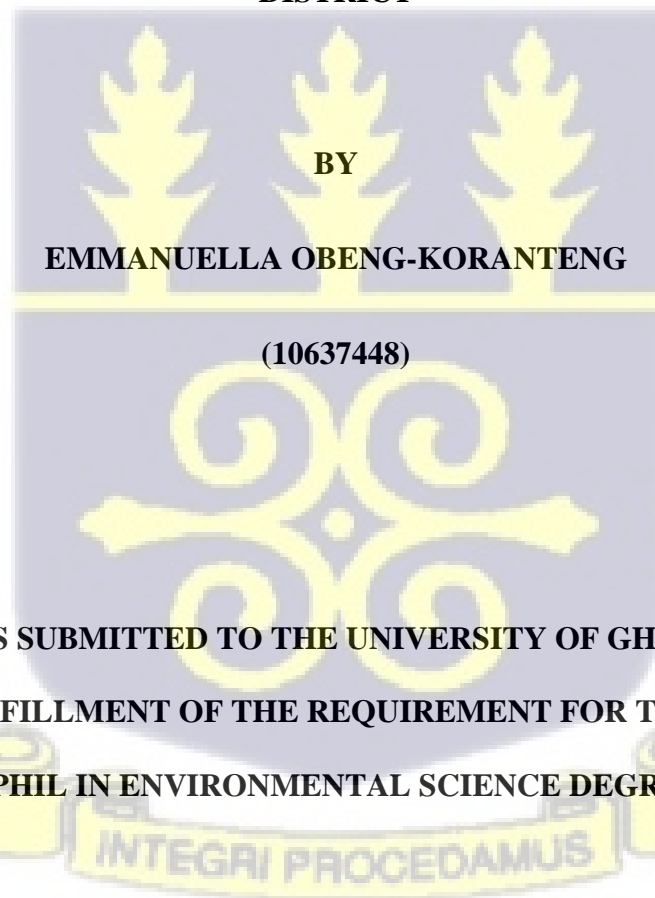


UNIVERSITY OF GHANA

COLLEGE OF BASIC AND APPLIED SCIENCE (CBAS)

**COMPLIANCE WITH MINING RECLAMATION POLICIES IN THE ATIWA
DISTRICT**



**THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN
PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF
MPHIL IN ENVIRONMENTAL SCIENCE DEGREE.**

INSTITUTE FOR ENVIRONMENT AND SANITATION STUDIES (IESS)

NOVEMBER, 2020.

DECLARATION

I, Emmanuella Obeng-Koranteng, hereby declare that this thesis is the result of my original research except for references duly acknowledged and has been undertaken under the supervision of Dr Opoku Pabi and Dr Jesse Sey Ayivor, both of the Institute for Environment and Sanitation Studies (IESS), University of Ghana.



16th September, 2021

.....
EMMANUELLA OBENG-KORANTENG

.....
DATE

STUDENT



16th September, 2021

.....
DR. OPOKU-PABI

.....
DATE

PRINCIPAL SUPERVISOR



16th September, 2021

.....
DR. JESSE SEY AYIVOR

.....
DATE

CO-SUPERVISOR

ABSTRACT

Environmental governance in the extractive industry has seen many reforms especially due to the activities of both illegal and legal small-scale miners. There is no doubt that mining contributes significantly to the nation's economy though the process has adverse impacts that need to be addressed. Reclaiming abandoned mine pits is one way of mitigating the impact of mining. In spite of this, the level of compliance implementation has not been evaluated. The study sought to assess compliance with mining reclamation policies in the Atiwa District, specifically, to review mining regulations; evaluate the role of stakeholders and the level of compliance; examine the extent of landscape degradation and ascertain community perception of reclamation in the District. A total number of 387 questionnaires were administered to generate the requisite primary data. Remotely sensed data were also used to determine the extent of environmental damage. Context analysis was used to analyze data for the review of regulations and the role of stakeholders and chi-square tests for community perception. A major observation was the wanton environmental destruction by mining activities resulting in abandoned open pits, pollution of the Birim River and the destruction of the vegetation. This was the result of unspecific reclamation regulations and technical language used in policy formulation. The study further revealed a generally low level of compliance of stakeholders to mining regulations. Some weaknesses that emerged include challenges in enforcement and allegations of bribery and corruption. The study concluded that with pragmatic policy formulation and the engagement of all stakeholders, there would be a win-win situation to ensure sustainable development. Suggested recommendations include formulating specific mining reclamation policies that are transparent; collaborating to undertake extensive research on reclamation; legally recognizing the Tributer system and sensitization of affected communities on their rights regarding the granting of social licenses.

DEDICATION

To my Mum and Dad, Lucy and Nana Obeng-Koranteng.

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LIST OF ABBREVIATIONS

ASM	Artisanal and Small-Scale Mining
CHRAJ	Commission on Human Rights and Administrative Justice
EAR	Environmental Assessment Regulation
EPA	Environmental Protection Agency
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EUFL	European Union Forest Law
FC	Forestry Commission
GIS	Geographic Information System
GDP	Gross Domestic Product
GSS	Ghana Statistical Service
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
IFC	International Finance Corporation
IMF	International Monetary Fund
KPMG	Klynveld Peat Marwick Goerdeler
LI	Legislative Instrument
LSM	Large-scale Mining
MC	Minerals Commission
NGO	Non-Governmental Organization

NCCE	National Commission for Civic Education
PNDCL	Provisional National Defence Council Law
REDD	Reducing Emissions from Deforestation and Forest Degradation
RSA	Reclamation Security Agreement
SSM	Small-scale Mining
UK	United Kingdom
UN	United Nations
UNCED	United Nations Commission on Environment and Development
UNCSD	United Nations Commission on Sustainable Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Sustainable environmental and natural resource management is key to the overall development of every society. Natural resource exploitation particularly mining has become an important economic activity since the pre-colonial times (Dauda *et al.*, 2013). Minerals are natural resources used by man in many ways for socio-economic development (Amponsah-Tawiah & Dartey-Baah, 2011). The minerals and mining sector provides materials for road construction; fertilizer production; manufacturing of hospital equipment; production of computer hardware; manufacturing of satellites and other countless aspects of human endeavour (Bach & Sundst, 2014). Sustainable environmental and natural resource management, particularly mining, is critical for holistic development (Aryee,2014).

Globally, mining makes an important contribution to the livelihoods of more than 11 million people (Shure *et al.*, 2011). Revenue generated from mineral exports boosts local economies, especially by using local content (Amponsah-Tawiah & Dartey-Baah, 2011). Mine workers are also able to raise enough income to cater for the educational and health needs of their families and other household expenses. Taxes accrued to the government are used for undertaking developmental projects such as road construction, infrastructural development, the supply of electricity and potable water, especially to rural communities. Many developed countries whose economies hinge on the mining sector, such as Australia, Canada and Sweden have benefited immensely from the sector directly and indirectly (Amponsah-Tawiah & Dartey-Baah, 2011).

In Australia for instance, gold production accounts for 8% of the economy and contributes to 40% of the country's export earnings (Australian Trade Commission, 2011). Again, the Australian mining industry provides direct and indirect employment for about 200,000 and 600,000 people respectively (Minerals Council of Australia, 2018). Mineral reserves from mining in Africa constitutes more than 30% and contributes more than 10% in Gross Domestic Product (GDP) (Smith *et al.*, 2019). The case is not so different in Ghana where the mining sector employs more than 1 million people from the small-scale sector and about 27,000 people from the large-scale sector (McQuilken & Hilson, 2016). In Ghana, revenue from Artisanal and Small-Scale Mining (ASM) increased to 28% in 2011 from 2.2% in 1989 and 16.3% in 2017 (UNDP, 2017).

Despite the numerous benefits the mining sector provides, the negative impacts are alarming. In Africa, generally, poverty and hunger in the rural areas have led many subsistence rural dwellers to engage in unsustainable mining activities. Mining is viewed as the perfect avenue to get rich quickly (Dubiński, 2013). Unsustainable mining has many adverse environmental impacts. Eroded sediments laced with heavy metals, for example, obstruct aquatic activities, alter the landscape and mar the aesthetic nature of the land (Drechsler, 2001). Destruction of the landscape creates abandoned open pits that serve as death traps to affected communities in many mining areas (Drechsler, 2001 ; Akabzaa & Darimani, 2001; Aryee *et al.*, 2003 ; Bach *et al.*, 2014 ; Bagah, 2016; Batool *et al.*, 2018).

Social effects of Small-Scale Mining (SSM) on neighbouring communities are also of much concern. Conflicts usually abound where there is an encroachment on concessions of large-scale companies (Luning, 2014 ; Opoku-Mensah & Okyere, 2014). Many mining communities record unusually higher cases of teenage pregnancy as young girls are lured into sexual activities. This disturbs the cultural setting and increases the spread of sexually transmitted diseases such as

HIV/AIDS and gonorrhoea (McQuilken & Hilson, 2016). Robbery and other social vices are also common occurrences in these communities as a result of the high standard of living (McQuilken & Hilson, 2016).

The process of mining involves different stages, including prospecting, exploration, site preparation and clearing, active mining, reclamation and closure (IFC, 2007). Each stage produces distinct environmental impacts which can persist even after closure (IFC, 2007). There are two (2) main types of mining in Ghana. These are Small-Scale Mining (SSM) and Large-Scale Mining (LSM). Major distinctions between these two types of mining include the scale of operation, types of equipment employed in the extraction and processing of minerals as well as capital investment (Bagah, 2016). Artisanal Small-Scale Mining (ASM) has no definite definition but can be said to employ rudimentary tools in their operations and are labour-intensive (Bagah, 2016). ASM can be formal or informal. Formal ASM and LSM are licensed, have an environmental permit and comply with the mining laws unlike the informal ASM popularly known as “*Galamsey*” which only has “Social License” to operate but not by law (Shure *et al.*, 2011). They are not regulated, do not adhere to any mining law and as such, pose serious environmental threats to mining communities. The Small-Scale Mining Law of 1989 legalizes ASM (PNDCL 218). The sector employs more than 1 million people and indirectly supports about 4.5 million others (Akabzaa & Sekyire, 2007; Ayee, 2011).

As compared to LSM, ASM mining involves low capital investment and less sophisticated machinery. Hilson (2002a) reported that approaching the end of 2002, some LSM companies adopted a means of successfully co-existing with small-scale operators by leasing portions of the land to them. These are sections of their concessions that are uneconomical to mine on a large-

scale (Hilson, 2002a). This mining arrangement is called the Tributary System and the miners who work on these leased lands are called Tributers (Hilson, 2002a).

The Minerals Commission accepted this method and as such, companies like Great Consolidated Diamonds, Goldfields Ghana Limited and Bogoso Gold Limited began to patronize it. These companies had about 4,000 Tributers (Amankwah & Anim-Sackey, 2004). Tributers use tools like pickaxes, hammers, sluice boxes, shovels, water pumping machines and pipes, trommels, excavators and mechanical bulldozers for their operations (Amankwah & Anim-Sackey, 2004). The ore, which is excavated manually, is crushed with the hammer or jawbreakers, washed in the sluice boxes and gold concentrates removed. It is then cleaned and amalgamated in pans (Hilson, 2002a). For very small amounts of ore excavated, blowing is used to separate the dust particles from the gold deposits (Hilson, 2002a).

Many Ghanaians prefer to operate informally due to barriers such as insufficient land space, financial constraints and bureaucratic bottlenecks involved in obtaining licenses (McQuilken & Hilson, 2016). Unfortunately, small-scale informal mining is unregulated and leaves devastating effects on the environment as aforementioned. Abandoned mine pits, in particular, have altered the landscape and in most cases, serve as death traps that have claimed innocent lives in these communities (UNEP, 2001). Reclamation of abandoned mine areas is therefore pertinent to restore the landscape to its acceptable environmental state to keep the ecological integrity of the land (Lamb & Gilmour, 2005). Good reclamation policies will enhance sustainable mining and engender sustainable development.

Sustainable development emphasizes the efficient use of resources now and for future benefits (Dubinski, 2013). This involves the economic, environmental, social and institutional pillars

(Dubinski, 2013). This is important in ensuring the enhancement of the 17 Sustainable Development Goals. These include goal 1 of reducing poverty ; goal 3 of promoting well-being at all ages; goal 6 of ensuring clean water and sanitation ; goal 8 of decent work and economic growth; goal 13 of climate actions ; goal 14 of protecting aquatic life and goal 15 of ensuring the efficient use and management of natural resources (Dubinski, 2013).

Against this backdrop, following public outcry to sustain the environment and restore sanity between miners and inhabitants, the Government of Ghana set up an Inter-Ministerial Tax Force/Joint Military Tax Force in 2017 popularly known as Operation Vanguard (Government of Ghana, 2018 ; Ghana Web, 2018 ; Today's Newspaper, 2018). Necessitated by some concerned journalists, the 400 member team was set up in response to addressing environmental impacts of the ASM sector especially in the hotspot areas within the Ashanti, Western and Eastern Regions of Ghana (Ghana Web, 2018). The team comprised of various enforcement agencies like the Police and Armed Forces. This was followed by a six-month ban on SSM activities across the country, seizure of some of the mining equipment and prosecution of some *galamseyers* (Ghana Web, 2018).

According to the Environmental Protection Agency LI 1652 of 1999, mining companies are mandated to provide a detailed Environmental Impact Assessment (EIA) stating how concessions are to be restored. Challenges faced by the mining sector revolve around legal and supervisory institutions (Hilson, 2002a ; Bansah *et al.*, 2016 ; Teschner, 2013). Under the Environmental Protection Act 1994, companies must comply with the conditions spelt out to ensure sustainability. This study focuses on the reclamation of abandoned mine pits in the Atiwa District and the level of compliance by miners with reclamation policies and legal guidelines.

1.2 Research Problem

Globally, reclamation has been proven to be an important tool in the restoration of ecosystems of mining areas and the adjacent communities particularly because of the enforcement of good reclamation policies and compliance (Hunt, 2013). In Ghana, like other countries such as Kenya, Australia and Canada, policies and legislations are formulated to regulate mining impacts (Government of Ghana, 1995 ; Addy, 1998 ; Australian and New Zealand Minerals and Energy Council, 2000 ; Clarke, 2000 ; Ayee *et al.*, 2011; Amoako-Tuffour, 2019). For instance, companies are expected by law to reserve a percentage of their revenue to reclaim abandoned mine pits to restore important ecosystem services per EPA regulations L1 1652, 1999 and Minerals and Mining Regulations LI 2182 (Ayee, 2011 ; Arthurs & Reay, 2014). Other policies include 1983 Economic Recovery Programme (ERP) ; Structural Adjustment Programme (SAP) ; EPA's Reclamation Security Agreement (Generic) ; 2012 Forest and Wildlife Policy ; Water Resources Commission Act 1996, Act 522 and the Riparian Buffer Zone Policy, 2013, Volume 2 (Ministry of Lands and Natural Resources, 2012). Since the introduction of ERP and SAP in Ghana in 1983, the mining sector continues to face challenges (Akabzaa & Darmani, 2001 ; Ofosu-Mensah, 2011). Generally, the impacts of mining have been widely researched on by many scholars (Hilson, 2002a ; Hilson, 2012 ; McQuilken & Hilson, 2016 ; Andrews, 2015).

Despite the existence of regulatory regimes, it is increasingly difficult in Ghana for mining activities to co-exist with indigenous communities that depend on the land for their livelihoods (Hilson, 2002a ; Thompson, 2015 ; Antwi, 2017). A plethora of assessments reveal the effects of mining on the environment, the health of affected communities and their livelihoods in Ghana (Akabzaa & Darimani, 2001 ; Hilson, 2002a ; Akabzaa, 2007; Hilson, 2012 ; McQuilken & Hilson, 2016 ; Aidoo, 2017). Brugger (2014) revealed that in the Amansie West and Denkyembuor

Districts, for instance, many farms have been destroyed. This is also the case in the Atiwa District where miners contact the traditional authorities and negotiate for the land without regard to the local people who depend on the land for farming activities (Bansah *et al.*, 2016).

Studies carried out in mining areas in Ghana indicate that after mining, the lands are usually left bare and unreclaimed (Hilson, 2012 ; Afriyie *et al.*, 2016 ; Amponsah-Tawiah & Dartey-Baah, 2011 ; Ansah, 2016 ; Bansah *et al.*, 2016). This deprives farmers of prime farmlands for farming activities leading to poverty as they lose their income. Reports by the media also indicate that the pools of water created from abandoned mine pits also become breeding grounds for mosquitoes besides being death traps (Citi FM Online, 2017 ; Today's Newspaper, 2018 ; Ghana Web, 2018). The result is that farmers become poorer because they lose their lands (Amponsah-Tawiah & Dartey-Baah, 2011). Farmers then move on to other uncultivated lands and the cycle continues (Amponsah-Tawiah & Dartey-Baah, 2011). The activities of illegal miners on encroached concessions of mining companies are difficult to monitor because they resort to operate at night to avoid government officials and local authorities in the District (Hilson, 2001 ; McQuilken & Hilson, 2016).

Very few studies have been documented on reclamation, specifically on abandoned open mine pits and policies that ensure compliance of mining regulations. Existing research work include that of AngloGold Ashanti on "Costed Reclamation Strategies at the Teberibie Mines" and Saman-Juaso and Newmont Ghana Limited on "Reclamation and Afforestation of Mined lands" (Tetteh *et al.*, 2015 ; Ansah, 2016). These studies reviewed mining reclamation strategies with details on the acreage of land that could be reclaimed, the financial commitment to undertake reclamation activities according to the Reclamation Security Agreement and the expected duration of the projects.

Despite these obvious challenges to compliance implementation, research focuses largely on impacts. Not much emphasis has been placed on compliance and regulations, the effectiveness of regulatory bodies and local authorities and the subsequent impacts on affected communities. In view of this, the question is, what is the level of compliance to mining entities with these regulations? What are the weaknesses and barriers in regulations that undermine compliance implementation? The provision of answers to these questions will help address the weaknesses in the policies, legislative instruments and implementation strategies that result in weak compliance and subsequent impacts on the environment and communities.

The Atiwa District of Ghana has experienced intense mining activities with several reported cases of negative environmental as well as socio-economic impacts in the area (Eastern Regional Coordinating Council, 2016). Such adverse impacts include the destruction of farmlands and the landscape; pollution of the Birim River ; abandoned open pits that serve as death traps ; the upsurge of teenage pregnancy and sexually transmitted diseases; social vices like drug abuse and theft (Eastern Regional Coordinating Council, 2016). This study, therefore, addresses the level of compliance with the reclamation policy requirements. The study was centred on four communities, Kwabeng, Bomaa, Akrofufu and Akwabuoso.

1.3 Research Objectives

The main objective of the study was to assess compliance by mining companies with mining reclamation policies in the Atiwa District. The ultimate aim was to enhance theoretical understanding and inform policy decisions.

The specific objectives for the study were:

- To review the existing policy and legal framework on reclamation in the country.
- To assess the level of compliance and the role of public agencies and institutions.
- To examine the extent of damage caused by abandoned mine pits .
- To analyze the perception of the people on reclamation and the impacts of mining.

1.4 Research Questions

- What are the existing policies and legal framework that address reclamation?
- What are the roles of institutions and agencies in ensuring compliance?
- What is the level of compliance of mining groups in the Atiwa District according to reclamation regulations?
- What is the extent of damage caused by abandoned mine pits?
- What is the perception of the people on reclamation of abandoned mine pits?

1.5 Research Hypothesis

The following hypothesis was proposed:

H₀: Non-compliance with reclamation does not affect the livelihoods of the people.

H₁: Non-compliance has negatively affected the livelihoods of the people.

1.6 Justification for the Study

Despite the establishment of various mining regulations like the Minerals and Mining Act, 2006 (Act 703), the Minerals Commission Act, 1993 (Act 450) and the Environmental Protection Act,

1994 (Act 490) (Akabzaa, 2007; Amponsah-Tawiah, 2011; Arthurs & Reay, 2014), environmental impacts of mining continue to be a major concern to the society. A major weakness is the lack of specific reclamation policies, technicalities used in policy documents and confidentiality of some information on the performance of mining companies (Hilson, 2001). Documentation of reclamation policies, practices and implementation strategies has been relegated to the background.

Key stakeholders in the mining sector are the Minerals Commission, EPA, Operation Vanguard Tax Force, Traditional authorities, small-scale and large-scale miners and community members. Some enforcement challenges faced include allegations of bribery and corruption, lack of collaboration, inadequate logistics, political interference and overlapping roles (Hilson, 2001; Bansah *et al.*, 2016). According to Bansah *et al.* (2016) and Teschner (2013), enforcement and monitoring of legal and small-scale miners are limited. Techner's work on a comparison between Goldfields, Tarkwa and Damang reveal that usually, the authority of traditional leaders are undermined and chieftaincy disputes ensue (Techner, 2013). This causes disunity and lack of cooperation in the affected communities due to poor accountability. Hence, investigating the level of compliance of stakeholders is important.

However, Hilson (2002a) and Dumakor-Dupey (2017) recognize that all types of mining have an impact on natural systems and livelihoods. Several media reports focus on ASM to the detriment of large-scale and legal mining impacts (Taylor, 2017 ; My Joy Online, 2020 ; Business and Human Rights Resource Centre, 2020). These reports indicated several cases of abandoned mine pits caving in and killing some artisanal small-scale miners and community members on LSM concessions in Paanyinikrom, Prestea and Anyanfuri in the Western and Central Regions

respectively (Taylor, 2017 ; My Joy Online, 2020 ; Business and Human Rights Resource Centre, 2020).

