

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.



**MASSEY UNIVERSITY**  
**TE KUNENGA KI PŪREHUROA**  

---

**UNIVERSITY OF NEW ZEALAND**

**Managing rivers in Ghanaian small scale  
mining communities: a case study in  
Amansie Central District, Ghana**

**A thesis presented in partial fulfilment of the  
requirement for the degree:**

**Masters in Environmental Management**

**Massey University, Turitea,**

**New Zealand**

**Gloria Boafo**

**2016**



---

## DECLARATION

---

I declare that this research study is my original work submitted as a requirement in partial fulfilment of a Master's degree in Environmental Management at Massey University, Turitea, New Zealand. I declare that this work is submitted for the first time at this university and has never been submitted to any other university for the purpose of obtaining a degree. I hereby authorise copyright of this product to Massey University.



GLORIA BOAFO

Student ID: 14113126

29/02/2016

DATE

---

## DEDICATION

---

I dedicate this work to my family; my parents Mr. and Mrs. Addae Boafo, my siblings: Eric Boafo, Ernest Boafo, Eunice Boafo and Salome Boafo. God bless them for their prayers and support while am out of Ghana.

---

## ABSTRACT

---

Water is a natural capital asset that must be preserved and sustained. In Ghana, rivers are critical and important source of water for the Ghanaian economy albeit with very poor and challenging sustainable management practices. This paper presents the findings of a study undertaken to assess mining and water pollution in Amansie Central District, Ghana. The quality of Ghana's endowed water resources is increasingly threatened as industrial activities including, small scale mining continue to expand. Small scale mining operations releases high quantities of sediments, toxic chemicals, and other contaminants into water bodies that have currently damaged most Ghanaian riverine systems. In particular, this is more alarming with the avalanche number of numerous mining operations that majority of such operations are unauthorized. In addition to sampling respondent's perceptions on small scale mining; its impacts and regulation in Amansie Central District, the study prescribes interventions that can assist in mitigating the negative impacts of small scale mining on community endowed water resources. Significant environmental performance and improved water quality can be achieved within the small scale mining sector if compulsory laws on protecting and improving water quality are adopted and adequately monitored and enforced and if government involve traditional rulers in mining regulatory frameworks to regulate unauthorized mining and to monitor community environmental performance.

---

## ACKNOWLEDGEMENTS

---

I have been pleased to have Dr Jeffrey McNeill, senior lecturer in Resource and Environmental Planning, Massey University, who made this work interesting. Our discussions on crocodiles in Ghanaian rivers and peanut butter soup in Ghana played great roles in relieving study tensions and remaining focused. His kind words, 'don't panic, yet' rang through my head throughout my write-up. I express my heartfelt appreciation and gratitude to him for his professional and technical support and for choosing to work with me.

I express gratitude and appreciation to the following individuals and group of people:

Associate Professor John Holland, Head of Environmental Management, Massey University, for his guidance and assistance in my study programme.

Dr Karen Hytten, lecturer in Environmental Management, Massey University for her immeasurable advice and support on my work and for my entire period in Massey University.

Dr Kuda Dube, lecturer in Computer Science and Information Technology, Massey University and family who has been an advisor on my work and assisted my stay in Palmerston North.

All workers and staff of Amansie Central District Assembly for their immense support and cooperation throughout my research process.

All stakeholders from various agencies consulted in Ghana, for their time and cooperation during my research process.

All miners and people of Amansie Central District who participated in the research process, for their time and cooperation during my research period.

## CONTENTS

DECLARATION .....	I
DEDICATION .....	II
ABSTRACT .....	III
ACKNOWLEDGEMENTS .....	IV
TABLES.....	VIII
FIGURES.....	VIII
CHAPTER ONE.....	1
1.0 Introduction.....	1
1.1 Research question .....	5
1.2 Research aim and objectives .....	5
1.3 Thesis structure.....	5
1.4 Significance of study .....	6
CHAPTER TWO: LITERATURE REVIEW .....	7
2.0 Introduction .....	7
2.1 Institutions and natural resource management .....	7
2.2 Natural resource management failure in developing countries: issues of property rights.....	8
2.2.1 Resource ownership and resource degradation .....	9
2.3 Natural resource management failure in developing countries: issues of government failure .....	11
2.3.1 Weak decentralization in resource management systems.....	11
2.3.2 Weaknesses in local level management .....	13
2.3.3 Effectiveness of legal framework to manage natural resources.....	14
2.3.4 Political influence in resource management systems .....	16
2.3.5 Conceptual framework of corruption .....	17
2.4 Resource management in developing countries: a way forward .....	19
2.4.1 Public participation in resource management.....	19
2.4.2 Policy coordination in resource management systems.....	21
2.4.3 Science-policy integration in resource management .....	22
2.4.4 Collaborative process in resource management .....	23
CHAPTER 3: RESEARCH DESIGN .....	26
3.0 Introduction .....	26



