?	[1] Yes [2] No
15.	If no, are you from the same region of the community	[1] Yes [2] No
16.	If no, what region are you from?	……..
	SECTION B: SOCIO-ECONOMIC AND METHOD OF MINING-RELATED CHARACTERISTICS OF STUDY RESPONDENTS	
17.	Methods of small-scale miner ***(Select all that apply)***	[1] Anomabo methods [2] Chisel and hammer [3] Underground method [4] Dig and wash method [5] More blade method [6] Changfa method [7] Dredge method [8] Alluvial washing plant [9] Others (specify)

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		…….
18.	Role of the respondent.	[1] Small-scale miner [2] Support worker (security, trader, etc.) [3] Others (specify) ……..
19.	**Economic activity before small-scale mining**	[1] None [2] Street hawker/trading [3] farming [4] Okada rider/driver [6] Labour work (Mason, carpentry, etc.) [7] Skilled work (Mason, carpentry, etc.) [8] Monthly income before small-scale mining. [9] Others (specify) …….
20.	Monthly income from small-scale mining	…….
21.	Are you currently involved in other economic activity other than scale mining?	[1] Yes [2] No
22.	**Other economic activity currently involved in**	[1] None [2] Street hawker/trading [3] farming [4] Okada rider [6] Labour work (Mason, carpentry, etc.)

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		[7] Skilled work (Mason, carpentry, etc.) [9] Others (specify) ……
23.	Monthly income from other economic activities	……
	SECTION C: FACTORS LEADING TO ILLEGAL SMALL-SCALE MINERS	
24.	Do you have a family member who also works as small-scale miners?	[1] Yes [2] No
25.	If yes, how many family members are also small-scale miners	……
26.	How were you first introduced to small-scale mining?	[1] A family member [2] Work colleagues [3] School friends
		[4] Others (specify) ……
27.	**What was the main reason you joined small-scale mining?** **(Select all that apply)**	[1] For the money [2] Because of my friends (peer influence) [3] I had no job (unemployment) [4] Others (specify) ……
	SECTION D: PERCEPTION OF SMALL-SCALE MINER ON THE EFFECT OF ILLEGAL MINING ON THE ENVIRONMENT	
28.	Small-scale illegal mining leads to water pollution	[1] Yes [2] No
29.	Small-scale illegal mining leads to agricultural depletion	[1] Yes [2] No

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30.	Small-scale illegal mining leads to extinctions of aquatic lives	[1] Yes [2] No
31.	Small-scale illegal mining leads to injury and death	[1] Yes [2] No
32.	Small-scale illegal mining has negative implications on the health of people within the community	[1] Yes [2] No
33.	Small-scale illegal mining leads to air pollution	[1] Yes [2] No
34.	Small-scale illegal mining leads to noise pollution	[1] Yes [2] No
35.	Small-scale illegal mining has a negative effect on endangered species in the forest	[1] Yes [2] No
36.	Small-scale illegal mining has a long-term negative effect on the livelihood of people in the community	[1] Yes [2] No
37.	Small-scale mining has a long-term health effect on small-scale miners	[1] Yes [2] No
	SECTION E: PERCEPTION OF SMALL-SCALE MINERS ON THE MANAGEMENT OF ENVIRONMENTAL AND HEALTH IMPACT OF MINING IN GHANA	
38.	Collaboration among government agencies	[1] Yes [2] No
39.	Formation of small-scale miner's association	[1] Yes [2] No
40.	Provision of alternative water sources	[1] Yes [2] No
41.	Education on environmental hazards	[1] Yes [2] No

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42.	Education on health hazards	[1] Yes [2] No
43.	Others (specify)	…… …… …… …… …… ……

SECTION F: AWARENESS OF THE POLICIES AND LAWS GOVERNING SMALL-SCALE MINING

Please answer these questions to your best of knowledge on the mining laws (rules & regulations) youknow in Ghana;

44.	Are foreigners allowed to be engaged in small-scale mining?	[1] Yes [2] No
45.	Can miners mine in the water bodies?	[1] Yes [2] No
46.	Can less than 18 years old be engaged in mining activities?	[1] Yes [2] No
47.	Can I mine in a reversed forest?	[1] Yes [2] No
48.	Can I mine within 100meter (buffer) from water bodies if there is a lot of gold in that zone?	[1] Yes [2] No
49.	Have I flawed the law if I export my gold mined and sold by myself?	[1] Yes [2] No
50.	Can a miner use mercury to mine for more gold?	[1] Yes [2] No

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51.	Do I need a permit before I can mine on a piece of land?	[1] Yes [2] No
52.	Do I have to reclaim (cover) the land after mining?	[1] Yes [2] No
53.	Can any person mine without a mining lease?	[1] Yes [2] No
54.	Do I have to do reconnaissance & prospecting before mining?	[1] Yes [2] No
55.	Should one renew licenses every five years?	[1] Yes [2] No
56.	Do I have to pay royalties to the state on my revenue acquired through my mining activities?	[1] Yes [2] No
57.	Small-scale mining is permitted only in Minerals Commission-designated zones.	[1] Yes [2] No
58.	Is it law for Minerals Commission's District Office to supervise and monitor small-scale mining activities and operations?	[1] Yes [2] No
59.	Is it law for Minerals Commission's District Office to coach and teach Small-scale miners to conduct successful and efficient mining operations?	[1] Yes [2] No
	SECTION H: OTHER RELATED ACTIVITIES INVOLVED IN SMALL-SCALE MINING	
60.	What are some of the dangers you face as a small-scale miner?	[1] Loss of lives from the pit [2] Loss of lives from other persons [3] Being arrested [4] Mining related illnesses

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		[4] Others (Specify) ……
61.	Do you or your boss make payments *(in the form of bribery)* to any public official?	[1] Yes [2] No
62.	If yes, what type of public officials do you make such payment to? ***(Select all that apply)***	[1] The police [2] The military [3] The galamsey task force [4] District assembly member [5] A chief [6] Others (specify) ……
63.	On average, how much is made for such payment (bribery) at a go	……
64.	How frequent is such payment?	[1] Daily

		[2] Weekly [3] Monthly [4] Quarterly [5] Yearly [6] Others (specify) ……
65.	Do you think reducing the activities of small-scale miners is the right thing to do?	[1] Yes [2] No
66.	If yes, give reasons …… …… …… ……..	

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67.	If no, give reasons …… …… …… ……..	
68.	Do you plan on leaving the small-scale mining activities any time soon?	[1] Yes [2] No
69.	If yes, give reasons …… …… …… ……..	
70.	If no, give reasons …… …… …… ……..	
71.	How soon do you plan on leaving the small-scale mining activities?	[1] In a year time [2] In 2 years [3] In 5 years [4] In 10 years [5] Never [6] Others (specify) ……..

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Appendix 11: Plates

Plate 1: field data collection (FGD), 2021

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Plate 2: field data, 2021-Stakeholder engagement

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Source: Graphic Online.

Operation Vanguard making arrest, seizing weapons and equipment of illegal miners in Ghana

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