Many scholars argue about the lack of education, awareness and non-involvement of affected communities in mining activities (Hilson, 2001; Hilson, 2002a ; Hilson, 2002b ; Prno & Slocombe, 2012 ; McQuilken *et al.*, 2016). This makes it challenging for the people to cooperate and hold stakeholders accountable for the menace mining activities create in the District.

Extinct literature on reclamation policies and compliance of regulatory and enforcement agencies indicate recurring incidences of environmental impacts and livelihood issues in mining communities (Hilson, 2003 ; Hilson, 2004). This study would inform policy makers to formulate specific reclamation policies; assess the role of stakeholders in ensuring compliance and reduce adverse environmental impacts. Community members would also be able to hold stakeholders accountable for their actions. It is against this backdrop that this study sought to understand mining policies and compliance issues of miners in the Atiwa District of Ghana.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter discusses relevant literature that emerged in the course of the study. Some themes discussed include the sustainable development approach, theoretical framework, pre-requisites of compliance to mining regulations, reclamation and compliance. Environmental governance has been associated with many arguments by conservationists (Tetteh *et al.*, 2015; Pattberg & Biermann, 2008; Brian *et al.*, 2016). The sustainable development approach best serves as a foundation for solving the complex issues of our world.

2.2 Overview of Mining Policies in Ghana

Ghana, formerly known as Gold Coast, has a rich history of mineral endowment particularly gold accounting for more than 95% of mineral revenues (Arthurs & Reay, 2014). The mining sector currently contributes approximately 41% of total export earnings, 14% of total tax revenues and 5.5% of Ghana's Gross Domestic Product (GDP) (Ayee *et al.*, 2011). Ghana's economic challenges even as Africa's second-largest gold producer emanates from issues concerning institutions and the political environment (Ayee *et al.*, 2011).

2.2.1. Background to Ghana's Policy and Legal Framework

2.2.2 Pre-Independence

Mining in Ghana started as far back as the 14th century with small-scale gold mining (Akabzaa & Darimani, 2001). In the 15th century, during the Pre-Independence period, Ghana was credited with 36% of the total world gold output (Arthurs & Reay, 2014). Small-scale gold miners worked with rudimentary tools, in groups, on small concessions (Akabzaa & Darimani, 2001). This was until the establishment of large-scale gold mining by the British and the banning of private small-scale gold miners after the 1932 Mercury Law (PNDC Law 217) was passed (Hilson, 2002b). The Mercury Ordinance of 1932 was the first legislation passed by the British Colonial Masters, which made the use of mercury in small-scale mining illegal (Hilson, 2002b; Hilson & Haselip, 2004; Jonsson *et al.*, 2009). Though the Ordinance did not prohibit small-scale mining, the native Africans regarded it as an act ostensibly to turn gold mining into the preserve of Europeans since effective extraction of gold from the ore at the time was only by the use of Mercury (Akabzaa & Darimani, 2001; Hilson, 2001). Given this, there was not enough labour for the British to sustain the industry especially because many Ghanaians preferred to mine independently, with others more interested in other productive ventures like cocoa processing and industries (Hilson, 2002b). This resulted in the upsurge of illegal mining activities in the country (Akabzaa & Darimani, 2001 ; Hilson, 2002b).

2.2.3 Post-Independence

After Independence, the state gained ownership of all mineral resources from 1957 to 1986 (Akabzaa & Darimani, 2001 ; Tsikata, 1997 ; Addy, 1998 ; Darimani, 2001 ; Hilson & Haselip, 2004). Attempts to reinforce the ban on the use of Mercury were not successful because of land

ownership and livelihood issues. Later in 1966, Konongo was nationalized and the state subsequently took control of the Obuasi mine in 1972 (Hilson & Haselip, 2004). In 1983, there was general stagnation in the industry except in a few instances. The poor performance was due to uncertainty by investors investing in Ghana (Arthurs & Reay, 2014). This was especially because there was not enough foreign exchange to acquire spare parts for mining equipment, machinery and other logistics. Performance of the industry had been dwindling with public outcries of health, safety and changes in the ecosystem (Amoako-Tuffour, 2019).

Public concerns on the negative environmental and social impacts associated with underground mining began to build up after almost two decades of the Minerals and Mining Law PNDCL 153 was enforced (Minerals and Mining Law, 1986). Due to these, surface mining companies sprang up neglecting the traditional underground mines. They used advanced technology that had detrimental effects on the environment especially leaching of toxic chemicals. This required experts and soon after, the unskilled local people were laid off (Arthurs & Reay, 2014).

Frequent conflicts between mining companies and the communities also emerged over issues of resettlement and compensation. This was because the living conditions of the people began to deteriorate and corruption on the part of mining companies and the local authorities set in. Obtaining 'Social License' became an issue (Arthurs & Reay, 2014). Soon, communities began to lose trust in local authorities and became agitated. Traditional authorities also played the blame game of accusing the government of not giving them their fair share of proceeds from the mining activities in the form of royalties. This was to enable them to undertake developmental projects to better the lives of the people (Arthurs & Reay, 2014). The Ghana Chamber of Mines supported these arguments (Arthurs & Reay, 2014). Mining companies were confronted and they claimed to have been complying with statutory requirements but accused the central government of unequal

distribution of taxes and royalties at the local levels (Arthurs & Reay, 2014). Meanwhile, mining companies and artisanal miners continued squabbling over land space especially because of the statutory limitations small-scale miners could lease (Arthurs & Reay, 2014).

In Adansi West (Obuasi) and Wassa West (Tarkwa), most of the lands are either owned by large-scale mining companies or designated as forest reserves hence encroachment on these lands (Arthurs & Reay, 2014). Consequently, mining companies, the government and the communities had to bear the brunt because there appeared to be little provision for settling conflicts in the then mining code (Arthurs & Reay, 2014).

However, the early Post-Independence period saw many changes. Mining concessions were taken over to ensure national interest (UN, 1962). The government also had the power to suspend or terminate mineral rights for poor performance and acquire 51% majority shares in mining companies in the country. This was spelt out in the then Minerals Act 126,1962 (Amoako-Tuffour, 2019). Some problems encountered were a lack of clearly defined legal and fiscal regimes and deteriorating infrastructure (Amoako-Tuffour, 2019). This made maintenance and rehabilitation of mines extremely difficult (Amoako-Tuffour, 2019). Early 1980, there was no significant investment in the industry and little support from the government.

In 1980, developing countries began to formulate structured policies to attract foreign investors and promote public participation as required by the World Bank and IMF (International Monetary Fund) (Akabzaa & Darimani, 2001). Some conditions attached to this new development were: good geological conditions; a good legal framework and structured policies. It was until 1983 that the Small-Scale Mining Law (PNDCL, 218) was enacted to legalize the use of mercury in the country (Akabzaa & Darimani, 2001). In 1983, the Economic Recovery Programme (ERP) and

the Structural Adjustment Programme (SAP) was launched to create more jobs and attract private investors (Ofosu-Mensah, 2011). Due to this, small-scale mining became operational but only with the acquisition of licenses and concessions of not more than 25 acres (Hilson, 2001; Ykovlena, 2007). This decision encouraged some mining companies to either restructure to expand their operations (Ashanti Goldfields Limited) or seek financial assistance from foreign donors (Tarkwa and Prestea Gold Mine) (Amoako-Tuffour, 2019). Some of the requirements for SAP were rehabilitation of state-owned mines (Akabzaa & Darimani, 2001).

However, there were two groups of miners, namely legal and illegal small-scale miners working on concessions of large-scale mining companies. It became difficult distinguishing between operations of the two groups because of difficulty in obtaining licenses (Amankwa & Anim Sackey, 2004). Activities of illegal small-scale miners began to thrive as a result of critical weaknesses in policies, bureaucratic processes of obtaining a license and lack of jobs, especially in the rural areas (Hilson & Potter, 2003; Ofosu-Mensah, 2011; Banchiriga, 2008).

Gold mining forms a significant part of Ghana's economy (Arthurs & Reay, 2014). Over 29,000 people in the large-scale mining industry and about one million in the Small-scale mining industry benefit from gold mining in Ghana (Arthurs & Reay, 2014). Total gold production was at its peak in 2012 (Arthurs & Reay, 2014). Despite this, challenges such as environmental pollution as well as the inability of state institutions to monitor and ensure compliance with laws and regulations remained (Amoako-Tuffour, 2019).

2.3 Reclamation and Compliance

Lamb & Gilmour (2003) emphasize that mine closure involves filling back mine voids, re-contouring, topsoil management and revegetating the land to reduce the adverse impacts of mining on the environment (Hayes, 2015; Abd Rashid *et al.*, 2015). Compliance, according to Aronson (2007), is the act or ability to adhere to or act in conformity with an established rule, principle or guideline. It is the mandate of an organization to obey its internal and external policies (Aronson, 2007). Also, regulations and enforcement are practical measures to prevent people from violating regulations. Environmental governance is defined by Agyemang & Castellini (2015) as the application of policy instruments by an organization to ensure the achievement of their objectives in a transparent way that is efficient and effective involving all stakeholders. These stakeholders include International Organizations like Food and Agricultural Organization, World Health Organization and United Nations Environment Programme (UNEP) (Agyemeng & Castelli, 2015). This also includes Non-Governmental Organizations (NGOs) and other multilateral financial institutions like the World Bank and International Monetary Fund (IMF). Good environmental governance is therefore crucial in ensuring compliance (Agyemeng & Castelli, 2015).

Mining is a process that begins with discovering the location of a mineral deposit, its economic value, processes to extract them and closure as well as rehabilitation of mined-out sites (UNEP, 2001). These can be undertaken after mining operations, once a concession has been worked on. Reclamation should be planned before the core mining activity. This should consider the use of environmentally friendly technology and the capacity of the company to comply with the regulations at each stage (Siddarth,2004). This should also be spelt out in the Environmental Impact Assessment (EIA) and the Environmental Management Plan (EMP) submitted to the EPA (Asiedu,2013). Reichenauer & Germida (2008) agree that reclamation involves filling back pits

appropriately; draining water out of trenches; restoring soil properties (depending on the end-use of the land) and tree planting or afforestation programmes (Yeldell & Squires, 2016). Reclamation centres on pit areas, tailings dams, haul and access roads and waste dumps (DOW Jones Inc.,2020). However, this research focused on pit areas because of the nature of the problem.

2.3.1 Reclamation Strategies

Types of reclamation programmes include natural recovery, assisted restoration or a combination of the two methods (Tordoff *et al.*, 2000 ; Li, 2006). According to Asiedu (2013), the successful reclamation of previously mined lands takes at least 5 years. Poor planning of these practices warrants failure right from the onset (Asiedu, 2013). Natural recovery methods deal with leaving the land fallow to regain its fertility after mining activities have taken place (Sheoran *et al.*,2010). When the topsoil is stripped off, it should be well stored to reduce the risk of erosion and the ability to lose its fertility (Sheoran *et al.*,2010). Additional chemical or natural components like manure or compost could be added to it to increase its fertility (Sheoran *et al.*,2010). Assisted restoration could also be undertaken by using topsoil from dugout pits to fill concurrent mining pits or by introducing nitrogen-fixing plants (Kuter, 2013; University of Wyoming, 2020; Pecharova *et al.*, 2011).

In many industrialized countries, affected groups serve as watchdogs to mine managers to undertake reclamation exercises as required by the law (Smith, 2007). In Australia, according to Smith (2007), the Beenup Mine which has been successfully reclaimed, emphasizes the end-use of abandoned mines if reclamation should be effective. McMahon & Sheldon (2002) stated that if mining is not seen as temporary land use, reclamation would be far-fetched. Lessons derived from the Beenup Mine assert the importance of community participation and the end-use of mined land.

Misima Gold Mine in Papua New Guinea is also a case of successful mine closure (Smith, 2007). Couman (2002) unveils that aside the engagement of the communities in the mining process, reclamation, to a large extent depends on specific legal requirements. Again, even though mining regulations are sited specifically, Couman (2002) and Michael *et al.* (2015) agree that reclamation requirements are broad.

At AngloGold Ashanti, Iduapriem mine, reclamation has been successful over the years (Arhinful & Agyei, 2017). This involved two main processes such as recontouring and revegetating the landscape according to Arhinful & Agyei (2017). The EPA Act 490 (1994) and LI 1652 (1999) was adhered to, as a reclamation bond between the EPA and the company was signed. Also, nitrogen-fixing tree species used in the reclamation process were *Acacia magnum*, *Gliricidia sepium*, *Senna siamea*, and *Leucaena leucocephala*. Adopted practices employed included earthworks, construction of drains to control erosion and afforestation (Arhinful & Agyei, 2017).

According to the EIS (Environmental Impact Statement) of the Akyem Gold Mining Project, the reclamation practice should involve regrading roads and monitoring the reclamation success apart from the aforementioned for AngloGold. Reclamation activities taken into consideration were topsoil management, regrading and revegetation. It was also noted that for water in open pits to synchronize with conditions of the surrounding water, it could take up to 200 years (MESTI, 2019). The company introduced fishes into pit lakes to feed on mosquito larvae (MESTI, 2019). This was done to reduce the incidence of malaria in affected communities. At Teberebie Goldfields Limited, miners used the self-regulation approach and submitted all the necessary reports to the EPA (MESTI, 2019). EPA inspected the site just once in two years (MESTI, 2019). Inadequate logistics, therefore, posed a challenge for the EPA in carrying out mine inspection (Domfeh, 2003). Moreover, disseminating information on best reclamation practices also remains a challenge

(Sheoran *et al.*, 2010). This is due to the unique features of each landscape through a few standard procedures. Factors that must be considered during the reclamation process include describing the constituent of overburden and waste, restoring land capacity by backfilling with topsoil, landscaping to controlling soil erosion and planting techniques (Luo & Tu, 2018).

2.3.2 Topsoil Management and revegetation

Topsoil management is important in reclamation and rehabilitation because it usually contains the necessary nutrients for plant growth (Reinhardt & Kuhlemeier, 2002). In undertaking small-scale gold mining, the vegetation is cleared and topsoil removed and separated from the subsoil to be used later for reclamation as it is nutrient-rich (Reinhardt & Kuhlemeier, 2002). Sublayers are usually dug to a depth of about 1 meter (Yelpaala & Ali, 2005). Asiedu (2013) asserted that topsoil and subsoil in Ghana are usually mixed in the case where topsoils are too thin. The aim of topsoil management is primarily for the landscape and vegetation to blend with the surrounding natural environment. The slope should also not be too steep to encourage runoff or too gentle to retain much water (Asiedu, 2013). Mustapha (2013) proposes ways to protect topsoil from erosion to preserve it properly. These include removing the topsoil after clearing before actual mining starts, piling topsoil in a designated area and creating embankments around the piled topsoil to prevent erosion (Tardoff *et al.*, 2000).

Fast-growing nitrogen-fixing species (grasses and legumes) increase the organic matter and nitrogen content of the soil at the initial stages (Conesa *et al.*, 2007). This controls erosion and provides fuelwood for medicinal purposes. After about two to three years, mixed species of local and exotic origin are cultivated to test the stability of the soil (Lamb & Gilmour, 2005). Indicators for measuring revegetation include physical, chemical and biological properties, plant vigour and

resistance. For example, in AngloGold Ashanti, tree species like *Leptaspis cochleata*, *Streptomyces gerontogea*, *Centothena spp.*, *Cyrtococcum spp.*, *Olyra latifolia*, *Oplismenus spp.*, and *Panium* are used (Arhinful & Agyei, 2017). Asiedu (2013) in his attempt to describe usual reclamation practices in Ghana realized that most of these activities are undertaken close to water sources, slopes usually do not exceed 30° and pits are backfilled.

2.3.3 Prerequisites of Compliance

The Environmental Protection Agency (EPA) requires an Environmental Impact Assessment Report (EIA) during and after mining activities (Arhinful & Agyei, 2017). One reason for this is to ensure public participation in the development planning process (Arhinful & Agyei, 2017). That way, mine workers are put on their toes. An EIA report and mine closure plan must be submitted for a license to be issued to start operations and this must include a reclamation bond (Arhinful & Agyei, 2017). Therefore, reclamation security agreements are a pre-requisite for acquiring licenses taking into consideration the capacity of the mining company to carry out the said reclamation plan stated in its Environmental Management Plan (EMP) (Clarke, 2000).

In some countries like the United Kingdom (UK), United States of America (USA), Australia and Canada, there are detailed and comprehensive mine closure plans enacted in specific environmental legislation (Clarke, 2000). In Clarke's findings, countries were grouped according to mining reclamation policies or documents. In the various groupings, there were many similarities (Clarke, 2000).

Countries in Category A included the USA, UK, Australia and Europe. In these countries, there are specific environmental and social requirements that directly or indirectly affect mine closure.

In Category B, provision for mine closure depends on the age of the country's mining law, the activities of past mining companies and other related environmental policies. Clarke (2000) concluded that countries with old mining laws do not have provisions for mine closure. Typical of this is Chile. Others also only have general plans in their mining agreements. Mantey (2016), also established that Reclamation Security Agreement (RSA) between the environmental agencies and mining companies mandate them to provide security (financial bonds) to EPA as a guarantee against the company's reclamation on the issuance of a closure certificate. Countries like Latin America, Ghana, Burkina Faso, Zimbabwe and Zambia constitute this group. However, conditions prevailing in each mine has important considerations (Arhinful & Agyei, 2017).

Garcia (2008), also adopted compliance schemes according to the magnitude of environmental impacts. In Category A were projects with significant and irreversible environmental impacts, Category B with limited and usually site-specific impacts that can be mitigated and Category C with little or no environmental impacts. In Europe, USA, Peru, Chile, South America and Mexico, specific requirements, either in separate closure policies as single documents or embedded in the general environmental laws are overseen by distinct regulatory bodies (Garcia, 2008).

2.4 Theoretical Framework

2.4.1 The Sustainable Development Approach

The extensive use of our resources to the detriment of the environment necessitated the need for some environmental decisions (Behrens *et al.*, 2007). Attempts to address environmental degradation have led to the issuing of various declarations and laws at the national and international levels (NCCE, 2017). At the international level, arguments on the utilization and

management of the world's resources became apparent by the 'North' and 'South' (Sands, 2012). Seemingly, the North were primary polluters and consumers of these resources especially after being able to resolve largely, the challenges that arose from the elementary issues of poverty and increasing population faced by the South (Sands, 2012). Again, issues of equity and efficient allocation emerged. A consensus had to be reached to attempt to satisfy both parties by bestowing different responsibilities taking into consideration the environment and poverty, population growth and consumption of resources (Bringmann, 2009).

Sustainable development, as defined by the "Brundtland Report" is the efficient use of resources presently and for future benefits (Dubiński, 2013; Hunt, 2013). It is an umbrella term that includes environmental, social, economic dimensions and institutions and their means of implementation (Sands, 2012). Sustainable development is a continuous process (Dubiński, 2013). Sustainable development of mining, therefore, requires expertise and 'social licenses' to operate. This inspired the UN in coming out with the Sustainable Development Goals (SDGs 2015-2030) of which 10 out of 17 goals are environmentally related (Sands, 2012). Sustainable development revolves around four landmark conferences on environment and development. These are : the 1972 UN Conference on Human Environment (Stockholm Conference); the 1992 UN Conference on Environment and Development (UNCED, Rio Conference, Earth Summit); the 2002 World Summit on Sustainable Development (Johannesburg Summit) and the 2012 UN Conference on Sustainable Development (Rio+ 20) (Andresen, n.d).

Environmental sustainability implies that the rate of depletion should not exceed the rate of regeneration and natural growth (Brian *et al.*, 2016). Economically, the exploitation of resources, investment and technology should be coordinated to enhance both current and future generation potentials (Biermann *et al.*, 2009). Substitutes must also be considered and included in policies.

Institutions should also be empowered to make changes and enforce environmental laws because well-structured plans with effective institutions produce sharp results. Most importantly, in the centre of it all, mankind should enhance his living condition. The approach should be people-driven, that is, maintain the cultural identity of the people.

According to Sutinen & Kuperan (1999) and Hajer (2003), environmental policy making and compliance with regulations have been given little recognition. As such there are no standard models for compliance with environmental policies (Sutinen & Kuperan 1999; Hajer, 2003). Several theories propose an understanding of compliant behaviour (Levine & Tap, 1997; Becker, 1968 ; Bentham, 1789). These theories attempt to understand why some operators are compliant while others are not, weaknesses in adopted compliance methods and propose ways of breaching the gap. Some of these models apply psychological, sociological and economic systems or a mix of these systems.

2.4.2 Introduction to Psychological, Sociological and Economic Theories

From the psychological perspective, these theories embrace reasons for compliance based on moral grounds (Becker, 1968). The theories analyze criminal behaviour based on an individual's sense of what is wrong and what is right. These can either be inculcated by the individual's own deep belief and upbringing (Kohlberg, 1969; Levine & Tap, 1977). On the other hand, an individual's attitude based on societal or external influence affects his/her decision to comply with environmental regulations (Akers, 1985 ; Aronfreed, 1968, 1969 ; Bandura, 1969). In this sense, compliance becomes obligatory. In other words, the more compliant society is, the higher the level of compliance operators exhibit (Mischel & Mischel, 1976).

Again, the need to comply, as espoused by Alingham & Sandmo (1972) is likely to emerge from keeping a good name in society. Some operators prioritize having respect in society to avoid disruption with their activities. Operators believe that their compliance compels society to also comply with some of their activities. Sutinen & Kuperan (1999) and Becker (1968) argued that moral suasion does not always work with policy. They explained that, in instances where the belief systems of operators are not in alignment with policies, non-compliance is likely to occur. This is because, some of the policies may appear to the people as being unfair (Becker, 1968; Sutinen & Kuperan, 1999).