3.1 A framework for assessing mining operations and water management within Ghanaian mining communities .....	26
3.2 Research design and strategy .....	27
3.3 Case study method .....	27
3.3.1 Interview technique .....	28
3.3.2 Observation .....	29
3.3.3 Document analysis.....	29
3.3.4 Questionnaire .....	29
3.4 Case study selection criteria.....	29
3.5 Research population .....	30
3.5.1 Research sample .....	30
3.5.2 Research sample size.....	31
3.6 Research instruments .....	31
3.6.1 Research Interviews .....	31
3.6.2 Research observations .....	32
3.6.3 Document analysis.....	32
3.6.4 Research questionnaire .....	33
3.7 Ethical considerations .....	33
3.8 Limitations.....	34
CHAPTER FOUR: ARTISANAL SMALL SCALE MINING IN GHANA.....	36
4.0 Introduction .....	36
4.1 Ghana's demography .....	36
4.2 Institutions .....	37
4.3 Small scale mining in Ghana .....	37
4.3.1 Overview of the Ghanaian mining legislative.....	38
4.3.2 Overview of mining regulations .....	38
4.3.3 Land ownership and use in Ghanaian small scale mining areas .....	40
4.3.4 Artisanal and small scale mining operations .....	41
4.5 Study Area: Amansie Central District.....	46
CHAPTER FIVE: RESULTS .....	50
5.0 Introduction .....	50
5.1. Respondents profile .....	50
5.2 Respondents perceptions.....	52

5.2.1 Impacts of small scale mining on the district .....	52
5.2.2 Causes of water pollution from mining operations .....	54
5.2.3 Challenges that undermine management efforts .....	59
5.2.4 Motivation for better management systems .....	62
5.2.5 Incentives for better management systems .....	64
CHAPTER SIX: DISCUSSION .....	66
6.0 Introduction .....	66
6.1 Conflicts of interests: Human welfare and environmental degradation .....	66
6.1.1 Socio-economic challenge of small scale mining .....	66
6.2 Local challenges with contemporary mining management systems .....	68
6.3 Formal challenges with contemporary mining management systems .....	69
6.3.1 Weak decentralization in natural resource management .....	69
6.3.2 Overlap of mining laws and policies .....	70
6.3.3 Effectiveness of legal framework in the small scale mining sector .....	71
6.3.4 Corruption .....	73
6.3.5 Political influence in the small scale mining industry .....	73
6.4 Motivations for better management systems .....	74
6.5 A focus on water quality solutions .....	74
6.5.1 Governance and Regulations (Formal Systems) .....	74
6.5.2 Local level involvement .....	78
CHAPTER SEVEN: CONCLUSION AND WAYS FORWARD .....	81
REFERENCES .....	85
Appendix: 1 Mineral and Mining Act, 2006 (Ghana) .....	97
Appendix: 2 Water use regulations, 2001 (Ghana) .....	100
Appendix: 3 Survey Questionnaire .....	105
Appendix: 4 Ethics Approval Form .....	106

## TABLES

Table 1: Characteristics of different property rights .....	10
Table 2: Degrees of decentralisation.....	12
Table 3: Framework for data analysis .....	27
Table 4: Case study framework .....	35
Table 5: Local government structure in Ghana .....	37
Table 6: Regulatory agencies in the Ghanaian mining industry.....	40
Table 7: Survey respondents by affiliation .....	50
Table 8: Miners profile .....	51
Table 9: Incentives for better management systems .....	64

## FIGURES

Figure 1: Ghana map .....	36
Figure 2: Pit under construction by an excavator .....	42
Figure 3: Tailing directly discharged from washing plants into water .....	42
Figure 4: Mercury amalgam subjected to open flame .....	43
Figure 5: Refined gold for the market .....	43
Figure 6: State of River Offin .....	44
Figure 7: State of River Pra .....	45
Figure 8: Ankobra River .....	45
Figure 9: Study Area: Amansie Central District .....	46
Figure 10: Oda River, Amansie Central District .....	47
Figure 11: Akaasum River, Amansie Central District.....	48
Figure 12: Gold mining impacts on the district .....	53
Figure 13: Causes of water pollution from mining operations.....	55
Figure 14: Perception about stakeholders responsible for mining and water pollution within the industry .....	58
Figure 15: Challenges that undermine management efforts.....	61
Figure 16: Motivation for better management systems.....	63

## **CHAPTER ONE**

### **1.0 Introduction**

In Amansie Central District where I served after completing my under-graduate studies, natives revealed to me that in the 1990s, heavy rainfall occasionally exposed gold deposits in their surrounding environment. The district is one of the 27 districts in Ashanti Region of Ghana that is blessed with huge deposits of Gold. The district is also blessed with many water resources which were sources of fishes and served domestic chores to the natives. However, today, these water resources have been polluted mainly from gold mining operations and not many rivers running through the district have been spared. I witnessed the Akaasum River which I crossed almost every day to the district's capital town.