Some economic theories make use of deterrence models to establish the behaviour of violators to environmental regulations. In this case, criminal behaviour is juxtaposed to maximizing satisfaction with reasonable cost. In other words, non-compliance is likely to occur when the benefits derived from activities outweigh the environmental cost to comply (Smith, 1759; Bentham, 1789). Becker (1969) argued that the most potent economic measure for compliance is the imposition of penalties. However, critics believe that environmental penalties are not feasible and sanctions are not properly defined to encourage compliance with regulations (Ackers, 1985 ; Aronfreed, 1968).

2.4.3 Contemporary Theories

In recent times, modern, practical theories of compliance have developed. The one that gained popularity is the theory of Institutionalism (Rorie, 2015). The institutional theory was developed by John Meyer and Ryan Rowan in the late 1970s (Rorie, 2015). It explains institutional structures, their internal regulations and how operators respond to external policy requirements (Greenwood, 1996). According to Scott (2008), it is a theory based on accepted routine practices of operators in

institutions but with no standard or appropriate behaviour on compliance. The theory assumes that over time, all companies exhibit the same behaviour patterns (Scott, 2008). These processes can be categorized into three forms (Scott, 2008). These are a company's compliance with government regulations; a company copying best practices from its competitors and a company which initiates a change to promote professionalism (Scott, 2008). A much deeper understanding of the theory of Institutionalism was then proposed in the mid-1980s called Neo-Institutionalism (Greenwood, 1996).

Neo-Institutionalism was proposed by an American Political Scientist called James G. March and a Norwegian Political Scientist named Johan P. Olsen (Breuning & Ishiyama, 2011). This theory incorporates the need to examine institutional constraints in tailoring external regulations to a company's regulatory regime (Meyer, 1977). It is a more scientific and quantitative approach as compared to the theory of Institutionalism (Meyer, 1977). The theory used the Game Theory approach to explain its assumptions. Mirowski (1992) explained that two or more players anticipate decisions of their opponents to make rational choices out of self-interest to maximize satisfaction. The assumptions are that all players are rational and seek to maximize utility with limited available resources (Von Neuman & Morgenstern, 1944). This theory aimed to increase productivity by resorting to compensations and practical policies that firms can adopt to promote legitimacy (Meyer, 1977). Scott (2008), emphasized the blend of social, economic and political actors. The theory recognizes the power interplay between political actors acting out of self-interest as barriers that may hinder compliance with regulations (Scott, 2008). A major critic of Neo-Institutionalism is that it is skewed to the developed than the developing nations (Von Neuman & Morgenstern, 1944). However, Neo-Institutionalism still provides a rich theoretical framework for the study of human behaviour in organizational management and encourages

operators to make the most rational choices to increase productivity (Von Neuman & Morgenstern, 1944).

Again, others categorized compliance with environmental theories according to a regulatory approach (Fang *et al.*, 1994). This has been a traditional practice where compliance, monitoring and inspection is done by regulatory agencies or third party agencies (Fang *et al.*, 1994). In some jurisdictions like Canada and USA, regulatory agencies are given certain rights to internal documents and facilities of operators (Fang *et al.*, 1994). Inspectors can also summon or sanction defaulters according to the regulations (Fang *et al.*, 1994). In the USA, the Clean Water and Air Amendments of 1990 permits inspectors to retain that power. Some sanctions imposed include court orders, injunctions and prosecution (Fang *et al.*, 1994). Weaknesses with this approach include inadequate logistics resulting in lack of rigorous monitoring, enforcement, inspection and insignificant penalties imposed as compared to operator revenues (Minerals Commission, 2015).

2.4.4 Stakeholder Approaches

Four policy approaches have been considered in the literature (Tuokuu *et al.*, 2019). These approaches include Participatory Democracy, Discursive Democracy, Deliberative Democracy and Stakeholder Approach (Tuokuu *et al.*, 2019).

Participatory Democracy is hinged on equal citizen power with political actors (Webler, 1995; Palerm, 2000). However, critics describe this approach as unrealistic since all parties would have to be represented. The choice of whose voice matters and to what extent citizens have that power is a difficult decision to make and is likely to create marginalized fractions among the people (Danielson, 2015; Cotton & Mahroos-Alsaiari, 2015). Discursive Democracy, built on the

Participatory Approach, acknowledges dissenting views of all stakeholders in the decision-making process (Durnova *et al.*, 2016). Deliberative Democracy is also inclusive of marginalized groups. This approach persuades the minority to support their agenda (Fishkin, 1999; Barber, 2003). Critics argue about the lack of legitimacy in avoiding opposite views (Cohen, 1997). Lastly, the Stakeholder Approach realizes all stakeholders as superior, especially community members (Freeman & Velamuri, 2006). This helps reduce conflict of interest and promotes legitimacy (Curry *et al.*, 2013). The most common approach used is the Stakeholder Approach (Idemudia, 2014).

2.4.5 Compliance Testing

Levels of compliance testing have distinct interpretations. Some are analyzed based on the outcome, as is done by using the checklist presented in a qualitative or quantitative format, statistical or in the narrative (Gagnon, 1998). From the available information, the literature reviewed both the qualitative and quantitative approaches were used (Pinto *et al.*, 2017 ; Domfeh, 2003). There is more emphasis on understanding the concept and detailing criteria peculiar to each country and situation (Domfeh, 2003). Tetteh *et al.* (2015) also suggested measuring vulnerability assessment factors like internal policies adopted by the company and the probability that regulations may not be adhered to, regarding the nature of the regulation and the availability of resources in assessing compliance. Again, a new dimension by Parker (2000), explains not just the ability to comply with regulations but also, the willingness to comply or ensure self-compliance by way of economic incentives instead of robust and strict enforcement practices (compliance-oriented regulation).

Adopted for this study, research undertaken by Pinto *et al.* (2017) categorized compliance into four components. The level of compliance above 80% denoted high compliance; 60 to 79%, medium; between 40 and 59%, low and below 40% no compliance. This was adopted to give greater statistical validity to criteria used in the checklist.

2.5 Barriers and Enablers to Compliance

2.5.1 Barriers to Compliance

Barriers to mine closure can be attributed to failures in the environmental governance system, poor planning, legal and financial constraints and lack of social licenses. Anukwonke (2015), indicated the need for natural resources to be governed by the central government instead of being used as public or communal goods. Previously, policy makers did not consider environmental management as a necessity but rather a hindrance to economic growth due to the environmental cost involved (Aryee, 2014). It is rather disheartening that environmental governance is entangled with political power instead of the well-being of the populace (Anukwonke, 2015). Instruments like Sustainable Environmental Assessment (SEA) and Environmental Impact Assessment are key to ensuring effective and efficient monitoring of the environment in the long run (Aryee, 2014).

However, mining cannot be discussed without making mention of formalizing ASM because of encroachment on small-scale and large-scale mining concessions (Bagah, 2016). McQuilken & Hilson (2016) assert that the greatest challenges concerning unsustainable mining are lack of land, insufficient funds and the autocratic nature of acquiring licenses. Teschner (2013) notes that the Tributer system has gained popularity among large and small-scale miners. However, illegal miners encroach on their concessions (Teschner, 2013). The main idea is for small-scale miners to

mine in areas that are not economical for LSM, thereby creating a win-win situation for both parties (Techner, 2013). This has thwarted the contribution of LSM to society, resulting in increased environmental degradation.

The capacity of large-scale miners to their Tributers has reduced, posing challenges to government regulatory officials and host communities (Hilson, 2002a). This has resulted in additional environmental cost (Hilson, 2002a). Tributers pay one-third of their returns to the companies (Hilson, 2002a). This right conferred on small-scale miners by large-scale miners allows the transfer of necessary logistics and technical know-how to enable them to comply (Chandler *et al.*, 2017).

As innovative as this initiative may be, it is still not without constraints (Hilson, 2002a). This, if not well asserted would cause interventions to fail (Hilson, 2002a). He argued that the inability to implement interventions practically, considering the root causes has translated to the failure of Operation Vanguard (the Inter-Ministerial Task Force) in Ghana (Chandler *et al.*, 2017). Some notable barriers to compliance include allegations of bribery and corruption; lack of social licenses; lack of financial capacity; political interests; enforcement bottlenecks and unwillingness to comply.

Corruption is the use of public influence on private interest (NCCE,2017). It broadens the poverty gap and leaves many people worse off (Mashal, 2011). The most effective way of dealing with this canker is transparency and accountability in governance which usually reflects in the abuse and misappropriation of goods (Halkos & Tzeremes, 2014). Pope (2000) brought to the fore the bribing of those who monitor regulations and the degree of compliance. The weaker the institution, the more corrupt it becomes (Porta *et al.*, 2000). He also found that countries with strict environmental laws are less corrupt than their counterparts with relaxed laws. This is because, the cost of being

corrupt outweighs the benefits and therefore, an improvement in judicial systems and level of compliance is important. Rich natural-resourced countries often feed corruption from extraction (Damania, 2010). For instance, in Indonesia, according to a report by the World Bank (Hilson, 2004), politicians are bribed to acquire state concessions, overharvest and ignore inconvenient regulations. In Peru also, the Lima river which serves as a source of drinking water for about 70% of the population has been polluted due to bribery and corruption (Amacher *et al.*, 2012). Many companies are not held liable due to the lack of enforcement of environmental regulations and the best way to tackle this issue is through transparency and accountability (Leitao, 2016).

Again, lack of social licenses concerning the issue of participation in undertaking mining activities is one of the key areas that often emerge in the literature (Prno & Slocombe, 2012). This implies that people retain the power to coordinate and take part in projects that affect them directly or indirectly (Osei-Kojo *et al.*, 2018; Offori & Offori, 2018). This is a two-way communication system that is not just about informing the people or just educating them on the need for the project but to seek local knowledge, helpful to the sustainability of the project (Hunt, 2013).

However, there seems to be a consensus on engaging the people at the initial stages rather than on just informing and consulting them but Molefe (2006) proposes that the people be engaged at every stage. This creates a sense of belonging and an informal approval referred to as “Social Licence”. Aryee (2014) argued the case in Tanzania, that the final decision to allow miners to operate or award licenses rests on the local authorities and not the central government. Local authorities have every power to refuse or terminate the licenses of mining companies. In the case of Ghana, a license application can only be informally refused by the community but not awarded (Ankrah, 2017). According to Ankrah (2017), the power of chieftaincy in Ghana has been dwindling since the late 1900s. Most of them are brainwashed by greed and corruption (Ankrah, 2017).

Furthermore, inadequate financial capacity is another barrier to compliance. As mentioned earlier, the reclamation plan should include the financial capacity at each stage to minimize adverse impacts to ensure sustainability. Finucane & Pershke (2016) assert that financial commitments be made at an early stage and concurrently as environmental costs increases during reclamation. This would make monitoring and compliance easier. To reduce the financial burden on the community and mining companies, Khanna (2000) suggests that businesses or industries partner with the government in undertaking community development projects that are sustainable so companies can focus on revamping the adverse effects of their activities. Industry workers can also contribute in terms of managerial or other forms of expertise or practical training for miners. However, this can materialize if there is mutual understanding and the people retain their power in making inputs into decision-making processes (Hilson & Potter, 2003; Ofosu-Mensah, 2011).

2.5.2 Enablers to Compliance

Garcia (2008) establishes that the absence of specific and well-defined closure guidelines in some jurisdictions pushes companies to collaborate with international sources such as World Bank, International Finance Corporation and adopt other well established national and state-specific legislation. The basic goal of closure is to minimize negative environmental as well as potential impacts of mining to reduce financial risks to stakeholders (Garcia, 2008). The high cost has prompted awareness, especially of private mining firms more concerned about building and maintaining their reputation (Asiedu, 2013). All aspects of mining environmentally impacts on the inhabitants. This is because the closure of mines could take a longer time than the life span of the mine itself (Asiedu, 2013). Private firms also attract some financial aid from NGOs and international bodies to carry out effective mine closure. Also, they usually have enough funds to

carry out mass education of reclamation compliance and ensure alternative livelihood options for the people (Tetteh *et al.*, 2015).

2. 6 Impacts of Mining Reclamation on Natural Systems

Depending on the type of mining activity undertaken, impacts can become significant (Asiedu, 2013). Some factors include the nature of the ore, type of technology, extraction methods and the sensitivity of the local environment to the mining operation (Tetteh *et al.*, 2015). As an ecosystem, it is essential to consider both the biotic and abiotic components and their interactions on land, air and water bodies (Aryee *et al.*, 2003). According to the Australian and New Zealand Minerals and Energy Council (2000), the closure and rehabilitation of mines are essential to restore the physical, chemical and biological components of the ecosystem within mining concessions (Van Druten & Bekker, 2017). In the long-term planning of the mining activities, it should be noted that for as long as poverty exists, artisanal mining cannot be completely eradicated (Obeng *et al.*, 2015). Therefore, it is important to include them in policy formulation to maximize benefits and reduce their impact on society (Obeng *et al.*, 2015).

2.6.1 Impact on Vegetation and Wildlife

A study by Armstrong (2008) proves the reduction of agricultural productivity in gold mining especially where arsenic is used, the sulfide ore treated and cyanide tailings are left on land surfaces. In a case in the Ashanti Region, Obuasi, there is the physical detection of crop leaves wilting and discolouring on mine lands close to water bodies (Yirenkyi, 2008). In areas close to cocoa-producing farms in the Atiwa District of the Eastern Region, there is also the evidence of dropping of immatured pods and in the Western Region, the low yield is particularly a

characteristic of high rent and unfavourable land tenure systems posed by mining activities to farmers (Ansah, 2016 & Lahiri-Dutt *et al.*, 2014).

Again, unsustainable mining destroys the vegetation cover along with relevant species of biodiversity and slows down the activities of soil microbes to break down organic matter into soluble, usable forms (Ansah, 2016). When this happens, there is the release of excess carbon dioxide from vegetation and the soil because they act as carbon sinks (Mendez *et al.*, 2008). The case is not different in Ghana where many mining communities are devoid of vegetative cover and have lost their aesthetic value (Hilson, 2001). This has caused habitat fragmentation and loss of biodiversity. It is estimated that about 70% of the Tarkwa community land is being used for mining activities and 40% to 60% of concessions for various mine-related activities like tailings dams, treatment plants, open pits and waste rock dumps (Akabzaa, 2001).

2.6.2 Impact on Air and Water Systems

The air is polluted by the release of some harmful chemical substances like cyanide and arsenic used in extracting gold as well as noise pollution caused by heavy machinery used in blasting heavy rocks (Antwi, 2009). Noise, vibration, air pollution from drilling, dredging, excavation, levelling of pits, access roads, topsoil, blasting and waste rock dumping releases a lot of dust particles into the environment (Oruonye *et al.*, 2016). This particulate matter usually contains toxic gasses such as sulphur dioxide, carbon mono-oxide, nitrous oxide which causes respiratory tract infections and other breathing disorders (Akabzaa, 2001). Particulate matter settles on surfaces, are resident in the air and washed by rain into streams, inhaled by mine workers or people in affected communities (Siddarth, 2004 ; Oruonye *et al.*, 2016).

Water bodies from which communities depend on for drinking, washing, watering livestock and for household purposes are polluted, affecting those downstream (Serfor-Armah *et al.*, 2006). Heavy metals like arsenic, lead and cadmium are released into water bodies (Tetteh, 2010; Adetunde *et al.*, 2014). In the aquatic system, they bioconcentrate in fatty tissues of aquatic life, bioaccumulate, biomagnify and become injurious in the food chain way to the final consumer (Obiri *et al.*, 2010). This considerably affects the health of the people when they consume resources from the aquatic system (Antwi, 2009 ; Asiedu,2013).

2.6.3 Social and Health Impacts

Few developmental benefits have accompanied mining projects in host communities (Hilson, 2012). This is because they are not properly integrated into the system (Hilson, 2012). More mineral products are exported and mining inputs imported resulting in little or no value-added domestically (Hilson, 2012). The mining sites develop into little townships, attracting all manner of traders (Akabzaa & Sekyere, 2007). The standard of living in the area becomes high (Hilson, 2012). The people are displaced, they lose their livelihoods and conflicts arise (Akabzaa & Sekyere, 2007). Culturally, morals are diluted (Oruonye, 2016). For example, male miners lure young girls in the community to engage in sexual intercourse and get them pregnant or spread sexually transmitted diseases like HIV/AIDS (Oruonye, 2016). Robbery, drug abuse, youth unemployment and inadequate housing have become the order of the day. Doku (2014) investigated the occurrence of mine-related diseases in South Africa and found HIV/AIDS on the increase. This was attributed to the infiltration of migrant labour into the industry (Doku, 2014). Finally, some traditional beliefs which prevented people from indiscriminately felling trees and overfishing no longer serve as a preventive measure (Aidoo, 2017).

Health consists of the complete well-being of a person: physically, mentally and psychologically and not just the absence of diseases (WHO, 1997). Health problems affect humans ability to be productive and cause financial burdens to affected persons. Mine-related diseases affect both mining communities and miners resulting in acute and chronic infections like high blood pressure and nervous system disorders (Ansah, 2016). Also prevalent are different types of cancers, asbestosis, melanosis, low IQ in children, bone marrow depression, abnormal heartbeat especially in children and blue baby disease (Yawuli, 2008). Groundwater becomes polluted and costly to treat. An example is the Bangladesh arsenic poisoning first detected in the year 1993. According to WHO/UNICEF (2008), there are approximately 8.6 million tube-wells in Bangladesh. Out of these, 39% tested safe and 15% unsafe out of the 55% tested for arsenic. Unsafe testing indicated that arsenic levels were above the permissible level of $>50\text{ppb}$ (Uddin & Huda, 2011). These heavy metals only become toxic when they exceed their permissible levels because most of them are also naturally occurring (Mendez *et al.*, 2008). As a result, a population plagued with health challenges cannot be efficient in terms of profit maximization (Aidoo, 2017). There is a strong correlation between mining activities, upper respiratory tract infections, diarrhoea and arsenic poisoning (Ansah, 2016; Batool *et al.*, 2018).

2.7 Conceptual Framework

National mining regulations and policy actions are established to reduce adverse impacts on the environment. Regulations do not exist in isolation but are established by the state and decentralized at the local level (District Assemblies, affected communities and all relevant stakeholders). Also, mining companies incorporate these regulations in compliance with policy implementation. The nature of these policies determines the barriers or enablers in implementation and enforcement.

Regulations that are flexible and easy to understand by miners and all stakeholders enhance compliance. On the other hand, technical and robust regulations tend to be the least complied with (Adeboye, 2012).

In any case, without enforcement and regulation of these policies, compliance cannot be achieved. Some enforcement agencies include the Operation Vanguard Tax Force, the Police and the Judiciary (at the national and district levels). Regulatory agencies also include the EPA, Minerals Commission, Forestry Commission, Water Resources Commission, traditional authorities and community members (Minerals and Mining Regulations, 2012).

Some enablers to reclamation compliance include granting of legal and social licenses by the communities, transparency in activities of mining companies and the willingness of mining companies to reclaim abandoned mine pits. Some barriers include corruption, political interference, lack of participation of all stakeholders in decision making processes and unwillingness to comply. Also, stringent processes in the acquisition of the legal documents and social licenses in the District impede compliance with regulations.

Furthermore, when miners do not commit to reclaiming abandoned excavated mine pits, the community bears the brunt. These negative impacts include pollution of water bodies; redirection of their courses; destruction of the topography of land and soil structure; noise and air pollution. Open mine pits serve as death traps to the people. The use of polluted water poses health implications such as cancers, chronic lung and skin diseases (Uddin *et al.*, 2011). Traditional norms and beliefs are eroded and many livelihoods that depend on arable lands are destroyed (Oruonye & Ahmed, 2016). On the other hand, community uproar could directly inform

amendment of policies and enforcement strategies at the national level and with companies management systems through the key stakeholders (Figure 1.1).