The Akaasum River was very useful to the Esereso community where I lived and worked with the District Chief Executive, District Coordinating Director, District Police Commander and most top officials of the district assembly. Every day I saw people abstract water from the Akaasum River for various domestic uses. Today the river no longer serves its useful purpose. The river was certainly polluted as a result of small scale gold mining. I could hear the sound of excavator actively scooping gold bearing sediments and saw a brown colour change of the river as result of tailings and sediment that were discharged into it.

Many rivers in Ghana have suffered the same loss as the Akaasum River. I witness and I question myself about the institutional arrangements put in place to manage the Ghanaian gold mining industry and rivers particularly those that serve livelihood in rural mining communities. The district officials in charge of the wellbeing of the district were clearly aware of the pollution and to the best of my knowledge as a resident; no immediate action was undertaken to halt the on-going pollution.

Unfortunately, clean water from rivers including the Ankobra, Oda, Pra, Birim, Offin and many others across all mining regions in Ghana have been rendered useless by artisanal small scale gold mining operations. Formerly used by communities that lived along the stretch of these rivers, toxic heavy metals, siltation, hazardous acid-generating sulphides, high faecal matter deposition waste rock impoundments and dewatering effects (excess water removal) have been identified as the main pollutants discharged into rivers as a result of small scale mining operations.

Water quality is generally essential to both industrial and domestic uses and also significant to national growth. However, in recent times, a closer look of Ghanaian

rivers gives a rude shock. Water abstraction has led to degradation in water quality and flow and impacted on both the aquatic ecosystem and availability for human consumption. Contaminated with mine wastes, most Ghanaian water resources have transformed into a pool of poison. All is not well with Ghanaian rivers and there is increasing concern about the level of pollution, particularly heavy metal contamination from mining operations (Armah et al., 2010; Asante et al., 2007; Macdonald, Lund, & Blanchette, n.d). Water quality in major rivers including Offin, Oda and Pra have greatly declined in quality and flow and this is largely attributed to increased small scale mining activities that is dependent on a reliable supply of water.

Gold plays significant role in the economy of most developing countries. It has been mined and refined to meet the needs of people locally, nationally and globally. Due to its physical and chemical properties, it is sought as an important mineral on the planet. Its unique features and rarity gives it a high monetary value and makes gold mining a major source of income for social and economic development. Gold mined on small scale are widespread in most developing countries in Africa, Asia and Latin America. Small scale mining takes place where minerals occur; near the soil surface, within unconsolidated rocks and frequently in river beds.

Small scale mining has both positive and negative impacts in developing worlds. Its impacts in developing countries are well documented by different authors including Hilson (2002). Its operations and management practices have impacts on both the local and national economy as well as the immediate and future environment particularly water and land resources. Artisanal small scale mining is a significant source of income for millions of poor people around the world. The past decade has experienced increasing numbers of people turn to small scale mining and efforts to eradicate the activity tend to fail due to its contribution to minimize poverty in rural areas (Hilson, 2002).

In most developing countries, gold is a significant contributor to national economy (Hilson, 2001). In many rural areas within developing countries including Ghana, it reflects a pivotal role in poverty alleviation through employment and wealth creation. Hilson (2002) attributes the latter to fewer infrastructures and insufficient industries to create jobs and wealth in remote areas. Due to its low technical threshold, the small scale mining sector employs all people including the least educated and the poor.

However, mining operations has various impacts on the environment including biodiversity loss, erosion, and soil contamination. The activity involves removal of minerals from the earth surface. Prior to the mining operation, vegetation is cleared and

deforestation occurs. Vegetation clearances bring about loss of trees, wild life, farm lands, air pollution and water pollution. The activity causes disturbances and destruction to numerous habitats and ecosystems. In farming areas, it also destroys productive grazing and croplands. In addition to creating environmental damage; food and water contaminations resulting from chemical leakages also affect the health of local people.

Mining operations consume and divert water resources; it damages rivers and streams and render them useless. Negative effects of mining operations vary from sedimentation caused by excavators and hand tools during pit construction through to sediment washing and tailing disposal. Alluvial gold is located in and around rivers which allows water pollution as a result of digging for minerals in river beds and banks. In developing countries, most mining operations occur in and around water bodies and huge amount of used chemicals and silt are discharged into these waters. Sediments and chemicals generated from the activity result in siltation and drying up of waters. Some researchers, including (Hentschel, Hruschka, & Priester, 2003), have identified some factors that affect mining operations on water resources. These include:

- Technology employed in mining (mechanized or non-mechanized equipment)
- Miners' knowledge and skills
- Miners' Environmental commitments
- The ability to monitor and enforce compliance with environmental regulations.

In mining, access to water is very significant. The mining sector cannot operate without water. However, there is the need to use water resources efficiently while preserving enough for human use and ecosystem functioning. In mining operations, water is obtained from rivers, streams, lakes and ground water or by means of commercial water suppliers. In some developed countries, water abstraction for operations is highly regulated and granted permits to specify the quantity of water to be abstracted and used. In such countries, governments have significant roles in allocating water resources among users. Potable water supply for domestic, recreational and other values require high water quality which is a consideration in water allocation and use in developed countries.

Also, in some developed countries, mining industries have developed innovative means to preserve water for other purposes. While some firms use alternative water supplies other than surface waters, others invest in infrastructure to source water to benefit other purposes.

The small scale mining industry is able to use lower quality water than that desirable for human use. Due to this, some environmentally friendly mining industries reuse water for mining operations or release it into surface waters (if meeting environmental and regulatory requirements after treatment). However, the latter is rarely practiced in most developing countries, including Ghana; rather the discharge of untreated water into surface waters is common and affects the receiving environment (water quality and flow). Da Rossa and Lyon (1997) document four main types of water pollution from mining operations that affects water quality and flow:

**Acid mine drainage:** Acid mine drainage occurs when water resources are polluted through natural processes; when sulphuric acid is generated from sulphide rocks exposed to air and water. This arises when large quantities of sulphide containing rocks are dug or excavated from pits. Sulphuric acids that are generated end up in water resources and contaminate the waters. Acid mine drainage severely damages water quality, destroys aquatic habitat and renders water unusable.

**Heavy metal contamination and leaching:** Heavy metal contamination and leaching occur when heavy metals such as mercury, lead, cadmium, zinc and silver contained in rocks are exposed when excavated and find their way into water bodies. These metals are carried downstream and become toxic when they accumulate. Accumulations of heavy metals render water bodies unsafe for ecosystem services and human consumption

**Processing chemical pollution:** Water bodies are polluted through chemical processing. This occurs when chemicals such as mercury or cyanide used in mining operations spill, leach or leak from mining sites into water bodies. In most cases these chemicals become toxic to aquatic life and human consumption.

**Erosion and sedimentation:** Vegetation removal and pit construction to acquire minerals disturbs soils and rocks. Erosion of exposed soil and rocks carry sediment loads into water bodies and clog water resources: it destroys aquatic life and damages human water consumption.

In Ghana small scale mining and water pollution is a trending issue. Even though government efforts seek to mitigate environmental impacts borne by the small scale mining sector through government regulations, negative impacts, particularly on rivers continue to deteriorate. Informal mechanisms such as the small scale miners' association also exist in such districts to assist mining regulators; however, not much had been done to minimize pollution from the industry.

### **1.1 Research question**

This study focuses on mining and water management in Ghanaian small scale mining communities. It draws on a case study on managing mining operations and community water resources in Amansie Central District. It investigates why minerals and water resources in Ghana appear poorly managed despite government regulations and public awareness.

### **1.2 Research aim and objectives**

The aim of the research is to investigate why small scale mining operations in Ghana appear poorly managed.

Objectives of this study are to:

- Review a theoretical assessment of natural resource management failure in developing countries
- Identify common themes in resource management failure in Ghana as a developing country
- Identify the main challenge to mining and water pollution in Ghanaian small scale mining communities
- Propose action plans for what constitute an effective response to mining and surface water pollution from artisanal small scale gold mining in Ghana

### **1.3 Thesis structure**

The next chapter provides a literature review on institutional failure associated with natural resource management in developing countries. The chapter reviews drivers that cause failure in institutional efforts in managing natural resources. It draws on institutional challenges in developing countries that undermine sustainable natural resource management systems.

Chapter three outlines the research design and methodology including, the various approaches used to identify common themes in resource management failure in Ghana as a developing country. The chapter outlines the research strategy in collecting public perceptions and opinions through administered questionnaires, interviews, observations and available information.

Chapter four addresses the socio-economic impacts of small scale mining in Ghana and its effects on water resources. It delves into its management systems and finally presents the study area: Amansie Central District.

Chapter five presents the findings from the empirical research. The chapter analyses the results to identify research objectives. It presents details of surveys, observations and interviews.



Chapter six discusses the research topic. It explores the difficulty facing formal institutions in managing rivers within small scale mining communities in Ghana. The chapter reveals perceptions of respondents in Amansie Central District on managing gold minerals and rivers in the district. It firstly explores the impacts of mining as well as the challenges to sound management practices. It further presents motivation and incentives for new practices to attain good water quality in Ghanaian small scale mining communities.