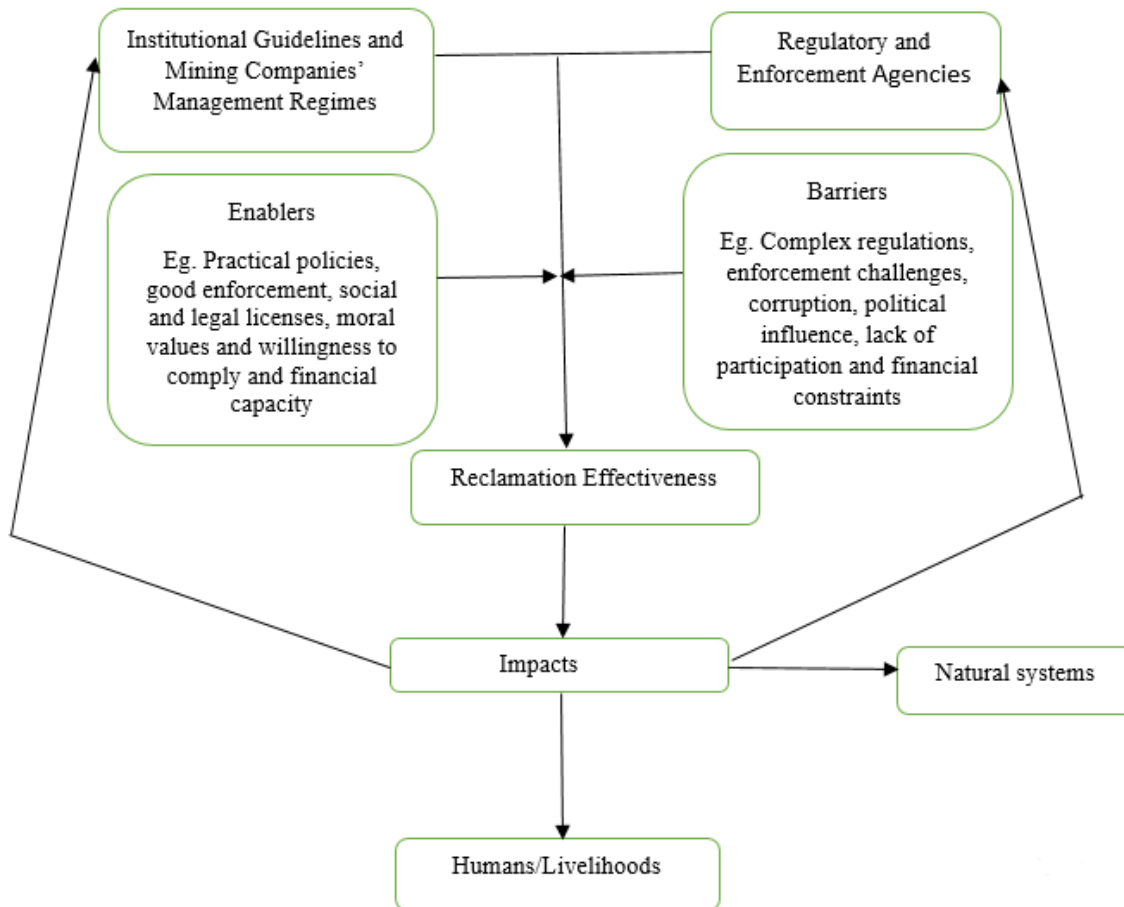


Figure 1.1 Conceptual Framework of the Study

Source: Researcher, 2019.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

3.1.1 Location and Population

Atiwa District lies between longitudes $0^{\circ} 30^0$ West, $0^{\circ} 50^0$ East and latitudes $6^{\circ} 10^0$, $6^{\circ} 30^0$ (GSS, 2014). It is bounded on the North by Kwahu West and Kwahu South Districts, on the North-East by the Fanteakwa District, East Akim to the South-East, Kwabibrim to the South and Birim North to the West. It has an estimated land area of about 1,165.3 km² and a population of 110,622 representing 4.2% of the region's total population (GSS, 2014). There are more females (50.6%) than males (49.4%)(GSS, 2014). Its capital is Kwabeng, situated at the foot of the Atiwa range (GSS, 2014).

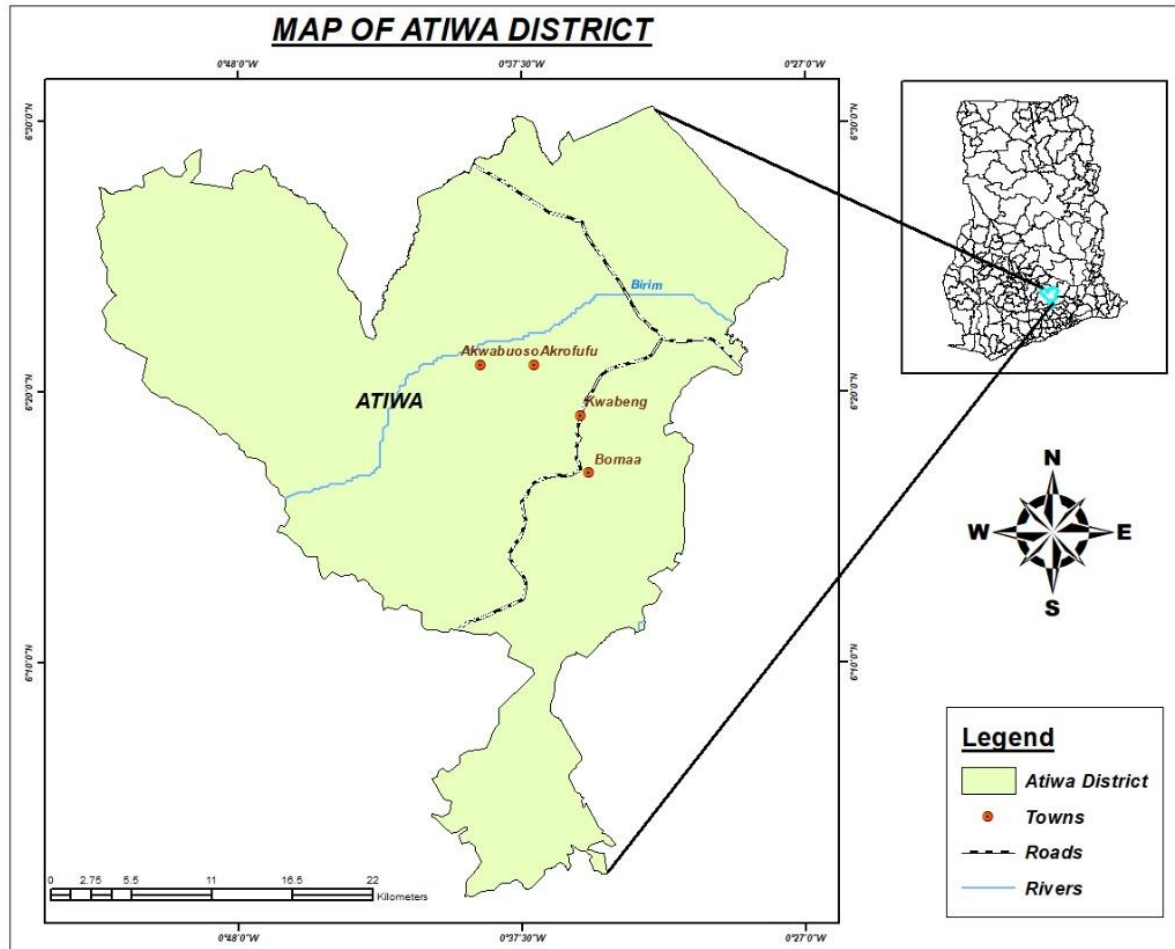


Figure 3.1 District Map of Atiwa

Source: CERGIS, University of Ghana, 2019.

3.1.2 Vegetation, Soils and Natural Resources

The District is located within the moist semi-deciduous forest region of the Atiwa range. Commercial tree species cultivated include Odum (*Milicia excelsa*), Wawa (*Triplochiton scleroxylon*) and Mahogany (*Swietenia macrophylla*) (GSS, 2014). The District is characterized by reddish-brown and well-drained soils rich in mineral deposits like gold, diamond, bauxite and kaolin, found in the Birim River basin. Forest reserves cover about 100 square kilometres of the

Atiwa ranges and contain various timber species and medicinal plants. Adenchensu, Akuku, Kankan, Abreu, Awusu, Kokobeng, Subri, Anikorkor are some of the rivers and streams in the District.

3.1.3 Climate, Geology and Drainage System

The Atiwa District lies in the wet semi equatorial zone (GSS,2014). The District has two rainy seasons with its peak from April to July and September to October (GSS,2014). The annual rainfall is between 1,250mm and 1,750mm (GSS, 2014). Temperature ranges between a minimum of 26°C and a maximum of 30°C (GSS, 2014). The District is characterized by the relative humidity of 65 to 75 per cent during the dry season and 75 to 80 per cent in the rainy season (GSS, 2014).

The District is characterized by gentle, uneven slopes of about 240m to 300m above sea level (Eastern Regional Coordinating Council, 2016). The highest point is the Atiwa range which is about 350m above sea level (Eastern Regional Coordinating Council, 2016). Different types of landforms have been the result of diverse rock formations (Eastern Regional Coordinating Council, 2016). Some of these include flat-bottom valleys and steep-sided highlands characterized by iron pans, kaolin and bauxite. Over 75 per cent of the forested areas are made up of birimian rock formations with granite existing in parallel belts. Rivers Birim, Densu, Adenchensu, Merepong and Pra are major rivers that take their source from the Atiwa ranges (Eastern Regional Coordinating Council, 2016). The direction of the flow of these rivers is from north to south. The distinct rock formation has resulted in the development of many waterfalls and significant growth for the quarry industry (Eastern Regional Coordinating Council, 2016). The Birim, Densu and Pra rivers trace their source from the Atiwa ranges, which serve as a potential source of water for irrigation and fishing (GSS, 2014).

3.1.4 Administrative Structure, Economy and Landuse

Like many districts in Ghana, the Atiwa District has a decentralized political and administrative structure (GSS, 2014). The Assembly is made up of fifty-one (51) members: thirty-four (34) elected on a non-partisan basis; fifteen (15) appointed by the government; two (2) Members of Parliament and the District Chief Executive (Eastern Regional Coordinating Council, 2016). Decentralized departments include Ghana Education Service; Social Welfare and Community Development; Physical Planning; Finance and Central Administration; Disaster Prevention; Health and Agricultural Department (Eastern Regional Coordinating Council, 2016). The District, however, has no Natural Resources and Trade Department (Eastern Regional Coordinating Council, 2016).

The people are engaged in agriculture, industry, trading and services. The majority (60%) of the people are engaged in agriculture, followed by the services sector (34%) and mining, representing 6.6% of the labour force (GSS, 2014). They cultivate on large-scale, produce such as cassava, maize, cocoa, oil palm and citrus (GSS, 2014). The industrial sector is dominated by small-scale manufacturing activities including gari processing, oil palm extraction and small-scale mining (GSS, 2014). The Atiwa District is predominantly rural with about 67% and 33% rural and urban respectively (Eastern Regional Coordinating Council, 2016). Illegal mining activities have destroyed vast arable agricultural lands except for a few urban communities (GSS, 2014).

The major conflicting land-use types are mining lands and arable farmlands (Eastern Regional Coordinating Council, 2016). Originally, various land uses did not have any laid down plan until the establishment of the Development Planning Committee of the District Assembly (Eastern Regional Coordinating Council, 2016). Due to challenges of enforcement, monitoring and

inadequate logistics, many unauthorized settlements have developed in the District (Eastern Regional Coordinating Council, 2016).

3.2 Research Methods

This research sought to explain the level of compliance with mining regulations and environmental policies, legislation and regulatory regimes of mining companies. It has been observed that compliance is influenced by the nature of policy, legislation and regulatory regimes of mining companies (Gagnon, 1998 ; Domfeh, 2003 ; Gray & Shimshack, 2009). Company management regimes are also important. These determine the level of environmental impacts. Some of the indicators used included the knowledge of existing regulations; the roles of regulatory bodies and institutions and the level of compliance; the acreage of unreclaimed lands ; community perception of unreclaimed lands and its impacts on the people.

Mixed methods (quantitative and qualitative methods) was used (Saunders *et al.*, 2012). Quantitative methods used included a survey for the affected communities to investigate their perceptions. Remote sensing and GIS was also conducted to quantify the changes in the cover of mined areas. Interviews of key informants and some regulatory bodies were conducted to gain insight and knowledge on policy, legislation and corporate strategies. Direct observations were made on the field to assess the environmental state and the processes of mining.

3.3 Data Sources

3.3.1 Primary Data

Primary data was collected on the field using a semi-structured questionnaire. Face-to-face interviews were also undertaken for key informants (Environmental Protection Agency, Minerals Commission, District Assembly Officials, Assemblymen, Mining groups and inhabitants of the communities).

3.3.2 Secondary Data

Secondary data was obtained from reviewed published journals, books, articles and government documents. These included data on the existing mining policies and regulatory framework and work done by scholars on policy formulation and reclamation in the mining sector. Some of these government documents included the Minerals and Mining Regulations 2012, EPA Act, 1994 (Act 490), Reclamation Security Agreement (Generic) and the Riparian Buffer Zone Policy, 2013, Volume 2. Satellite imageries were also taken from Google Earth Pro.

3.4 Sampling Techniques and Sample Size Determination

3.4.1 Community Survey

Purposive sampling was used to select key enforcement agencies in mining reclamation sector. Four (4) communities within some mining concessions were purposively selected with the help of the District Assembly. These communities were Kwabeng, Bomaa, Akrofufu and Akwabusoso. These four communities were selected because they had the worst cases of abandoned mine pits in the District. Three hundred and ninety (390) respondents were randomly selected from the

communities. They constituted miners, farmers, government workers, traders and students. The sample size was obtained using the formula:

$$n = \frac{N}{1 + N(e)^2}$$

Yamane (1967 as cited in Agrasuta & Nelson, 2013)

N represents the total population, n, the sample size and e, the margin of error. A margin of error of 5% was used to ensure accuracy. This was done by using the aggregate population size of the individual communities as the total population size (N =16344), finding their percentages of the total population to get the proportionate sample for each community (Table 3.1 below). Therefore, the individual sample sizes obtained were 260, 22, 82 and 26 out of the population sizes of 10,901, 941, 3,418 and 1,084 representing Kwabeng, Bomaa, Akrofufu, and Akwabuoso respectively. The population sizes were obtained from the Planning Department of the Atiwa District Assembly. The Assemblymen, opinion leaders and local authorities of the various communities were contacted and necessary announcements made to ensure effective co-operation before field visits.

Table 3.1 Sample Distribution by Proportional Allocation

Towns	Total Population	Sampled Population
Kwabeng	10,901	260
Akrofufu	941	22
Akwabuoso	3,418	82
Bomaa	1,084	26
Total	1,6344	390

Source: Field Survey, 2019.

Generally, some of the questions asked were on the following: knowledge of reclamation regulations; institutions responsible for reclamation; interventions by the local authorities; sanctions imposed on perpetrators and impacts of abandoned mine pits on the environment.

The questionnaire was in three parts (Appendix A below). The first part was directed at the communities, the second, three small-scale mining companies and then some selected staff of the District Assembly and other government officials. In all, 390 questionnaires were administered.

Section A of the questionnaire was made up of the demographic characteristics of respondents. Each question had options to choose from. They included the names of the communities; gender of respondents; educational status; residential status; occupation and types of minerals mined. Section B was also concerned with the role of stakeholders and institutions in the reclamation exercise. Section C focused on the perception of the people on reclamation. Subsequently, section D focused on the implications of reclamation on locals. Section E, which was the last section,

thrived on recommended practices to make co-existence of communities with mining activities peaceful.

Also, EPA's standard requirement for Reclamation Security Agreement was used to assess the level of compliance. Given this, a compliance scale was developed. According to the existing criteria by the EPA (2012), eleven (11) reclamation criteria were selected and used as a checklist. The type of minerals mined, method of mining and scale was taken into consideration.

The checklist used consists of :

- Stable slopes free from rockfall and soil movement.
- Establishment of protective zones around the pit to protect community members from water hazards.
- Water run-off managed effectively.
- Gentle rolling platforms of similar aesthetics to existing areas.
- Protected access to unconsolidated tailings.
- Existence of embankment freeboard.
- Existence of overflow spillway.
- Existence of vegetation cover.
- Area functioning for the designated purpose.
- Topsoil management.
- Backfill of abandoned pits.

The adopted scale of measurement used is shown in Table 3.2 below.

Table 3.2 Adopted Scale of Measuring Compliance

Scale	Rating
<, =40	No compliance
59-41	Low compliance
79-60	Medium compliance
>, =80	High compliance

Source: Researcher, 2019.

3.4.2 Questionnaire Administration

Questionnaires were developed and administered to respondents in the selected study areas (Appendix A). First, an introduction was made to the Assemblymen in the respective study areas. Respondents were assured that all responses were solely for academic purposes. Respondents were thanked in advance for their time and efforts. Respondents were made aware that each interview would last between 45 minutes and one hour. Respondents were then interviewed individually. In some cases, the questionnaires had to be translated from English to the *Twi* language. It was also to ensure that all the questions were well understood and to eliminate all ambiguities.

3.4.3 Key Informants' Interviews

Key informants interviewed were officers in charge of the Mines Division of the EPA and Minerals Commission at both the Greater Accra and Eastern Regional branches. Some officials from the Atiwa District Assembly and three mining companies in the District were also interviewed. A meeting was scheduled by the officers in charge for a discussion. Four (4) different interviews were held with the total number of twelve (12) people interviewed. Respondents were made aware

that the discussions would last for at least 30 minutes and at most one hour. This was done with the use of an interview guide. Respondents were thanked after the interviews were granted. Some of the issues discussed were the knowledge of mining reclamation policies and their impacts on land, air and water; monitoring and enforcement of regulations; the roles of stakeholders in ensuring sustainable environmental governance; collaborating institutions and challenges faced in the execution of their duties.

3.4.4 Mapping of land cover change in mined areas, Remote sensing and GIS

Remote sensing and GIS (Geographical Information System) technologies were used to map out areas within the District with various degrees of abandoned mine pits. This was used to detect distinct changes in the areas with abandoned mine pits and to observe the distances to the Birim River. Google Earth Pro was used as a satellite data source. This method was used because of its high- resolution imagery of 15m within a relatively small land area (Connette *et al.*, 2016). The imagery was then exported to Arc GIS to view and calculate the extent of mined areas in hectares. The mined, unreclaimed and degraded areas were digitized on-screen, based on the interpretation of satellite image. This was done to create vector data for 2008, 2014 and 2019. The vector data was transported to Arc GIS and areas for the different years calculated. Five (5) year intervals were used in creating the maps.

3.4.5 Field Observations

According to the nature of research and ethical considerations, some important occurrences were observed and captured as pictures. Pictures were taken at the mine sites, the District Assembly and

within the communities. Also, some reactions made by respondents concerning reclamation impacts on the environment were duly noted.

3.5 Data Analysis

3.5.1 Policy, Legislative and Regulatory Reviews

The various mining laws on reclamation and their major requirements were analyzed. This is because it is based on developing issues and arguments (Pirro, 1990). It also helps to reveal trends, weaknesses and risks in the regulations (Pirro, 1990). The major mining regulations on reclamation were reviewed and observations made. These were presented in table form and explained in the text.

3.5.2 Role of Institutions and Level of Compliance

The effectiveness of stakeholders on the ground was evaluated in context. The results from using this method were crosschecked by comparing the official and observed roles of the enforcement agencies. Responses from key informants and community members were also compared and some weaknesses outlined. This was presented using frequencies and tables. Data from some of the key informants were transcribed.

Also, an assessment test was conducted to determine the level of compliance for mining companies using a checklist from which a scale of measurement was developed. Each criterion was assessed using a maximum score of 5. This was calculated by checking compliance with the criteria on the field and dividing the number of checks by 11. Scores were then multiplied by 100 to get

percentages and the results checked using the rating criteria: no compliance; low compliance; medium compliance and high compliance. Mathematically, the formula used was:

$$\frac{\text{Number of criteria complied with}}{\text{Total number of criteria}} \times 100\%$$

3.5.3 Changes in Mined and Unreclaimed areas

The vector data generated from Google Earth Pro was analyzed using Arc GIS and Microsoft Excel applications to evaluate how reclamation has affected the Birim River and its catchment area. The percentage change for the affected areas over time was evaluated. Five (5) year intervals were used. The 2007 imagery was not available. Hence, that of 2008 was used. The mapped-out polygons were then exported to Arc GIS, reprocessed and overlaid with Ghana shapefiles. The “measure” statistical tool was used to measure affected portions of the Birim River and areas of affected polygons captured and saved.

3.5.4 Community Perception

A survey was conducted to examine the perception of the people in the affected communities. The questionnaire was cleaned by excluding the unanswered and partially answered ones. Responses were coded and entered into SPSS (Statistical Package for Social Sciences) version 25.0. Data were analyzed according to the various themes in the questionnaire. Data were presented using descriptive and inferential statistics. Descriptive statistics used included frequencies, tables, graphs and charts. Inferential statistics used were chi-square analysis.

Community perception data were analyzed using cross-tabulation and chi-square analysis. This method was used because it helps to present relationships of associations between categorical variables and results that may not have been apparent. Chi-square tests were also used to check the level of significance by noting the p values for the proposed hypothesis of the study. Data from some of the respondents were transcribed from *Twi* to English. The transcribed data was used as supporting statements to the statistical evidence.

3.6 Ethical Consideration

All requirements were met for consent to participate in this study. A formal application was sent to the Ethics Committee for Basic and Applied Sciences (ECBAS) through the Institute of Environment and Sanitation Studies (IESS) (Appendix B). Respondents were also free to opt-out at their convenience without any penalties.

3.7 Limitations of the Study

Limited time and resources were major challenges. Several letters were sent to five (5) different small and large-scale mining companies in the Eastern Region to seek their permission to participate in the study. Though regular follow-ups were done, feedback was not forthcoming. This delayed the schedule for the commencement of data collection from the mining companies. Field visits were undertaken at the Head Quarters and District offices of the EPA as well as the Minerals Commission at least three (3) times each to solicit more information about reclamation activities in the Atiwa District. Despite this, some information on reclamation activities of mining companies were confidential and could not be accessed.

Also, some miners were unwilling to grant permission to participate in the study, despite the letter of consent, an escort from the District Assembly and the student identification card. As a result, information granted was limited. Before this, during a preliminary survey, the miners were engaged and some of the responses were noted. Furthermore, some information about the mining entities had to be withheld because of the sensitive nature of illegal mining in the District during that period. The intended sample size of 390 was not achieved because some of the community members were not willing to participate in the study. Therefore, 387 responses were used.

CHAPTER FOUR

RESULTS OF THE STUDY

4.1 Legal Framework of the Mining Sector

Several other laws were passed to regulate the mining sector after the Small-Scale Mining Act, 1989 (PNDCL 218). Principal laws governing mining sector regulation in Ghana include the Minerals and Mining Act, 2006 (Act 703) amended by the Minerals and Mining Amendment Act 2015(Act 900); the Minerals Commission Act, 1993 (Act 450) and the Environmental Protection Agency Act, 1994 (Act 490).