Chapter seven concludes the main findings of the study and provides suggested solutions to achieve environmental performance within Ghanaian small scale mining communities.

#### **1.4 Significance of study**

This research underlines a perspective that is still developing in the definition of sustainable development: the emphasis on institutional arrangements. The finding from this work may be useful in Ghanaian institutional arrangement to firmly manage operations of small scale miners in order to restore and preserve community endowed water resources within mining areas to its usefulness for present and future generations.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.0 Introduction**

Developing countries depend significantly on their natural capital. People earn their living directly from utilization of renewable natural resources such as water, forests, minerals and plants. In many developing countries, such resources are continuously exposed to unsustainable exploitation, pollution and conversion to other uses. When natural resources degrade, people livelihoods are affected or disappear. It aggravates challenges of rural poverty and insecurity.

Population growth, market failures, government failures and property rights failures are the four main factors scholars identify with natural resource depletion and environmental destruction (Haysom & Kane 2009). This chapter focuses on property rights and government failure in natural resource and environmental degradation in developing countries.

Developing countries like Ghana often face challenges in managing their naturally endowed resources. The chapter identifies and analyses various challenges that undermines property rights and government institutions in developing countries. It reveals the intimate and dynamic relationship between institutions and natural resources in such countries as well as the interaction between them that generates outcomes that have profound consequences on the environment. The chapter finally reviews reforms to effectively manage natural resources in developing countries.

### **2.1 Institutions and natural resource management**

The success of a society as well as its access and fair allocation of resources is determined by both formal and informal institutions. There are various views on natural resource management in developing countries that are widely focused on institutions that supports resource-sustainability. Unfortunately, the dire state of resources in many developing countries indicate institutional failure. Various authors including Acheson (2006) contend that natural resources in developing countries can be successfully managed if appropriate institutional structures are strategically developed and used to manage them.

North (1990) describes institutions as the 'rules of the game' and organizations as 'the players'. Both formal (rules, laws, constitutions, regulations, rights) and informal mechanisms (customs, traditions) underpins the nature of institutions. Uphoff (1992) describes organizations as an association with defined and accepted roles, responsibilities and positions structured to achieve a desired objective. Within the existing institutional framework, organizations exist to secure and advance the interest

of their members while it seeks to influence the framework to maximize its advantages and benefits. Informal institutions exist in every society and become salient specifically in circumstances where the formal ones are weak. Informal institutions can assist in complementing formal ones by either reinforcing or undermining them. According to Hyden (2008), policies lack absorption in most developing countries because most developing countries have created a mixture of formal institutions and informal values to manage resources in which the informal values have dominant power relations, but are not understood or recognized. Lobo (2009) argues that beyond identifying the right institutional fit for a social-ecological system, the manner in which the context affects the institutional reform design and its outcome must be well understood and established.

Helmke and Levitsky (2004) reported that most institutional incentives and expectations are often shaped basically if not exclusively by formal regulations. Such narrow foci, they explained, are often challenging for the risk of missing much of what drives actual undesired behaviours. Their research findings on informal institutions broaden the scope of comparative research on the analysis of informal rules. According to them, careful attention to informal institutions is significant to understand incentives that enable and constrain human behaviour. Although most management mechanisms adhere to both formal and informal incentives, they demonstrated that, informal ones often surpass the formal ones.

Consideration of informal institutions is often important in complementing institutional outcome. They shape the performance of formal institutions in varied and unexpected ways. An example is cited in Latin America where neopatrimonial norms permitting unregulated presidential control over state institutions yielded a degree of dominance that far exceeded the presidential constitutional authority (Helmke & Levitsky, 2004). Also informal institutions complement formal ones by creating and strengthening incentives to comply with the formal rules that might exist on paper. Helmke and Levitsky (2004) bring together a large but disparate research that integrates informal institutions into comparative formal institutional framework to generate positive results. They cited judicial politics, public administration and state building as some areas informal rules positively shaped formal institutional outcome.

## **2.2 Natural resource management failure in developing countries: issues of property rights**

Property rights play significant role in natural resource management. Literature and practical experiences are increasingly drawing attention on property rights as a significant consideration in sustainable management of natural resources including,

minerals, land and water. It is a critical factor in determining how mineral and land resources are used and managed and how such resources are developed or degraded.

Mechanisms for natural resource management can be categorised according to the right or the kind of natural resource or ownership and use of the resource (Haysom & Kane, 2009). Mechanisms that govern natural resource ownership are often seen as challenges in developing countries (Table 1). According to Haysom and Kane (2009) resource ownership appears challenging in resource management and its sustainability.

### **2.2.1 Resource ownership and resource degradation**

Property rights in resource management have captured the attention of many authors. According to Demsetz (1967), the concept of property right conveys the right to benefit or harm others. Property rights issues have revealed various and controversial opinions that are often related to resources including, minerals, land use, water and forests.