4.1.2 Minerals and Mining Act 2006

The Government of Ghana, to foster collaboration, ensured that mining sector bodies were represented on their respective governing boards (Amoako-Tuffour, 2019). In addition to this, mining entities can apply to be granted water rights from the Water Resources Commission. This is to ensure the efficient management of mineral resources, promote the judicious exploration and minimize the adverse impacts on the environment for the benefit of the society. This reiterates the need for sustainable development; the attraction of foreign investment; public participation at all stages of development and equitable distribution of benefits. Captured in the policy document is Environmental Protection Agency Act, 1994 (Act 490); Environmental Assessment Regulations, 1999 (L.I. 1652); the Forestry Commission Act, 1999 (Act 571); Mine closure and post-closure policies between mining companies and the EPA; Water Resources Commission Act 1996 (Act 522).

There have been efforts to use locally manufactured equipment. However, key issues to be tackled remain specific to standard reclamation guidelines and provision of alternative livelihoods. To be able to train and sensitize the people, research geographical data is paramount. The inability of stakeholders to address mining issues holistically and work independently is evident in the overlapping objectives of Mining Acts and working independently. Principal regulations governing the mining sector in Ghana are as follows:

4.1.3 The Minerals and Mining Act, 2006 (Act 703)

The Minerals and Mining Act of 2006 was enacted by the Government of Ghana to revise and merge the laws relating to mining (Gray & Shimshack, 2009). The main reason for the Act was for the consolidation of proper licensing, permit procedures and compliance. The Act makes provision for the ownership of mineral rights, issuance of permits and licenses, royalties, rentals and penalties regarding non-compliance.

Section 1 states that “Every mineral in its natural state in, under or upon the 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”. According to Section 4, the Minister may by Executive Instrument, reserve land from mining. Section 5 indicates that the Minister may grant or terminate mineral rights on behalf of the President and as recommended by the Commission. Also, in Section 9, a person is not permitted to conduct any mining activity unless he has been granted a mineral right either for reconnaissance, prospecting or exploration. All relevant documents required by the Commission are to be submitted to the Forestry Commission and EPA for the protection of natural

resources and public health in Sections 11 and 18. In Regulation 20 subsection 3, there should be public access to information and Regulation 50 spells out the training and recruitment of Ghanaians in mining operations. Parties, with the knowledge of Land Valuation officials, should also determine the amount of compensation.

4.1.4 Minerals Commission Act, 1993(Act 450)

Espoused in them are the licensing schemes, mineral rights and powers of regulatory bodies. The Act was established to review the already existing Minerals and Mining Law 1986 (PNDC Law 153) and to merge it with the Small-Scale Gold Mining Law 1989 (PNDC Law 218) to reflect new developments in the mining industry. According to the Act, Government Departments, Agencies and other public authorities are to cooperate fully with the Commission in the performance of its functions (Chandler *et al.*, 2017). Section 2 demands the management of mineral resources and the coordination of policies relating to them. In Section 94, compensation is to be paid to landowners. A minimum of 100 penalty units and or imprisonment not exceeding 3 years or both is to be meted out to violators.

The Minerals and Mining Regulations 2012 was enacted by the Government of Ghana to give effect to the provisions of the Minerals and Mining Act 450. Regulations 80, 84 (1b), 94(2a) and 480 (b) state some basic requirements. Regulation 80 and 94 (2a) state that there should be danger signs to warn passersby from falling into abandoned pits. Regulation 274 states that potential harm to the environment should be manageable and that there should be no emission of air, water or dust from closed mine sites. Regulation 275 also mandates the submission of mine closure plan and rehabilitation of mined areas within 12 months after closure (Ministry of Lands and Natural

Resources, 2012). Finally, regulation 480 states that all pits should be filled a month after mining operations to prevent water from accumulating in them. As mentioned earlier in the Security Agreement, there are no such structures to ensure long term management of mined areas.

4.1.5 Environmental Protection Agency Act, 1994 (Act 490) and Environmental Assessment Regulations 1999 (LI 1652)

The EPA was established to oversee the sustainable management of the environment (Cletus, 1999). The Act was enacted by parliament in 1994. Act 490 replaced the Environmental Protection Council Decree 1974 (N.R.C.D. 239) and the Environmental Protection Council (Amendment) Decree, 1976 (S.M.C.D. 58). The major requirements are to control pollution and issue environmental permits by collaborating with other regulatory agencies. The Act in Section 45 permits mine inspectors to cancel licenses to licensees who fail or refuse to comply or where the continuation of their activities poses a threat to human beings, crops, animals or the environment (Ayee *et al.*, 1994). Section 54, subsection 2c also gives inspectors the right to seize equipment and arrest offenders and subsection 4 states that offenders are to be taken to court within 48 hours (Minerals and Mining Regulations, 2012).

LI 1652 which concerns the operationalization of regulation 28 of Act 490 was enforced in 1999 by the Ministry of Environment, Science, Technology and Innovation (MESTI). The LI 1652 stipulates the provision of a mining entity in obtaining a license and processes for ensuring minimum environmental impact (MESTI, 1999). Regulation 23 requires that a reclamation plan be submitted and approved by the Minerals Commission. Schedule 30, regulation 2 also states that the environment should be devoid of polluted water especially those used primarily for

domestic purposes (Ministry of Lands and Natural Resources, 2012). Regulations 45 and 54 (2) mandates the cancellation of licenses and seizing of equipment for failure to comply. The main requirement for reclamation is espoused in part IV section 28(1) which demands the restoration of the environment in general and attracts a sanction of not exceeding two thousand Ghana cedis (GH ₵2,000.00) or imprisonment for a term not exceeding 1 year or both or a fine of two hundred million Ghana cedis (GH ₵200,000,000.00) for recalcitrant perpetrators (Minerals and Mining Regulations, 2012).

The Environmental Assessment Regulation, 1999 (L.I. 1652) requires the provision of a reclamation plan and a financial bond which must be approved by the Environmental Protection Agency (EPA) (Tetteh *et al.*, 2015). Specific requirements are as follows:

- There should not be the release of polluted air or water into the environment after mine closure.
- A mine closure plan should be submitted and approved by the Minerals Commission.
- Mining areas are to be rehabilitated within 12 months after mining operations.

Failure to comply may result in the cancellation or suspension of a mineral right. The holder of the mineral right is given a grace period of 120 days by the Minister of Environment, Science, Technology and Innovation. If nothing is done after the grace period, the holder is queried.

Other policies include the following:

- 2012 Forest and Wildlife Policy

The Forest and Wildlife Policy of Ghana was established by the Ministry of Lands and Natural Resources and is enforced by the Forestry Commission. The main objective is to conserve and

manage forest resources in Ghana. It is concerned with restoring the ecology through appropriate land-use practices. Section 4.2 postulates the efficient rehabilitation and restoration of the degraded landscape by afforestation activities and the reduction of mining operations in the forest as much as possible (Ministry of Lands & Natural Resources, 2012). To achieve these objectives, the Government of Ghana became a signatory to the European Union's Forest Law (EUFL) and the United Nations Programme for Reducing Emissions from Deforestation and Forest Degradation (REDD).

- Water Resources Commission Act 1996, Act 522

Established by the Ministry of Water Resources, Works and Housing in 1961, the Water Resources Commission Act 1996 is responsible for the efficient management and utilization of water resources in Ghana. The Commission, based on this Act grants water permits and limits or terminates the use of water resources for private means for public use. Water bodies may be diverted only in the case of a secured mineral right according to regulation 17 (Water Resources Commission, 1996).

- Riparian Buffer Zone Policy, 2013, Volume 2

The Ministry of Works and Housing prepared the Riparian Buffer Policy, Volume 2 while the Water Resources Commission is responsible for the management and efficient utilization of water resources in Ghana. The Buffer policy was established to protect fringe vegetation and ecosystem services of headwaters against pollution from excessive anthropogenic activities such as mining and bad farming practices. An essential component considered was local participation in determining the efficient use of water bodies. According to the Riparian Buffer Zone Policy Volume 2, water bodies that take their sources from forest reserves must have a buffer of 10 – 15

meters (generally, 10-100 meters). This was not considered in the communities close to the Birim River (Ministry of Water Resources, Works and Housing, 2013).

- Reclamation Security Agreement (Generic)

The Reclamation Security Agreement (Generic) was prepared by the EPA. It was endorsed by the 1992 constitution of Ghana as a confidential agreement between mining companies and the EPA to secure a deposit into an account for the reclamation of mined lands. This agreement differs from one mining company to the other based on the scale of operation and their financial capacity. This financial bond is signed and deposited at the Bank of Ghana as a guarantee to mitigate adverse environmental impacts by the end of the mining period as stated in the EIS report of mining companies. The objective is to return degraded lands to acceptable forms to protect the ecosystem and for the stakeholders' benefit. Based on the 11 reclamation criteria selected from schedule 2, a checklist was developed. Some of the requirements include protective zones to be put up around pits and tailings dams; soils free from erosion and water runoff managed effectively and the area to be used for the designated purpose for which it was initially assigned. A summary of the major regulations, basic requirements, personal observations and weaknesses are found in Table 4.1 below.

Table 4.1 Summary of Mining Regulations

Public Org.	Policy/LI	Major Requirements	Comments/Remarks	Weaknesses
EPA	EPA Act 1994 (Act 490)	Part IV section 28(1) Restoration of the environment. Defaulters attract a sanction of not exceeding GH ₵2,000.00 or imprisonment for a term not exceeding 1 year or both or a fine of GH ₵200,000,000.00 for recalcitrant perpetrators.	Mass pollution.	Monitoring is poor because of inadequate of district offices. Inadequate logistics. Allegations of Bribery and Corruption. Fines paid are rather seen as bribes or token because as compared to the returns made, they are insignificant.
	Environmental Assessment Regulation 1652 (1999)	Reg. 23 Reclamation Plan based on approved work plan by MC. Schedule 30 (Reg. 2) The environment should be devoid of polluted water especially those used primarily for domestic purposes.	Not recognized by MC as a small-scale mining entity but are tributers. Most miners dredge in the water bodies. Though sanctions are imposed, work still goes on.	Imprisonment is only for a few hours. after ‘fines’ have been paid. No proper action is taken against mining activities because of the boost in economic development of a few to the detriment of the environment. Lack of education and training on the health and safety hazards.
		Reg.45 and 54 (2)		The District Court is compromised.

	<p>Cancel licenses & seize equipment for failure to comply. Reg. 54(4) Sanctioned by the court within 48hrs after a grace period of 120 days.</p> <p>Fine not exceeding 200 penalty units.</p> <p>Mine closure plan to be submitted to MC for approval.</p> <p>Mining areas to be rehabilitated within 12 months after operations.</p>	<p>Rehabilitation is done quickly as and when they know the authorities will be visiting the sites.</p>	<p>appease nearby communities and to build a reputation for themselves.</p> <p>Compensation is little/ non-existent.</p> <p>Penalties are not strict enough to deter others.</p> <p>Technical language is used.</p> <p>Lack of law enforcement.</p>
Reclamation Security Agreement (Generic)	<p>Schedule 2 Protective zones around the pits and tailings dams.</p> <p>Water discharge meets with EPA effluent guidelines.</p> <p>Soils free from erosion.</p>	<p>No protective zones either around pits or tailings dams.</p> <p>In most cases, tailings dams do not exist.</p> <p>No measures to revert the state of the environment.</p>	

		Water runoff managed effectively.	
		Area functioning for its designated purpose.	
Minerals Commission	Minerals and Mining Act, 2006 (Act 706)	Consolidation of proper licensing, permit procedures and compliance. Public Access to Information (Reg. 20,3). Compensation should be determined by parties with the knowledge of Land Valuation officials (73).	The people are unaware of operations of the mines and agreements miners may have had with the local authorities. Compensation agreements are only between landowners and miners.
	Minerals and Mining Reg. 2012(LI 2182)	Reg. 274 Potential harm to the environment should be manageable in the long run. No emission of air, water or dust from closed mine sites. Reg.275	A pollutant is released without protective measures. Illegal miners do not need any reclamation plan.

		Submission of the mine closure plan.	
		Rehabilitate mine areas within 12 months after closure.	
	Minerals Commission Act 1993(Act 450)	Section 2 Management of mineral resources and coordination of policies relating to them.	Full Compensation only happens after a substantial amount of mineral is found on the land.
		Section 94 Compensation for landowners.	
		Section 99 Minimum of 100 penalty units/imprisonment not exceeding 3 years or both.	
Forestry Commission	2012 Forest and Wildlife Policy	Section 4.2 Efficient rehabilitation and restoration of degraded landscapes by planting trees.	Active mining is ongoing in the Atiwa Reserve.
		Section 5.1	

		Reduce mining operations in forests as much as possible.	
Water Resources Commission	Water Resources Commission Act 1996, Act 522	Reg.17 May divert or allow the use of water in the case of a secure mineral right.	Diverted water sources illegally.
		Liable to a fine of not exceeding seven hundred and fifty penalty units or a term of imprisonment of three years.	
	Riparian Buffer Zone Policy Volume 13	Section 9.3.2 Streams that take their sources from forest reserves should have a buffer of 10-50 m.	

Sources: EPA Act 1994 (Act 490), EAR LI 1652 (1999), Generic Reclamation Security Agreement, Minerals and Mining Act 2006 (Act 706), Minerals and Mining Act 1993 (Act 450), Forestry and Wildlife Policy 2012, Water Resources Commission Act 1996 (Act 522).

A review of the mining policies revealed that some details of reclamation regulations are left to the discretion of miners. Specific guidelines for each mining site is to be detailed in the reclamation plan submitted to the Minerals Commission. Furthermore, aside the generic Reclamation Security Agreement criteria, disclosure of specific activities of these mining groups by the Commission remained a challenge.

4.2 The Role of Institutions and Compliance Assessment

The institutional framework for governing the mining sector is complex. The Ministry of Environment, Science, Technology and Innovation (MESTI) and the Ministry of Local Governance and Rural Development are responsible for policy formulation and at the national and local levels respectively. Major regulatory bodies include the Minerals Commission, EPA, Water Resources Commission and Forestry Commission. At the local level, there are District Assemblies (DAs) and Traditional Institutions (Ayee *et al.*, 2011).

According to the 1992 Constitution of Ghana, ownership of minerals in, upon or under the land is vested in the Government of Ghana and held in trust for the people. Article 268(1) also makes provision for required regulations for natural resources extraction.

4.2.1 The Ministries and State Institutions

The National Mining Policy recognizes the need for all sector institutions, both state and non-state to ensure that the objectives of the sector are achieved. To foster such collaboration, the government has to promote mutual representation of public mining sector bodies on their respective governing boards (National Mining Policy, 2010). The Ministry of Environment, Science and Technology are responsible for formulating a national policy on environmental

protection (National Mining Policy, 2010). The Ministry provides overall policy oversight for the natural resources sector. It is to ensure the efficient management of the nation's mineral resources, promote their judicious exploration and processing with minimal harm to the environment for optimum benefit to society. The Ministry of Local Government and Rural Development also has the overall responsibility for policy formulation at the local government level.

Minerals Commission is responsible for the promotion, regulation, management and the utilization of the mineral resources of Ghana and the coordination of policies therein (Section 1). Through its Inspectorate Division (formerly Mines Department), environmental, health and safety inspections are undertaken to ensure compliance with existing regulations. The Commission is also responsible for monitoring the implementation of laid down policies of the government on minerals and report to the Minister accordingly (Minerals and Mining Regulations, 2012).

Regulations 7(3f), 9(3k), 80, 81 (a,b,c,d), 83 (3), 84 (1b), 94(2a) and 480 (b) state some basic requirements expected of managers of exploration programmes (Minerals and Mining Regulations 2012, L.I 2182). The managers of exploration programmes and the Minerals Commission are to ensure that all regulations concerning the reclamation of open mine pits are adhered to.

The EPA sets guidelines for the compliance of environmentally permissible mining activities. The Agency maintains a close liaison with the Minerals Commission to ensure that the latter's promotional, regulatory and superintending roles over mining operations are consistent with the country's environmental requirements.

The Forestry Commission is responsible for the sustainable management of the country's forest resources. It maintains a close liaison with the Minerals Commission to ensure that mining

operations are carried out with due regard to the laws and regulations that govern the forestry sector (Forestry Commission Act, 1999).

The Water Resources Commission ensures the sustainable use of the country's water resources. In particular, the Commission's role is important in determining alternative water uses as an economic and social good (Minerals and Mining Act, 2014) (Ministry of Lands and Natural Resources).

The Lands Commission helps to determine the level of compensation to displaced or affected people through its Land Valuation Division. The Survey and Mapping Division of the Commission is responsible for demarcation, mapping and certification of land boundaries, while the Land Registration Division manages land titles. Other sectors are as follows:

4.2.2 Local Governments

The District Assembly concept constitutes the bedrock of the country's decentralized system. They are empowered to ensure individual, community or district endorsement or objection of applications for mineral rights. They are also required to ensure, through District Environmental Committees, that mining operations are carried out in an environmentally acceptable manner. The Assemblies are required to provide the economic and social infrastructure from mineral royalties (Arthurs & Reay, 2014).

Traditional rulers are in most cases the overlords of lands on which mineral rights are acquired. They are expected to provide input on the grant of mineral rights, galvanize community members to be the local watchdog of the mining operations which they host and to ensure that such operations are carried out in conformity with the country's laws and regulations (Arthurs & Reay,

2014). As beneficiaries of the government's mineral royalty revenues, traditional rulers are expected to apply such funds to undertake social infrastructure and to raise the dignity of their high office (Ankrah, 2015).

Mining communities host mining operations and therefore bear the brunt of its undesirable effects. They release lands for mining operations (in return for rent or upon the payment of adequate compensation). They are to benefit from part of the royalties paid from the Mineral Development Fund through the provision of social infrastructure by the Assemblies and the traditional authorities. Communities have a responsibility to themselves and the nation to ensure that mining operations are carried out legally and in consonance with the country's environmental regulations.

It is to avoid catastrophic environmental impacts that the Forestry Commission, EPA and the Water Resource Commission formulated the National Mining Policy. This was established to recognize all sector institutions, both state and non-state. In all, 19 institutions are recognized. Key challenges include overlaps and possible conflicts in the activities of some institutions. In some situations, it is not clear as to which institution finally decides on an issue. The issue of policy formulation conflicts because six out of the nineteen institutions formulate policies. Also, there are no clear-cut boundaries to define distinct roles.

The Ministry of Lands and Natural Resources provides an overall policy for the natural resources sector. However, it is not clear as to how each of the institutions carries out its mandate without conflicting with that of the Ministry of Lands and Natural Resources. If each of the other institutions is to formulate various policies to govern the mining sector, then the Ministry of Lands and Natural Resources has no responsibility. However, it appears that the Ministry rather formulates policies for all the other institutions.

The Ministry of Environment, Science, Technology and Innovation is responsible for formulating a national policy on environmental protection using appropriate technology. It is prudent that the EPA, which operates under the Ministry, sets guidelines for the compliance of environmentally permissible mining activities. Nevertheless, with the Minerals Commission undertaking environmental inspection, and the District Assemblies forming Environmental Committees, overlaps exist.

Furthermore, the EPA operates as a legal body independent of the District Assemblies. However, the regional offices are to ensure that mining operations are undertaken in an environmentally acceptable manner. There could be conflicting situations in issuing and/or withdrawal of mining permits. Moreover, it is not clear as to whether it is the EPA or the Forestry Commission that finally determines if an area should be mined. The associated ministries may misinterpret the provisions of these institutions and impose their interests on the people. Again, the EPA may not be allowed to appropriately sanction defaulted companies since it operates under a Ministry that is headed by a politician. There could also be possible conflicts between the District Assemblies and the Traditional Rulers when it comes to granting of social licenses. The various mining sector institutions in the country play key roles in regulating mining activities in the country but there appears to be duplication and conflicts with the functions of some these institutions. However, effective collaboration and clear-cut roles could be operational in achieving the objectives of the mining sector. For a reclamation policy to be enforced, all key stakeholders must work hand in hand at their various levels to ensure the sustainability of the project. An Assessment was therefore pertinent to ensure compliance in the District (Table 4.2)

Table 4.2 The Roles and Observations of Stakeholders and Institutions in Enforcement

Agency	Department	Official Role	Remarks/Comments
EPA	Mining Department	Environmental Protection.	Miners receive prior information before the inspectors arrived.
Minerals Commission	Mines Inspectorate Division	Consolidate policies related to minerals and mining. Ensure compliance with mining laws.	Allegations of bribery and corruption. Do not have district offices. Ineffective collaboration.
District Assemblies	SSM Committee	Community	“Gentleman agreements”
Traditional Authorities	Custodian of lands	watchdogs. Monitor activities of mining and its impacts.	Chieftaincy disputes. Allegations of Bribery and Corruption.

Agency	Department	Official Role	Remarks/Comments
Mining Communities	Beneficiaries of all developmental projects.	Monitor activities of mining and its impacts.	Victimization of respondents. Disunity in the society.
Water Resources Commission	Inspectorate Department	Sustainability and management of water resources.	Inadequate logistics because of uncontrollable mining activities. Do not have district offices.
Forestry Commission	Inspectorate Department	Efficient use and conservation of forest resources.	Ineffective collaboration.

Sources: National Mineral and Mining Policy 2006; Water Resources Commission Act 1996; Act 522; 2012 Forest and Wildlife Policy and EPA Act 1994, Act 490.

Two hundred and twenty-two (222) out of three hundred and eighty-seven (387) respondents (57%) indicated that there had not been any interventions by the local authorities to ensure reclamation compliance. According to respondents, reasons for the lack of interventions included chieftaincy disputes, which constituted 46%, bribery and corruption, 28% and 25% claimed to have no idea about the interventions.

A respondent at Kwabeng had this comment to make, *“Ah! The officials hardly come to the mining sites and even when they do, they only acquaint themselves with the miners and take something small from them. Due to this, they do not report any issues of concern to the appropriate authorities. As for us, we do not have any active chief to speak on our behalf because there are disputes among the authorities as to which chief is suitable to rule over us. We are therefore left to our fate”* (Mining community, 2019).

An elderly woman also said, *“Oh! Due to chieftaincy disputes, no action is taken even after meetings are held behind closed doors. Nothing changes”* (Mining community, 2019).

An interview granted by the regulatory bodies revealed internal challenges in levels of collaboration. In the course of its operations, each institution is supposed to file reports to the appropriate agency in charge of the other areas that are not within their jurisdiction to address them. Also, it is asserted that as and when the need arises, a meeting is arranged to discuss the way forward. The ineffectiveness of the level of collaboration is nulled by many other barriers listed in Table 4.2 above.

4.2.3 Compliance by miners

Illegal small-scale miners, mostly locals referred to as Tributers benefit from the mutual agreement of their employers to make ends meet. It was noted that the Minerals Commission does not recognize these mining groups as small-scale mining entities. Informally, the Tributer System has been accepted by the Minerals Commission. This method was also being used in the District. Small-scale miners paid 20% of their revenue to large-scale mining companies and use 1% to carry out reclamation exercises. This directive was not being adhered to as most miners were even dredging in water bodies and whether or not sanctions were being imposed, work continued. There were allegations that judicial systems at the local level had been compromised. Also, reclamation was done quickly in areas close to communities anytime miners were hinted about visits from the regulatory agencies. Miners knew the visiting schedules of regulatory agencies and feigned compliance before they arrived at the sites.

The terrain features had gentle slopes and heaps of overburden materials in isolated areas in such a way that they did not cause considerable harm to biodiversity and affected communities. Also, there was the absence of protective zones around pits. Community members were therefore at risk of falling into open pits which were sometimes filled with water. Again, there was not much vegetation cover on the sites even though the general terrain had some vegetation and gently sloping landforms. Tailings dams were almost non-existent. There was the over-reliance on the Birim River and its tributaries and no embankments around dams. The absence of overflow spillways caused excess water to spill to surrounding land (Table 4.3 below).

Table 4.3 Level of Compliance with Reclamation Requirements.

Checklist criteria	Tributer 1	Tributer 2	Tributer 3
Protective zones around pits			
Water runoff managed effectively			
Stable slopes free from rockfall and soil movement			
Embankment freeboard			
Gentle rolling landforms			
Overflow spillway			
Protected access to unconsolidated tailings			
Vegetation cover or grass			
Open-pit backfills			
Topsoil management			
Area functioning for the designated purpose			

Source: Field Survey, 2019.

There was generally low compliance for all the three (3) Tributurs with Tributer 1 attaining medium compliance and Tibuters 2 and 3, no compliance (Table 4.4). Each ticked criterion was

awarded a minimum mark of 3 and a maximum mark of 5. This was divided by the total number of checklist criteria which is 11, multiplied by the maximum score for each, which is 5 (55). The result was then multiplied by 100 and rated according to the scale of measurement used (Table 4.4). Marks scored for each ticked criteria included stable slopes free from rockfall and soil movement (5); embankment freeboard (3); gentle rolling landforms (3); protected access to unconsolidated tailings (3); vegetation cover (4); open-pit backfills (5); topsoil management (5) and area functioning for the designated purpose (5).

Mathematically, $(33 \div 55) 100 = 60\%$.

Table 4.4 Compliance Assessment

	Checked	Unchecked	Total
Tributer 1	60	40	100
Tributer 2	0	100	100
Tributer 3	0	100	100

Source: Researcher, 2019.

From Table 4.4:

Tributer 1 - Medium compliance

Tributer 2 and 3 - No compliance

A mine worker under Tributer 1 had this to say, “*We have hopes of being registered as a separate entity again so that we can expand our operations to maintain our reputation*”.



Plate 4.1 Self-regulated site at Kwabeng showing reclaimed tailings dam and land cover



Plate 4.2 Reclaimed Sites at Kwabeng

Source: Field Survey, 2019



Plate 4.3 General vegetation and gently sloping landforms at Kwabeng.

Source: Field Survey, 2019.



Plate 4.4 Embankment around the tailings dam and spillage from processing pipes at Kwabeng.

Source: Field Survey, 2019.



Plate 4.5 Operational area at Bomaa attempting reclamation on one of its sites

Source: Field Survey, 2019.

4.3 Mining Impacts and Reclamation

It was noted that before 2014, areas close to the River Birim (more than 10 meters) were devoid of mine pits (Figures 4.1, 4.2 and 4.3). In 2014, unreclaimed pits emerged right in the Birim River. These open pits widened from 2014 to 2019 with significant proportions located in the Birim River.

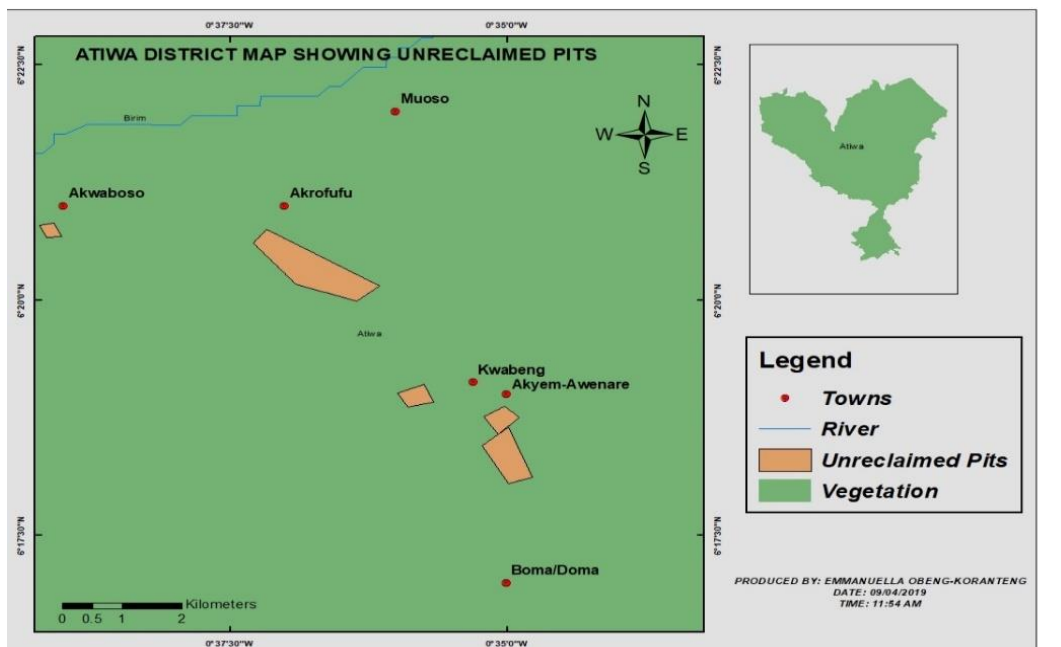


Figure 4.1 The Extent of Unreclaimed Pits in 2008

Source: Image from Google Earth Pro, 2019.

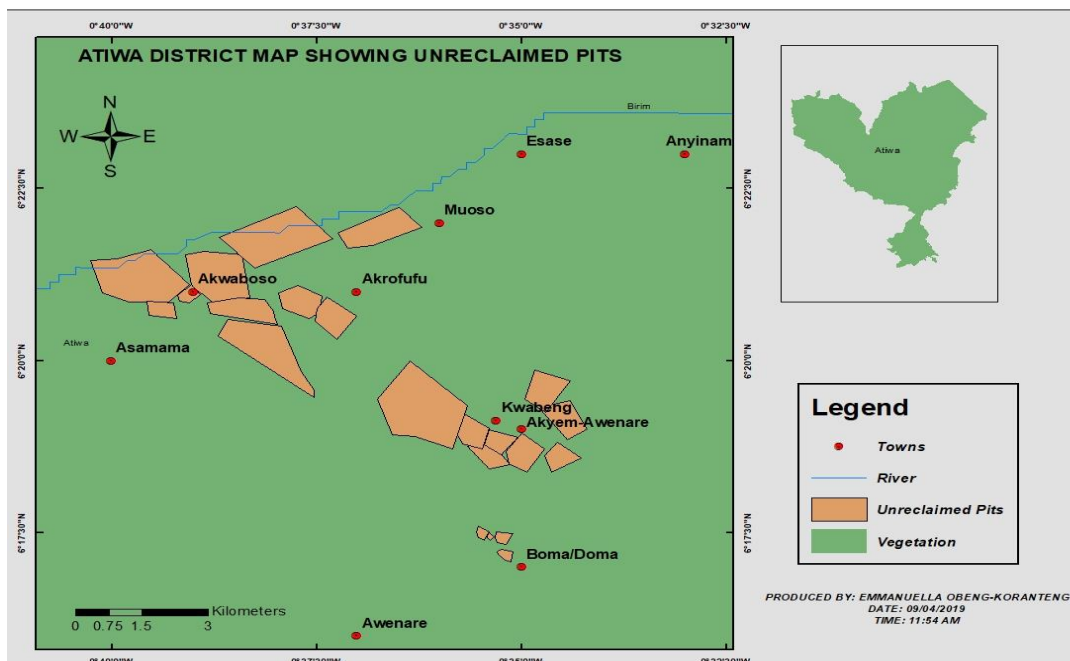


Figure 4.2 The Extent of Unreclaimed Pits in 2014

Source: Image from Google Earth Pro, 2019.

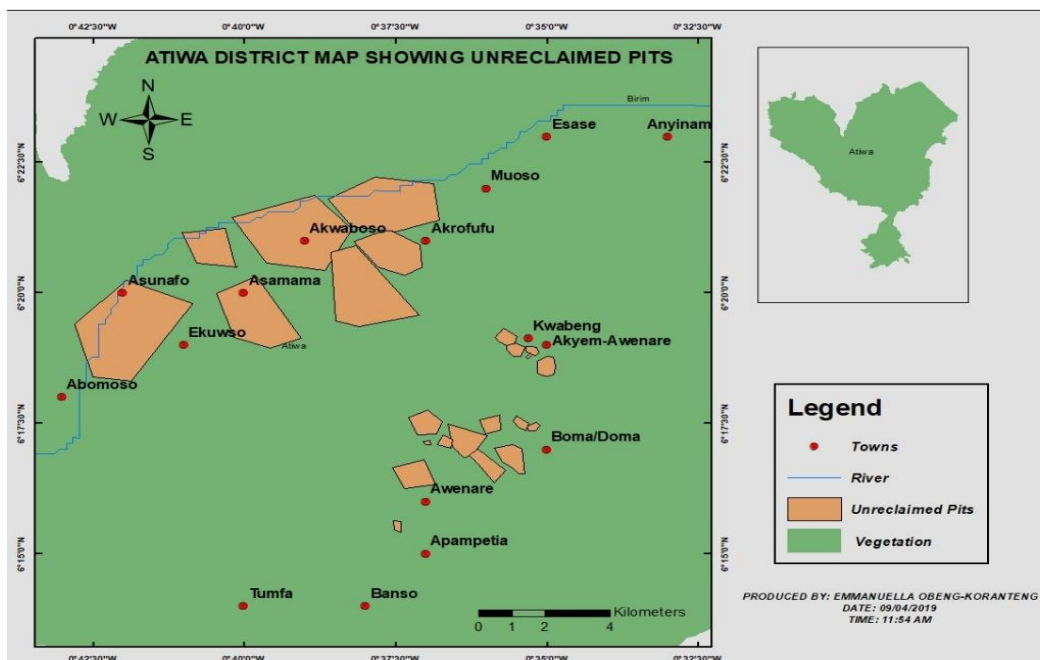


Figure 4.3 The Extent of Unreclaimed Pits in 2019

Source: Image from Google Earth Pro, 2019.

It is evident from Table 4.5 that from 2008 to 2014, the areas of unreclaimed pits increased from 198.61 to 3526.45 but reduced to 1698.50 in 2019.

Table 4.5 Total Area of Reclaimed Pits in Hectares and the Percentage Change

Parameters measured	2008	2014	2019	Total
Area in ha	198.61	3526.45	1698.50	5423.56
% change	(2008-2014)	(2008-2019)	(2014-2019)	258%
	113%	94%	51%	

Source: Computed from ArcGIS.



Plate 4.6 Destruction of productive lands at Kwabeng

Source: Field Observation, 2019.

In Table 4.5, between the years 2008 to 2019 recorded the highest percentage change in areas of reclaimed pits. The highest percentage change was 113.24. This was reduced to 51% from 2014 to 2019. The Birim River, which takes its source from the Atiwa Forest Reserve suffers the brunt of mining activities in the District. This has reduced the supply of water for irrigation and domestic purposes and destroyed the scenic view. It was observed that the Riparian Buffer Zone Policy Volume 2 was adhered to in 2008. That was not the case in 2014 and 2019. The river was further degraded to 7.95 km (Table 4.6 and Plate 4.7 below) in 2019. From Table 4.6, the impact of non-compliance with reclamation regulations increased.

Table 4.6 Environmental Impact of Non-compliance

Period	2008	2014	2019
Distance in km	0	5.62	7.95

Source: Computed from ArcGIS.



Plate 4.7 Polluted Birim river with a floating *Chanfang* machine

Source: Field Survey, 2019.

4.4 Respondents' Perception of Reclamation and Mining Impacts

4.4.1 Demographic Characteristics

The demographic characteristics represent the distribution of the population by locality, gender, the age of respondents, residential status, level of education and occupation. The female population was greater (54%) than that of the male (47%). The population of the study areas is considered to be youthful. The highest percentage recorded was 29% being between 21-30 years with considerable reductions in the subsequent age brackets and a much smaller population being the elderly representing just 4%.

Most of the respondents were indigenes from the Eastern Region. A few from other regions as well as foreign nationals. From the results, only 27% were migrants and 73% indigenes. The study revealed that foreigners from Nigeria and Burkina Faso constitute 1% of the population. Many of the respondents had been resident for at most 5 years, representing 16% and those residents above 15 years represented 1%. Those who were resident between 5 and 10 years constituted 5%. 1% of the population had been resident between 10 and 15 years.

Most of the people had attained secondary education (46%). It was noted that 12 % had attained primary education and 24 % were graduates of Junior High School (Table 4.7). Respondents were predominantly farmers and traders representing 43% and 23% respectively. 7% of the respondents were unemployed with at least 1% engaged in mine-related services (Table 4.7).

Table 4.7 Demographic Characteristics of Respondents

Demographics	Variable	Frequency	Percentage (%)
Gender	Male	180	47
	Female	207	53
Age	20 and below	76	20
	21-30	109	29
	31-40	58	15
	41-50	52	13
	51-60	41	11
	61-70	36	9
	70 and above	15	4
Residential Status	Migrant	103	27
	Permanent	284	73
Educational Status	Primary	47	12
	Junior High	92	23
	Senior High	178	46
	Tertiary	43	11
	No Formal Education	27	7

Occupation	Farmer	165	43
	Student	67	17
	Trader	90	23
	Government Work	22	6
	Miner	15	4
	Unemployed	26	7
	Mining services	2	1

Source: Computation from field data, 2019.

4.4.2 Community Differences

The District capital of the Atiwa District, Kwabeng recorded more than half of the sampled population size (67%), Akrofufu (22%) with Boma recording just 5% of respondents (Figure 4.4).

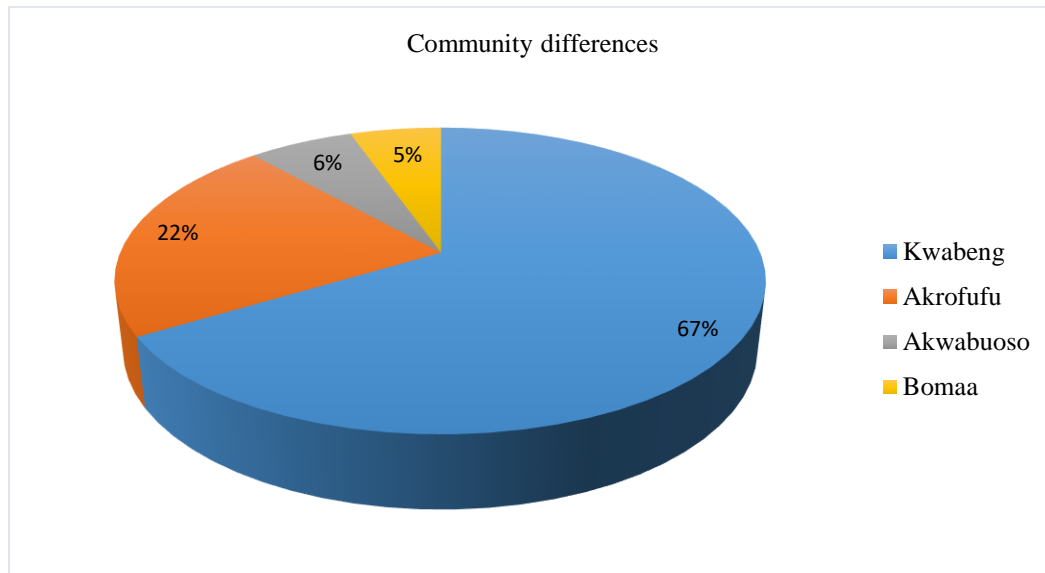


Figure 4.4 Community Differences of Respondents

Source: Computation from field data, 2019.

4.4.3 Extent of Mismanagement

More than half of the total number of respondents (78%) confirmed that the environment was being managed poorly in their respective communities (Figure 4.5). Also, 60% alluded to the fact that water pollution was a major challenge. This was followed by abandoned pits.

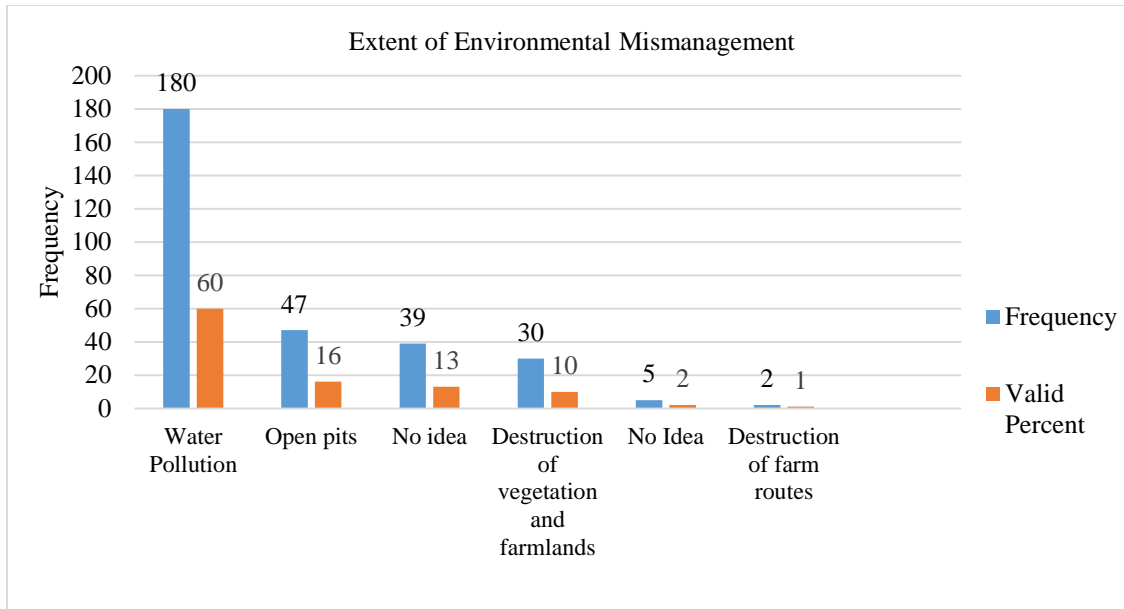


Figure 4.5 Extent of Environmental Mismanagement

Source: Survey, 2019.



Plate 4.8 A Farmland in a Mining Area

Source: Field Observation, 2019.

4.4.4 Sanctions Imposed on Violators of Mining Regulations

Out of the total number of respondents interviewed, only 25% alluded to punishments meted out by the enforcement agencies to people who mismanage the environment (Table 4.8). It is evident, from Table 4.8 that fines (65%) were the most common penalties imposed on perpetrators while 11% of had their activities suspended with just 4% reporting cases of brutal physical abuse.

Table 4.8 Sanctions Imposed

Sanctions	Frequency	Valid %
Fines	62	65
Suspension of mining activities	10	11
Imprisonment	8	8
Confiscation of machines	7	7
Physical Assault	4	4
No Idea	4	4
Total	95	100

Source: Survey, 2019.

A respondent from Akrofufu had this to say, *“Regulatory officials particularly Operation Vanguard taskforce blow their sirens when approaching the communities and so illegal miners take to their heels or prepare “something small” for them before they get to the site. They are not reliable at all. Also, local authorities collect funds for community projects paid by some miners but the funds do not translate into anything meaningful”* (Mining Community, 2019).

Another respondent sobbed, *“Aww daughter my 17-year-old grandson was gunned to death by a miner because he was suspected of being a snitch. The case was put before the authorities and the perpetrator arrested but was released not long after that”* (Mining Community, 2019).