A property right as defined by Haller (1998) is the access right to a stream of benefits from a resource. According to Acheson (2006), economists show property rights to have a number of virtues. They contend that property rights promote efficient use of resources as the owners of the resources are free to use them in ways that grant them high income and ignore less productive options.

However, Schlager and Ostrom (1992) also argue property right owners to possess the consent of others to allow them to act in specific ways. Haller (1998) argues that property rights determine how individuals can benefit or be harmed from a resource as well as who should adjust the actions taken by others. This relationship as reported by Acheson (2006) leads to the inter-relationship between property rights and externalities. In developing countries, property rights do not always result in resource conservation. The essential point in the notion of property is that there is recognised right of control over things vested in the owner (Haller, 1998).

In most developing countries, property rights is perceived as the right to control, exploit, use or enjoy that which is owned. A right in which within certain limits, is free from the interference of others and often gives a rationale to overexploit a given resource (Haller, 1998). In most developing countries, property owners often satisfy their desire for wealth by exploiting the underlying resources. For instance forest, minerals resources and land resources in developing countries are often exploited as a result of resource ownership and property rights issues.

**Table 1: Characteristics of different property rights**

Type of Property	Ownership	Management	Access	Enforcement
<b>Private</b>	individual	individual	closed	Society/Law
<b>Public</b>				
<b>Open access</b>	All members	No one	All	No one
<b>Closed access</b>	Group	Group	members	Group
	members	members	Group members	members
<b>Government</b>	Government	Government	All	Government

Source: Schlager and Ostrom, 1992.

### **2.2.1.1 Public access and resource degradation**

Various natural resources in developing countries directly or indirectly provide livelihoods to millions of people, but they are threatened by over-exploitation and environmental degradation (Mearns, 1996). As public access resources, these natural resources, such as water, forests, minerals and lands have several features that make their management challenging. Whenever a group of people rely on a resource that everybody has open access, an individual's use affects another person's ability to use that resource. As a result, either the group fails to preserve the resource, over use it or fails to replenish it.

In developing countries, open access resources, including water, minerals and forests, meant for communal use often face congestion of overuse due to their subsequent loss as everyone has an incentive to overuse. The theoretical result is that the resource is ruined as most people assumed not to internalise the consequences their attitudes have on the resource. Benjaminsen, Cousins, and Thompson (2002) also explain that total self-interest behaviours are often attached to the use of open access resources and achieve a least to be desired outcome in its management efforts.

In addition to the known features of public resources that make their management a challenge, other forms of constraints to effective management relate to governance (Acheson, 2003; Berkes, 1989; Ciriacy-Wantrup & Bishop, 1975; Rose, 2000). In developing countries resources meant for communal use are often governed by different institutional arrangements that are often, group or community ownership. Such governances are often informal norms that are passed from one generation to another or formal written laws that are enforced by ownership. Management often fails in sustaining such resources in developing countries and to provide for their availability. In most cases, absence or ineffective regulations on group access resources cause severe degradation of such resources. Pre-existing interests of individuals or ownership group also overturn or destroy management efforts in supportive of a poor

agenda. Public access resource research-based initiatives have ultimately had difficulty attaining its desired outcome in most developing countries due to lack of rules that limits utilization. Also, conservation rules and policies that do exist or enforced on such resources causes the depletion of public access resources in these countries.

### **2.3 Natural resource management failure in developing countries: issues of government failure**

There are many instances of depletion of easily reached and relatively easy to extract resources in developing countries. In such countries, research and policy debates have greatly focused on identifying set of government institutions that manage such resources. This section demonstrates factors that undermine governments' efforts in natural resource management in most developing countries.

#### **2.3.1 Weak decentralization in resource management systems**

In the past decade, many developing countries have changed course with respect to resource governance. For various reasons including equitable share of national resources, these countries have embarked on programmes aimed at creating local self-governing systems that are democratic and relatively autonomous as well as effective in allocating resources and services (Olowu, 2004). As a result, most developing countries designed decentralization programmes that depend largely on intergovernmental transfer of authority from national levels to local levels (Shamsul Haque, 1997; Unsworth, 2010).

Due to historical legacy across most developing countries, central authority extension over natural resources including, wildlife, forests water and fisheries is a fundamental reform that has gained grounds in governing natural resources (A. M. Larson & Soto, 2008). In practice, the way these reforms have been designed varies greatly as a result of historical, political and other factors. Government bureaucratic agencies to local communities in most developing countries, particularly African countries, often involve decentralisation of resource governance in one form or another (Hyden, 2008).

Decentralisation is defined as the act by which the central government transfers authority to local level actors in the political-administrative or the territorial hierarchy. Ribot (2004) distinguishes two different types of decentralisation. Deconcentration which he explains grants authority to local representatives of the central government who are accountable to central authorities and not to the local constituency and democratic decentralisation as the transfer of authority to locally elected authorities that are downwardly accountable. McGuire, (2010) also demonstrated three degrees of decentralization (Table 2).

**Table 2: Degrees of decentralisation**

<b>Decree of Decentralisation</b>	<b>Political Features ( Demand)</b>	<b>Fiscal Features ( Revenue/Spending)</b>	<b>Administrative Features ( Supply)</b>
Deconcentration	<ul style="list-style-type: none"> <li>No elected local government</li> <li>Local government appointed by, and accountable to, the central government</li> <li>Weak local voice</li> </ul>	<ul style="list-style-type: none"> <li>All funds from central government</li> <li>Local government is the delivery arm of the central government</li> <li>No local discretion over services</li> </ul>	<ul style="list-style-type: none"> <li>Staff are employees of, and are accountable to the central government</li> <li>Weak local capacity</li> <li>Weak client power</li> </ul>
Devolution	<ul style="list-style-type: none"> <li>Local government is locally elected and accountable to the local electorates</li> <li>Strong local voice</li> </ul>	<ul style="list-style-type: none"> <li>Subjects to nationally set minimum standards, local government can allocate resources</li> <li>Funds mainly from local revenues</li> </ul>	<ul style="list-style-type: none"> <li>Staff are employees of local government</li> <li>Strong client power</li> </ul>
Delegation	<ul style="list-style-type: none"> <li>Local government elected locally but it is partially accountable to the central government</li> <li>More local voice which can never be over ruled by the central government</li> </ul>	<ul style="list-style-type: none"> <li>Most funds from the central government</li> <li>Some local authority over resource allocation to meet local circumstances</li> </ul>	<ul style="list-style-type: none"> <li>Local government have some authority over hiring and management of staff</li> </ul>

Source: McGuire, 2010.

At the local level decentralization is regarded as beneficial as officials can be easily held accountable by the people for their actions due to the closeness of government officials to the people. It brings government closer to the local people and strengthens the voice of the voiceless. The system according to (McGuire, J. M. 2010) gives government the flexibility to respond to different needs of the poor among local jurisdictions. According to McGuire (2010), an effective decentralisation can improve monitoring and create stronger incentive for government to effectively deliver basic goods and services.

However, most developing countries practice deconcentration as demonstrated by (Ribot, 2004), where resource users are not granted authority over resource

management decisions and uses. Average and Desmond (2007) argue that the assumed 'decentralized' structures of administration only act as an effective tool for centralizing authorities within the central government, only for government officials to make decision while local representatives remain silent. Decentralization efforts in this scene, they argue is ineffective as there is little or no local voice in decision making. The system of weak decentralization in developing countries turns to be centralization of resource management at national and regional levels that neglects district efforts and participation in resource management systems and consequently allows natural resources including, water, forests, lands and minerals to be mismanaged and degraded at the grass root level.

The system of decentralization in natural resource management according to Larson (2002) is not only about transferring authorities to government officials but rather requires the devolution of actual authority over productive resources. In addition, it should be authority divergent among a host of actors so that externalities associated with natural resource management are not borne. Kiss (2002) further explains that decentralization should be an actual extension of control into the hands of those who are most affected when the resources are degraded. He suggests natural resource governance requires effective democratic decentralization as demonstrated by (Ribot, 2004) or devolution (McGuire 2010) rather than deconcentration.

### **2.3.2 Weaknesses in local level management**

In developing countries, local level management may result in degraded natural resources. The scope of responsibilities of local governments in developing countries in relation to administration has risen due to the expectations and demands of local people for goods and services from local actors (Shamsul Haque, 1997).

There are many instances where local-level communities organized to conserve resources on which their livelihood depends (Acheson, 2006). However, in most cases, a bureaucratic mode of local governance that is characterized by central government dominance over local actors, large economic dependence on the central government and the lack of opportunity for community participation in legal requirement hinder effective local management. The latter limits the autonomy of local authorities to function appropriately in resource management and meeting environmental obligations. A strong central government coordination of local institutions often creates mediocrity towards resource management needs at the local level (Agrawal & Ribot 1999). Acheson (2006) also contends that local actors fail to manage their resources due to inability of community to devise rules to manage such resources or the rules fail after they are established. Inability to get rules right varies from case to case and resource to resource. In some instances, an inability to establish and enforce boundaries often



undermines local management efforts (Ostrom 1992). Where boundaries cannot be drawn and be defended, outsiders gain benefits of the resource and the resource is ruined.

Social diversity according to Acheson (2006) is also an attribute that makes it impossible to make rules work in local resource management. For instance Lam (1999), reports on Nepal where conflict from ethnic differences made it impossible to maintain and operate some local irrigation systems. Also, local efforts to manage resources failed where there is a reduced dependency on the resource (Acheson, 2006). An incident in Nepal, where rural people obtain other sources of income or part-time city jobs, reduced the incentive to manage forests and irrigation systems at the local level (Lam 1999).