4.4.5 Local Participation in Mining Activities

The level of participation of affected communities in mining activities were low. It was established from Figure 4.6 that 91% were neither involved nor consulted in the decision-making process concerning the acquisition of their lands, 8% were involved and 1% had no idea. It was further reported that out of the 8% who participated in mining operations, 29% washed the ore, 23% did the exploitation, 16% exploration, 8% were mine cooks, 7% in prospecting and 7% in mine planning.

A respondent strongly argued, *“We refused to grant them social licenses but they still went ahead to operate because there was no chief to speak on our behalf. It is not surprising to go to your land one day only to find out it has been destroyed without prior consultation”*(Mining Community,2019).

A miner had this to say, *“We only do what we have been asked to do but we have little knowledge of discussions or negotiations that result from meetings held”* (Mining Community, 2019).

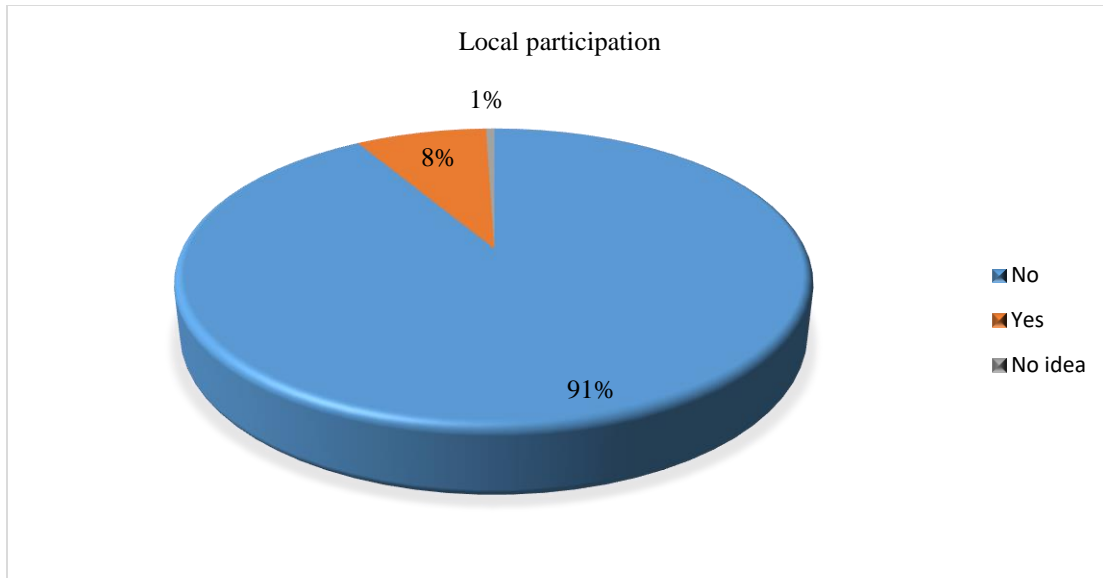


Figure 4.6 Percentages of Local Participation of Respondents

Source: Computation from field data, 2019.

4.4.6 Level of Education and Knowledge of Reclamation Regulations

Respondents were asked if they knew any regulations concerning reclaiming the land and whether or not these regulations were being adhered to (Table 4.9). The progressive increase in percentages from those who had no formal education through to those who had been through tertiary education (Table 4.9) was proven to be significant. $\chi^2(8, N=387) = 42.77, p=0.00$. Therefore, the hypothesis is significant.

Table 4.9 Level of Education and Knowledge of Reclamation Regulations

		Knowledge of Regulations				
		Yes	No	No idea	Total	
Level of Education	Primary	2	38	7	47	
	%	6	13	11	12	
	Junior High School	5	70	17	92	
	%	14	24	27	24	
	Secondary	12	135	31	178	
	%	34	47	48	46	
	Tertiary	15	21	7	43	
	%	43	7	11	11	
	No Formal Education	1	24	2	27	
	%	3	8	3	7	
	Total		35	288	64	387
			100	100	100	100
Chi-square value- 42.775		N- 387	Probability value- 0.000	df- 8		

Source: Computation from field data, 2019.

4.4.7 Implications of Reclamation on Livelihoods

The respondents were asked if they had been negatively affected by mining activities and the nature of impacts. There was a strong relationship between the influence of reclamation on livelihoods and personal impact. From Table 4.10, 244 (81%) said they had not experienced any positive impact of mining in the community. The chi-square test revealed $\chi^2(4, N=387) = 22.97$, $P=.00$. Therefore, the hypothesis was significant (Table 4.10).

Table 4.10 Impacts of Mining and Reclamation

Influence of Reclamation on Livelihood			Impact of Mining		
			Yes	No	Total
Improved Living Standards	Frequency	48	33	81	
	%	16	38	21	
Increased farm sizes		3	2	5	
	%	1	2	2	
Reduction of diseases		4	0	4	
	%	1	0	1	
Reduction of dust particles		2	1	3	

	%	1	1	1
None of the above		244	50	294
	%	81	58	76
Total		301	86	387
	%	100	100	100
Chi-square value- 22.970	N- 387	Probability value -0.000	Df-4	

Source: Computation from Field data, 2019.

4.4.8 Knowledge of Institutions Responsible for Enforcing Reclamation

The respondents' knowledge of institutions that are responsible for ensuring reclamation revealed that a large proportion of the people could identify the presence of Operation Vanguard Tax Force (Figure 4.7).

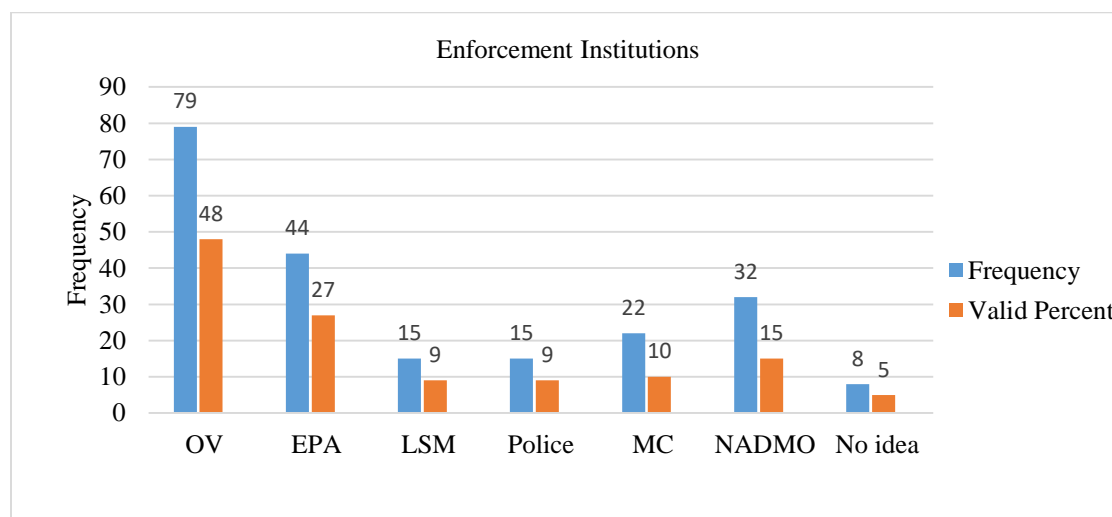


Figure 4.7 A Graph showing Institutions that Enforce Reclamation

Source: Computation from field data, 2019.

4.4.9 Implications of Non-compliance on Occupation

The primary occupation recorded for respondents was farming. Secondary occupations recorded were mining and mine-related work (Appendix C, Table 4.11). Also, a significant number of respondents were traders, students and government workers. There seemed to have been some shifts by many people into other occupations to sustain livelihoods. Surprisingly, only 2% of farmers depended on farming activities as their main source of livelihood. 47% engaged in trading as their secondary occupation and 16% mining. Also, 9% of the traders were farmers and 2% miners. Again, 11% of resident students were farmers and just 4% of government workers were traders.

Furthermore, a cross-tabulation and chi-square test were conducted to assess how the different livelihood activities have been affected and how significant these impacts are (Table 4.12). 138 farmers and 70 traders were negatively impacted by non-compliance of mining regulations. On the other hand, the least affected respondents were miners (5) and those who engaged in mine-related work (2).

Table 4.12 Occupation and personal impact of mining

Occupational status	Adverse Impacts of Mining		
	Yes	No	Total
Farmer	138	27	165
%	36	7	43
Trader	70	20	90
%	18	5.2	23
Miner	5	10	15
%	1	3	4
Mine-related Work	2	0	2
%	1	0	1
Student	50	17	67
%	13	4	17
Government Worker	15	7	26
%	4	2	7
Unemployed	21	5	26
%	5	1	7
Total	301	86	387
	1	22	100
Chi-square value-22.68	N-387	Probability value-0.001	Df- 6

Source: Computation from field data, 2019.

4.4.10 Knowledge of Environmental Impact

A chunk of the population, 31% as seen in Figure 4.8 reported an increase in the cost of food, 22% said there was a reduction in farmlands and the least recorded, 3% indicated excessive noise in the respective communities (Figure 4.8).

A widower who won the best cocoa farmer award was greatly hit when his farms were completely destroyed so he gave up his other farms to assist community-led projects (Mining Community, 2019).

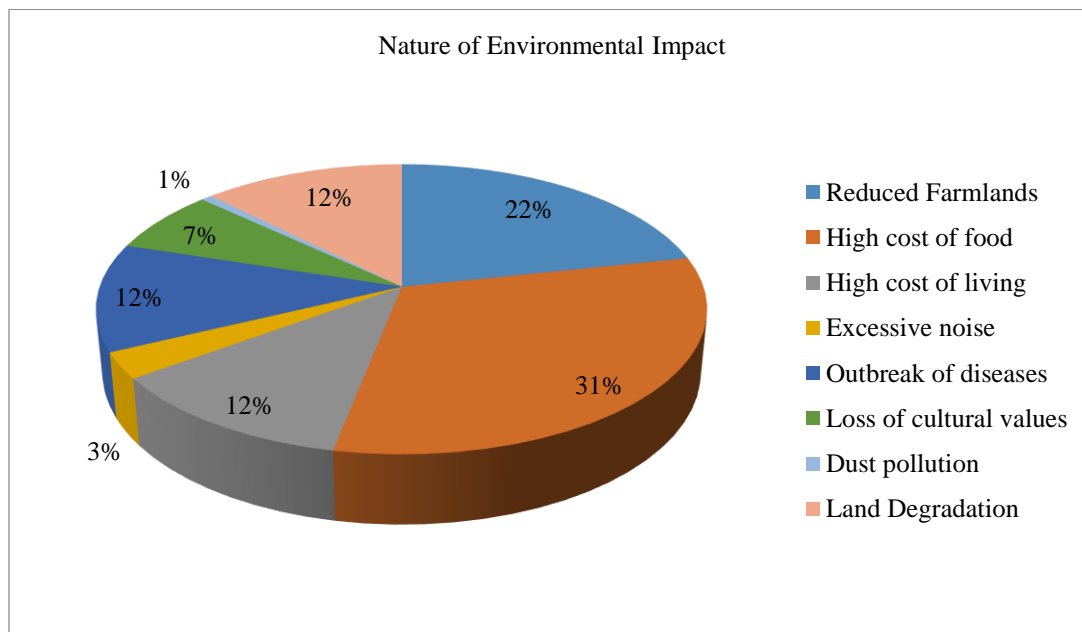


Figure 4.8 Nature of Environmental Impact

Source: Computation from field data, 2019.

CHAPTER FIVE

DISCUSSION

5.1 Legal Guidelines, Regulations and Stakeholder Enforcement

It is evident from the extant, fragmented literature that there is emerging interest in environmental policies because of the key role regulations play in compliance in the mining industry (Allen *et al.*, 2017; Tuokuu, 2019). Tuokuu (2019) argues that the increased interest could be as a result of the UN's 2015 Millenium Development Goals.

Ghana has made concerted efforts in ensuring sustainable management of resources through policy implementation both at the international and national levels (Hilson, 2002a; Minerals Commission, 2015; McQuilken & Hilson, 2016). This is evident in Ghana's commitment to acceding to agreements and treaties like the 1972 Stockholm Conference and the 1992 Rio Conventions which have placed the nation on a promising path of environmental protection (Sands, 2012). Based on these agreements, environmental policies and institutions emerged to enforce these provisions (Government of Ghana, 1995). Ghana is also reported to be among the African countries with the best score in natural resource governance (Amoako-Tuffour, 2019). Despite these efforts and the existence of regulations, grave challenges remain, as far as compliance is concerned. Major problems included the structure of regulations and functions of regulatory bodies in ensuring compliance (Hilson, 2002a; Hilson & Potter, 2005; Arthurs & Reay, 2014).

First and foremost, every environmental policy is designed to appreciate the cultural, social and economic context of a nation (Ayee, 2019). Without these important considerations, specificity in solving problems is lost. Policies and institutions are many and structure is so broad and disjointed that non-adherence to regulations is inevitable (Tuokuu, 2019). The research revealed that

requirements in the mining industry lack specificity, are technical to understand and as such difficult to practise (Ayee, 2019). Reclamation regulations are site-specific such that one ought to pay particular attention to conditions of the site, stakeholders involved and end-uses of mine sites to ensure success (Arthurs & Reay, 2014). For instance, in Schedule 2 of the Reclamation Security Agreement, the term “reclamation” has been used in broad terms to indicate restoration. This makes operationalization and implementation subjective or discretionary. For instance, the statement, “soils have to be free from runoff” and “water runoff should be managed effectively”. The lack of detailed indicators makes enforcement and compliance difficult especially at the local level. Weak reclamation enforcement strategies resulted in low compliance. This was affirmed by Laeitio (2016) when he stated that the stricter the enforcement of a nation's laws, the greater the compliance. In support of this, Hilson (2013) explained that weak institutions and a misplacement of the common interest of society limit environmental compliance.

There were no considerations for the types of mining activities and minerals mined as well as where they occur (geology of the area) (Reclamation Security Agreement, Schedule 2). To be able to categorize compliance criteria as such, there is the need for detailed and relevant information concerning mining activities and a review of records in Ghana (Hilson, 2002a).

Akabzaa & Darimani (2001) and Tuokuu (2019) argue that the EIA documents of the EPA are technical to understand. Robust regulations attract non-compliance because mine workers are not able to come out with creative and adjusted schemes to properly manage their environment (Smith, 2007). Therefore, there must be a balance in making regulations practical. Central Security Depository (2019) agrees that to be compliant means the people must know and understand what the requirements demand and must be willing and able to comply. Cumbersome regulations promote non-compliance (Leitao, 2016). Again, enforcement could be better if regulations are

well understood and miners are not limited to following robust regulations (Leitao, 2016). Also, the confidentiality clause of the EIA document limits public access to reclamation details (Hilson, 2002a). According to Akabzaa & Darimani (2001), the EIA document does not compel mining companies to comply with audit reports if they do not think the reports are realistic or would not conform to their management regime. Furthermore, the EIA document neither covers compensation nor guarantees public participation (Akabzaa & Darimani, 2001). This was a major challenge encountered during data collection as confirmed by Akabzaa & Darimani (2001) in their research on “Impact of Mining Sector Investment in Ghana”.

5.2 The Role of Public Institutions and Compliance Assessment

Institutions are key to understanding governance issues, particularly with enforcement and compliance. An institution is a line of action that promotes social change (Prno & Slocombe, 2012). The role of institutions in environmental governance assumed increasing concerns towards achieving sustainable development. In this context, Prno & Slocombe (2012) and Obeng *et al.* (2019) argued that social licenses should be seen as informal institutions. Otherwise little would be achieved just by organizational measures.

Furthermore, the Neo-Institutionalism approach best describes this study, though it has been criticized by some scholars (Mirowski, 1992; Hajer, 2003). The Neo-Institutionalism theory has been classified in different ways by other scholars. Research undertaken by Tuokuu *et al.* (2019), Cotton & Mahroos-Alsari (2015), Durnova *et al.* (2016) and Idemudia (2014) cited the stakeholder approach to policy making as alternative strategies to the Neo-Institutionalism approach. This is because this theory takes into consideration, not only the bottlenecks in compliance with adjusting

external policies to operators' management regime but attempts to understand the complex relationships with other factors. These include the social, economic, psychological and political factors (Breuning & Ishiyama, 2011). The above-mentioned theories are also similar to the regulatory approach as third parties like the EPA, Minerals Commission, the Police, the Operation Vanguard Tax Force among others are responsible for ensuring compliance with reclamation regulations in the Atiwa District. Participation is therefore a central tenet.

In the results, respondents pointed out that random visits were made to the sites. Similar to this study, a survey conducted by NCCE (2017) on public perception on the state of corruption, accountability and corruption in Ghana revealed that there were allegations of bribery and corruption, chieftaincy disputes, inadequate logistics and little interventions by the local authorities. Though the Operation Vanguard Tax Force visited the communities regularly, their efforts in bringing perpetrators to book were dwindling. This was confirmed by Ayee (2019) in a study on the formulation and implementation of environmental policy in Ghana. The EPA and Minerals Commission also confirmed that they did not have district offices and that the headquarters was understaffed with only one well-equipped laboratory to facilitate work. Studies by Hilson (2002a), Akabzaa & Darimani (2002), Hilson & McQuilken (2016) and Ayee (2019) have noted that these inadequacies fuel allegations of bribery and corruption, aside political factors like change in government and lack of interest in environmental issues. The chiefs have little input once concessions and licenses are granted by the EPA and Minerals Commission in Accra. This was because the District Court has also been compromised due to allegations of bribery and corruption.

Challenges encountered by public institutions were lack of collaboration and inadequate district offices to enforce compliance. Overlapping roles and lack of standard reclamation procedures were

the main causes of ineffective monitoring, enforcement and implementation. Interviews conducted with the EPA and Minerals Commission officials revealed that a client may be granted a permit by the EPA though their licenses may not have been approved yet by the Minerals Commission. Irrespective of this, concessioners proceed with their mining activities which were still deemed to be illegal.

5.2.1 Assessing the Level of Compliance

Generally, the results of this study revealed low compliance with reclamation regulations. There is little work done concerning this area since it is sensitive. As espoused by Hilson (2002a) and confirmed by Techner (2013). This method is adopted by LSM companies as a measure to encourage proper environmental management in mining areas and to equip small-scale miners with the requisite skills and logistics to mine sustainably (Hilson, 2002a; Hilson & Haselip, 2004; Techner, 2013). It was noted that out of the three Tributaries interviewed, Tributer one (1) was self-regulated. According to some mine workers, they worked as licensed small-scale companies until 2017 when their activities were banned. They then became Tributers but still functioned with their management structure. As a result of this, they were not officially recognized. This was in line with research carried out by Hilson (2002a); Asiedu (2013) and Hilson & McQuilken (2016). They had then started reclamation exercises where the communities' refuse was spread on some of the backfilled pits to build staff bungalows. Also, they strictly adhered to the general national mining regulations which could be misinterpreted. On the other hand, the second group of Tributers were only concerned with paying their share of returns to the recognized large-scale mining company as long as they were making profit. Compliance with reclamation regulations by the miners

became cumbersome because the financial costs outweighed that which was needed to keep the operations running.

Practically, the affected persons were informed rather than engaged in activities that directly affected them and alternative livelihood programmes remained short term (Spiegel, 2015). Research undertaken in Zimbabwe, Tanzania and South Africa by Spiegel (2009); Currey *et al.* (2013) and Eeden (2008) confirm that the stakeholder approach yields the best results in curbing illegal small-scale mining. This assertion is also confirmed by Johnson *et al.* (2009) and in Ghana, in recent studies by Armah *et al.* (2011); Lange (2011) and Darimani *et al.*, (2013). Policy documents did not reveal any underlying factor such as poverty in solving environmental problems (Hilson, 2002a; Hilson & McQuilken, 2016). Therefore, an emphasis on complying with environmental regulations without the necessary resources proved difficult (Smith, 2007). Inadequate attention to environmental issues politically has induced non-adherence to accountability and transparency, even though Ghana is a party to the Extractive Industries Transparency Initiative (EITI) (Amoako-Tuffour, 2019).

Increasing youth unemployment, limited alternative livelihood options and social marginalization is the root cause of poverty in the District. Small-scale mining was a convenient way to earn a living to escape the vicious cycle of poverty. A study by Bansah *et al.* (2017) on “Post-mining reclamation in ASM in Ghana” confirms that the main barrier to engaging in illegal small-scale mining and opting for the Tributer system is to escape the clutches of poverty. Contrary to this assertion, Hilson & Potter (2005) and Andrews (2015) argue that engaging in these destructive activities is not to get rich quick but rather, the inability of small-scale miners to acquire the necessary licenses to operate (Hilson, 2010). The process of acquiring licences is intimidating. The Tributers did not consider licenses because they worked as hired labourers in large-scale mines.

Shimshack (2014) revealed, in agreement with the results of this study, that fines were largely ineffective in deterring violators except when increased for repeated violations. Guttel & Harel (2005) also argued that the more a firm violated the regulations, the greater the punishment over time. Fines levied on violators of reclamation compliance as compared to the revenue of miners do not offset harmful environmental impacts in the communities. Miners reported the absence of incentives in complying with reclamation regulations because of the financial cost compliance incurs on production. Due to this, some miners no longer practised self-regulation. Given this, environmental monitoring by regulatory agencies have to be strengthened (Thorton *et al.*, 2005). Contrary to this, some miners showed mixed reactions to non-compliance. In the bid to maintain the reputation of some mining entities with enforcement agencies and the affected communities, self-regulation was undertaken.

5.3 Social and Environmental Impacts of Non-compliance

Non-compliance with statutory requirements by all stakeholders eventually affects society. The satellite imagery shown in section 4.3 is not an all conclusive result for determining areas of open mine sites. The Tributer system gained more prominence after the ban on small-scale mining. Tributers continued working on large-scale mining concessions. This explains the widening of pits from 2014 to 2019. The Inter-ministerial Task Force appointed by the Government of Ghana was also equipped to end the activities of these illegal miners. This result is consistent with a study conducted on the impacts of reclamation in Myanmar using Landsat satellite imagery (Akiwumi, 2007). It was observed that without actual visits to the sites, obtaining the accurate number of hectares destroyed was a challenge. Because of this, delineating the boundaries of the individual towns and their associated abandoned mine pits was a challenge. This is because many open pits,

areas of bare ground and the Birim River were covered with weeds. It appears bare ground areas captured were newly mined. The situation on the ground was such that farmers only visited the farms in the dry season when farm routes could easily be traced. Hilson (2002b) confirms the clearing of productive lands for mining activities, abandoning open mine pits. Occurrences of abandoned open pits in the District make it challenging for the Survey Department of the Lands Commission to determine areas for exploration unless aided by the knowledge of some residents (Hilson, 2002a). Research undertaken by Aryee *et al.*, (2003), Hilson (2002b), Asiedu (2013) and Tuokuu (2019) reveal that in Columbia, Zimbabwe, Burkina Faso, Mali and Niger, more than 50,000 hectares of farmland have been lost to mining.

Agricultural lands were destroyed and water bodies polluted. Air pollution was rampant from excessive dust and toxic gases. There was also the risk of people falling into abandoned pits (UNEP, 2001). This assertion aligns with reports by farmers in the District. Some farmers could not access their farms. They also feared falling into open pits. Farmers had to carry sachet water to farms for irrigation and those who could not afford it used polluted water, which caused ripple effects to consumers of farm produce. This resulted in unemployment, forcing many to branch into other ventures such as mining and trading. The Birim River, an important source of water for the District experienced some destruction as recorded in 2014 and 2019. Some factors that accounted for the reduction in the percentage change from 2014 to 2019 were the ban on small-scale mining and the Tributer system. This necessitated an uproar in the communities especially among the youth (Mining community, 2019). Some of the challenges that needed to be addressed were the shortage of water due to pollution; high cost of food; teenage pregnancy and high rate of unemployment.

Again, the temporary watering of access roads by mining companies, though done regularly proved to be ineffective. Mining activities forces dust particles into the atmosphere after short intervals of dewatering. Many cases of respiratory infections were reported by the mining communities, especially at Akrofufu. Culturally, migration of other mine workers or people engaged in mine-related work results in dilution of community values, as opined by community members and supported by Babut *et al.* (2003), Ansah (2016) and Tuokuu (2019). The consequences included teenage pregnancy; the upsurge in sexually transmitted diseases; school drop out rates; unemployment and high crime rate in the District (Babut *et al.*, 2003). A similar study by Akabzaa & Darimani (2002) in Tarkwa confirmed this assertion.

5.4 Perception of Communities on Reclamation

5.4.1 Local Participation in Mining Activities

Participation as part of community development specifically in the mining sector is crucial to sustainable mining as Bebbington & Bury (2009) postulated. They revealed that in Peru, Ecuador and Bolivia projects that consider the opinions and involvement of the indigenes are more likely to succeed and that what is suitable for a particular mine site may not be appropriate for others. Concerning participation, community members especially those who have lived in the area almost all their lives have local knowledge about peculiar practices that may help to sustain mining activities. To engage them is to make them feel like they own it (Hunt, 2013). However, those who are involved are only consulted and not engaged (Van Drutten & Bekker, 2017).

The case in Atiwa District was not different. Protests arose in 2014 when unreclaimed pits began widening beyond that in 2008. The environment was negatively impacted and this produced ripple effects on the livelihoods of affected communities. According to the study, loss of livelihoods and

high standard of living resulted in theft, loss of family values and diverse forms of abuse. On the other hand, in AngloGold Iduapriem Mine, communities were engaged in weed and fire control, the supply of native tree seedlings, nursing and returning unmined lands to landowners (Addo, 2008).

5.4.2 Sanctions Imposed on Violators

Some barriers to reclamation compliance in the District were challenges in enforcement, non-engagement of the local people and lack of provision of alternative livelihoods. With regards to enforcement challenges, a fine of not more than 750 penalty units must be paid or a violator faces imprisonment or both (Akabzaa & Darimani, 2001; EAR, 1999). Fines were duly paid and violators went scot-free. Researchers argue that penalties imposed should depend on the severity and motive behind committing the offence, whether intentional or unintentional, simple or serious. It was also discovered in the USA that balancing the carrot and stick approach did not yield much as stakeholders struggled to ensure regular monitoring (Shimshack, 2014). The idea was to effect compliance by monitoring in such a way that monetary compliance would not necessarily be the case always but this is not so as human behaviour is highly unpredictable. Also realized was the fact that fines imposed tainted the reputation of large-scale mining companies such that they preferred spending more to minimize environmental pollution. Domfeh's (2003) study on compliance and enforcement in environmental management in Ghana confirmed that fines imposed are not deterrent enough since monitoring and enforcement remain major challenges in ensuring compliance. In the case of this research, fines were being translated into bribes, if paid at all.

5.4.3 Level of Education and Knowledge of Regulations

It is well known in the literature that most mining activities take place in rural communities (Hilson 2002b; Hilson 2004; Hilson 2012). These communities have typical characteristics of low levels of education, unemployment and high living standards. The case was not different in the Atiwa District where only a marginal percentage had gained tertiary education and increasing income was more important to them. The people did not know much about their rights and how advantageous it could be in the process of granting social licenses. Domfeh (2003) reveals the correlational link between income levels and educational levels. Similar to this study was a significant relationship between education and knowledge of reclamation regulations.

5.4.4 Implications on Livelihood

Where mining co-exists with other forms of livelihood, there is likely to be some form of occupational shift. However, the perception of the people based on their knowledge of mining activities and educational status makes farmers deny being called miners after the shift. Identified occupational groups were farming, mining, traders, students and government workers. Farmers claimed that as long as their lands had been taken away with little or no compensation, they had every right to engage in small- scale or illegal mining activities. They did not consider it illegal (Lahiri-Dutt *et al.*, 2014). Respondents were hesitant to reveal their respective occupations for fear of being reported as illegal miners.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Pragmatic policy formulation informs the environmental impacts caused by mining operations. Additionally, regulatory and enforcement agencies are fundamental in ensuring environmental protection and sustaining the livelihoods of the affected communities. Non-compliance with mining reclamation policies results in pools of water created by abandoned mine pits that serve as death traps, results in loss of livelihoods and vegetative cover as well as severe health implications. Other impacts include noise, air, water and soil pollution. The study provides a review of mining reclamation regulations and policy weaknesses. The roles of stakeholders both at the national and local levels were assessed. Also, an assessment of reclamation indicators and a quantitative measure of the extent of unreclaimed mined areas were made. It also provides the perception of community members in the Atiwa District on the impacts of non-compliance of reclamation regulations.

Major weaknesses observed were lack of specificity in regulations, the technical language used in policy documentation and confidentiality of some documents especially that of mining companies. Fines imposed on violators were proven to be ineffective on the ground. Regulations are difficult to understand because of the technical language used by policy makers. Lack of specificity made compliance to regulations difficult and so specific compliance indicators were left to the discretion of miners. No provision was made in the regulations for incentives for compliant miners.

Furthermore, on the role of stakeholders and compliance assessment, familiarity with some representatives of the Environmental Protection Agency, the Minerals Commission, the Police and

Operation Vanguard Officials made enforcement difficult. Key enforcement challenges identified were allegations of bribery and corruption, inadequate logistics, overlapping roles and lack of collaboration among stakeholders. Though there was the establishment of the Operation Vanguard Tax Force, the Tributer system of mining made it difficult to distinguish between Tributers and legal small-scale miners hence, reclamation regulations were not being adhered to by many miners. The District Assembly made “gentleman agreements” with miners through the District Court. The power of the District Court is compromised. Disunity among miners on the recipient of royalties made accountability and transparency a challenge.

The Birim River was polluted resulting in a shortage of water for domestic, industrial and irrigation purposes. This was evident with the proximity of the River to the mine sites. The landscape was destroyed and many abandoned mine pits which contained water bred mosquitoes and became death traps to the people.

Finally, the study sought to assess the perception of respondents on mining activities in the District. The study revealed that communities knew very little about regulations and their right as social license holders. Fines were the most common penalty for violators. However, the respondents called it “bribe”. There was also a significant shift from agriculture to other forms of livelihoods. Findings from the study indicate that the level of education of respondents influences the knowledge of the people on existing regulations. Concerns of the people indicated forceful acquisition of some farmlands without compensation; the inability of the District Assembly to enforce compliance through the District Court; allegations of bribery and corruption; lack of deterrent penalties for violators of reclamation regulations and victimization of respondents who attempted to report cases of environmental mismanagement.

6.2 Recommendations

The following recommendations were proposed based on the findings of the study:

- The Ministry of Environment, Science, Technology and Innovation (MESTI) should redevelop site-specific policy, with fewer technicalities for easy understanding and implementation. The confidentiality clause in EIA should be removed to ensure transparency and accountability of mining companies in the District.
- Regulatory agencies like the EPA and Minerals Commission should collaborate with the Local Government, academia and other key stakeholders to undertake extensive research on reclamation of mines in the Atiwa District. Enforcement agencies like the Operation Vanguard Tax Force and the Police should enforce deterrent penalties, alongside the provision of incentives. The government should in turn provide stakeholders with relevant logistics and review the functions of regulatory agencies to avoid overlapping roles. Reshuffling of officials especially the Operation Vanguard team should also be done quarterly. This will help reduce complaints of allegations of bribery and corruption, environmental pollution, restore the people's trust in the Atiwa District Court and keep miners on their toes.
- Also, the Tributer system of mining should be regularized as a livelihood option and miners trained in sustainable mining operations by the large-scale mining companies with support from the government.
- The NCCE, CHRAJ, EPA and other relevant stakeholders should sensitize the communities on their rights and responsibilities concerning the environment. The people should be educated on the power to grant social licenses. Information should be disseminated by EPA and Minerals Commission on successful reclamation strategies. This

will also help miners in the Atiwa District keep abreast with modern and effective methods of mining. These strategies should be explained in the *twi* dialect for easy understanding to enable the people make informed decisions.

- The findings of this study should serve as the basis for further research in reclamation and other related subjects in mining districts in the country. Examining the value of ecosystem goods and services before and after reclamation programmes as well as cost-benefit analysis can also be undertaken in future research.

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APPENDIX A- QUESTIONNAIRE GUIDE

This questionnaire is designed to solicit information on the title “Compliance with Mining Reclamation Policies in the Atiwa District” as part of postgraduate dissertation work. It is particularly targeted at the mining companies, regulatory bodies and the local people in some selected communities in the District.

Please fill the blank spaces where appropriate. **All information provided is solely for academic purposes and as such is confidential.**

Please tick where boxes have been provided. **NB: You may tick more than one option where appropriate.**

1.1 SECTION A

Demographic characteristics of inhabitants of the selected communities

1. Name of community

- i. Kwabeng [] ii. Bomaa [] iii. Akrofufu [] iv. Akwabuoso []

2. Gender of respondent

- i. Male [] ii. Female []

3. Age of respondent

- i. 20 and below [] ii. 21 - 30 []
iii. 31- 40 [] iv. 41 - 50 []
v. 51 – 60 [] vi. 61-70 [] vii. 70 and above []

4. Level of Education

- I. Primary [] ii. Junior High [] iii. Secondary []
iii. Tertiary [] iv. No formal education [] v. Others.....

5a. Residential Status i. Permanent resident [] ii. Migrant []

b. If migrant, length of stay in the community

- i. Less than 5 years [] ii. 5-10 years [] iii. 10- 15 years [] iv. Above 15 years []

6. Home town.....

7. What is your occupation?

- i. Farmer [] ii. Trader [] iii. Miner [] iv. Mine related work [] v. Student []
vi. Public Servant []

8. What are some of the minerals mined in the area?

- i. Gold [] ii. Diamond [] iii. Bauxite []

1.2 SECTION B

Stakeholders/institutions in reclamation compliance

9. Have you ever heard of mining reclamation?

- i. Yes [] ii. No [] iii. No Idea []

10. Are you aware that mined sites are supposed to be reclaimed?

- I. Yes [] ii. No [] iii. No Idea []

11a. Is mining reclamation being done in your locality?

- ii. Yes ii. No iii. No Idea

b. If yes, how often?

- i. Weekly ii. Monthly iii. Annually iv. Once in a while v. No idea vi. Any other.....

c. If yes, how is it being done?

.....
.....

1.3 SECTION C

Perception of the people on reclamation

12a. Do you think mining companies in your locality have managed the environment well?

- i. Yes ii. No iii. No Idea

b. If yes, what other uses are the mined sites put to?

- i. Farmlands iv. Buildings
ii. Fallow land iii. Reserve
iii. Reserve

c. If no, explain the extent of damage/ mismanagement

.....
.....

13a. Do you know any regulation which mandates mining companies to restore the natural environment after their operations?

- i. Yes ii. No iii. No Idea

b. If yes, mention the regulation

.....

c. Are the miners adhering to the regulation?

i. Yes ii. No iii. No Idea

14a. Does any institution ensure enforcement of the regulation?

i. Yes ii. No iii. No Idea

b. State them

i. EPA ii. Operation Vanguard iii. Police iv. Large-scale Mining Supervisors

15a. Are you aware of any sanctions imposed on those who do not adhere to the regulation?

i. Yes ii. No iii. No Idea

b. Mention them

i. Fine ii. Imprisonment iii. Confiscation of machines iv. Physical Assault v.
Suspension of mining activities

1.4 SECTION D

Implications of reclamation on livelihoods of local inhabitants

16a. Have you been personally affected by mining activities in your locality?

i. Yes ii. No iii. No Idea

b. If yes, please elaborate on the nature of this effect.

i. Reduced Farmlands viii. Dust

- ii. Food shortage/high cost of food []
- iii. The high cost of living []
- iv. Excessive noise []
- v. The outbreak of diseases []
- vi. loss of cultural values []
- viv. Land degradation []
- vv. Loss of biodiversity []
- vii. Loss of soil fertility []

17. Was your land taken from you for mining?

- i. Yes []
- ii. No []
- iii. No Idea []

18a. Were you paid compensation for your land?

- i. Yes []
- ii. No []
- iii. No Idea []

b. If no, has your land been reclaimed?

- i. Yes []
- ii. No []
- iii. No Idea []

19. If reclaimed, has your land been given back to you?

- i. Yes []
- ii. No []
- iii. No Idea []

20a. Did the mining company provide an alternative source of livelihood?

- i. Yes []
- ii. No []
- iii. No Idea []

b. If yes, what are the alternative livelihood options?

- i. Bee Keeping []
- ii. Animal rearing []
- iii. Craft making []
- iv. Inclusion in mining activities []

21. In what way has mining reclamation influenced your livelihood?

- i. improved living standards []
- iv. Improved water quality []

- ii. Increased farm sizes []
- v. Increased Biodiversity []
- iii. Reduction of the incidence of diseases
- vi. Restoration of cultural values []
- vii. Reduction of dust particles []

22a. Are you/were you engaged in the mining process?

- i. Yes []
- ii. No []
- iii. No Idea []

b. If yes, at what stages are you/were you engaged?

- i. Prospecting []
- iii. Mine site planning []
- vi. Exploitation []
- ii. Exploration []
- iv. Development []
- vii. Reclamation []

23a. Have there been/are there any interventions by the local authorities to ensure livelihood security?

- i. Yes []
- ii. No []
- iii. No Idea []

b. If no, why?

.....
.....

c. If yes, what are they?

.....
.....

24a. Have the institutions been effective?

- i. Yes []
- ii. No []
- iii. No Idea []

b. Briefly explain your response in question 23c. above.

.....
.....

1.5 SECTION E

Recommendations

25. Any recommendations?

.....

.....

QUESTIONNAIRE FOR MINING ENTITIES

1.1 SECTION A

Background Information

1. Types of Minerals mined

- i. Gold [] ii. Diamonds [] iii. Bauxite []

2. Type of Mining i. Surface Mining [] ii. Underground Mining []

3. How long has your institution been extracting minerals from this locality?

.....

1.2 SECTION B

The existence or otherwise of mining reclamation policies

4. What is your opinion is mining reclamation?

.....
.....

5. Does your company have any policies or regulations on environmental reclamation?

- i. Yes [] ii .No [] iii. No Idea []

b.If yes, provide the following details of this document;

i.Name

.....

ii.Date of entry into Force

.....

iii.General Objective of the Policy

.....
.....

iv.One specific objective each relating to;

Land

1.5 SECTION E

Enablers and barriers to mining reclamation

19. Why do you undertake reclamation exercise(s)? List them

.....
.....

20. Have you identified some weaknesses in your company's reclamation regulation?

- i. Yes [] ii. No []

21. If yes, how does your company seek to improve them?

.....
.....

1.3 SECTION F

Implications of reclamation on livelihoods.

22a. Are the local people engaged? I. Yes [] ii. No [] iii. No Idea []

b. At what stages are the people engaged?

- i. Prospecting [] iii. Mine site planning [] vi. Exploitation []
ii. Exploration [] iv. Development [] vii. Reclamation []

23. How has the reclamation impacted on the lives of the people?

.....
.....

1.4 SECTION G

Challenges and Recommendations

24. What were the challenges you encountered during the reclamation exercise?

.....
.....

25. Any recommendations?

.....
.....

QUESTIONNAIRE FOR ATIWA DISTRICT ASSEMBLIES AND KEY INFORMANTS

1.1 SECTION A

1. Department.....
2. What is your opinion is mining reclamation?
.....
.....
.....
.....
3. Are reclamation programmes undertaken in your District by mining companies?
I. Yes [] ii. No [] iii. No Idea []

1.2 SECTION B

The existence or otherwise of mining reclamation policies

- 4a. Are there any regulations guiding reclamation in your establishment?
i. Yes [] ii. No [] iii. No Idea []

b. Briefly describe the following features of the said regulation.
i. Name:
ii. Main Objective
.....
.....
5. Briefly describe the nature of the reclamation process undertaken by your institution concerning the following environmental media.
i. Land
.....
.....
ii. Water
.....

iii. Air

.....
.....

6. Is your reclamation regulation based on the state policy of reclamation?

i. Yes [] ii. No [] iii. No Idea []

7. If yes, **how many** institutions have your establishment successfully collaborated with, concerning mining reclamation? Please mention them.

.....
.....

8. What is your role in ensuring sustainable environmental management concerning mining reclamation based on state policy?

.....
.....

9. Briefly describe the results of your reclamation exercise on the following;

i. Land

.....
.....

ii. Water

.....
.....

iii. Air

.....
.....

1.3 SECTION C

Enablers and barriers to mining reclamation programmes in the area

10. Why does your institution undertake mining reclamation? List them

.....
.....

.....
.....

15. Any recommendations?

.....
.....

APPENDIX B-ETHICAL CONSENT LETTER

UNIVERSITY OF GHANA



COLLEGE OF BASIC AND APPLIED SCIENCES

Ethics Committee for Basic and Applied Sciences (ECBAS)

Official Use only Protocol number ECBAS 021/18- 19

PROTOCOL CONSENT FORM

Section A- BACKGROUND INFORMATION

Title of Study:	Compliance with Mining Reclamation Policies in the Atiwa District
Principal Investigator	Emmanuella Obeng-Koranteng
Certified Protocol Number	ECBAS 021/18-19

Section B- CONSENT TO PARTICIPATE IN RESEARCH
--

You have been selected as one of the persons to help the student investigator in her project which is titled ‘Compliance with Mining Reclamation Policies in the Atiwa District’.The purpose of the study is to assess the compliance of mining companies with reclamation policies in the Atiwa District. The data to be collected will be used purely for an academic purpose. You will be interviewed for about 30 minutes to 1 hour but note that your participation is voluntary. Please if there is any question on the topic that you need clarification, you can ask before we start with the interview.

You will help the researcher achieve the purpose of evaluating the level of compliance of reclamation regulations and the effects of abandoned mine pits in the Atiwa District which will inform policy in the mining sector.

You will also acquire knowledge about the planning of reclamation policies and practices. This will help miners, farmers and community members make the most use of once-abandoned mine lands for other developmental projects to improve the livelihoods of the people.

Biodata, financial and social information will be asked of respondents of which they may want to be kept confidential. You are assured of confidentiality and anonymity as the questionnaires are designed in such a way that biographical information obtained from you will not be traced back to you, as they will not be personalized.

During the investigation, research records will be accessible to only the student investigator. After the study, research records will be available to the entire staff and student.

Section C- VOLUNTEER
AGREEMENT

"I have read or have had someone read all of the above, asked questions, received answers regarding participation in this study, and I am willing to give consent for me, my child/ward to participate in this study. I have not waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for my records."

Name of Volunteer

Signature or mark of volunteer

Date

If volunteers cannot read the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

Name of witness

Signature of witness

Date

I certify that nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

Name of Person who obtained Consent

Signature of Person who obtained Consent

Date

APPENDIX C- ALTERNATIVE OCCUPATION OF RESPONDENTS

Table 4.11 Primary and Secondary Occupation of Respondents

Occupation	Occupation			
	Farmers	Traders	Miners	Mine-related Work
Farmers	1	20	7	2
%	2	46	16	4
Traders	4	0	1	0
%	9	0	2	0
Students	5	0	0	0
%	12	0	0	0
Government workers	0	1	0	0
%	0	2	0	0
Total	10	21	8	2
%	23	49	19	5

Source: Computation from field data, 2019.