In developing countries, different cultural and social factors also undermine resource management efforts at the local level. They allow people to disobey resource management rules or increase their exploitive behaviours that cause resource degradation. In some cultures, the incentive to free-ride is so strong that there is no demand for local actors to conserve resources (Gibson & Becker, 2000). For instance, the 'Orma' issue in Kenya where social change made the elders unwilling to continue to enforce rules to control the number of cattle that grazes on land resources. This incident resulted in overgrazing, which (Ensminger, 1992) describes as a classic failure of collective action at the local level.

### **2.3.3 Effectiveness of legal framework to manage natural resources**

Legal frameworks are significant in managing natural resources and to meet desired results. The concept of legal framework is broad and includes all rules and enforcement mechanisms (Pillay & Kluvers, 2014) that guide and coordinate people's behaviour in relation to a desired outcome.

Ascher and Healy (1990) argue that policies have great roles to explain why resource-rich developing countries fail to develop. According to them, most developing countries have established laws and formal structures to manage their resources, but only a few structures become successful in meeting obligation due to the effectiveness of their legal frameworks. Initiatives of failed natural resources are traced to faulty policy making procedures and policies (Ascher & Healy, 1990). In most developing countries, legal frameworks or policies used in resource management experience what Verbruggen (1994) describes as 'instrument crises'. According to him, these crises show themselves in the general recognition that, there is a wide gap between the formulation of environmental policy goals and standards and the implementation and realization for the goals and standards. Verbruggen (1994) identified two dimensions in which environmental policy fails to attain its desired outcome. First, he argues that

formulated environmental goals are not always attained within the proposed period. Secondly, should these goals be met, the social costs borne are relatively high. Verbruggen (1994) grouped the actual causes of policy failure in natural resource management systems:

- Policy instruments are far from efficient and effective application
- At the most efficient and effective policy level, there is lack of application of appropriate environmental policy instruments
- Inconsistency and inefficient mutual coordination between various policy levels: national, regional and local.

He goes on to say that resource policies are mostly not implemented with optimal combination of appropriate policy instruments. Thus, combinations of policy instruments that are applied at various policy levels are not efficient and effective enough to attain desired resource management outcome.

In addition to the inappropriate combination of policy instrument in managing resources which generates undesired outcome, resource users and grass root actors are often excluded in legal frameworks (Average & Desmond, 2007). This is common in some African countries regarding legislative provision of their natural resource management systems. In most cases, local people are not empowered in legislations to manage or have control over their resources. Legal authorities to manage resources are therefore denied by real users and custodians of local resources. Average and Desmond (2007) contend that in most cases, the practices of resource users are not recognized by the operative legal system. Community values and practices are denied the avenue to inform the operative legal provisions so they reflect and accommodate local practices to meet management objectives.

For instance, in Zimbabwe, community members who are mainly producers and managers of wildlife do not have much say in the management system (Average and Desmond, 2007). The state and its agencies retain responsibilities of approval; implementation and fiscal control in legal frameworks while roles of resource producers and users are relegated to only initiating project plans. In such scenes, it is challenging to achieve management outcome since interests and priorities of the real users and managers are not considered in policy regulations and they also lack legal authority to efficiently operate to conserve resources.

When a state dominates over decision making in regulatory frameworks especially when it sorely relies on its central agencies and also controls finances as in many developing countries, local organizations in direct contact with resources tends to languish and fail to develop their own capacity to conserve and manage the use of their natural resources (Ascher & Healy, 1990). The integral demand of effective policy

framework according to McNie (2007) is the recognition of priorities and values of local actors as the centre of policy in regulatory framework that binds their resources.

#### **2.3.4 Political influence in resource management systems**

The influence of politics in natural resource management is widespread in developing countries particularly, African countries. In most developing countries, the successes and failures in resource development and management depend on the presence or absence of 'political will' (Booth & Therkildsen, 2012). In most parts of the world elections have become the standard practice in promoting democracy. It is highly promoted by the international community as a sign of legitimacy of elected government officials to promote development. Elections are generally termed as the foundation of democratic decentralized governance that should raise the credibility of governments and increase the willingness of citizens to contribute to decision making. However, in relation to natural resources management, the rise of electoral politics in most developing countries does not necessarily bring with it desired development and management outcome (Asher & Novosad, 2014). The latter contend in the case of India that in most developing countries, the incentives of political leaders shape resource management outcome.

Banomugisha, (2006); Carreri and Dube (2014) also identify politicians as the central part in policy and decision making over management and utilization of the environment and natural resources of a nation. Most developing countries are resource-rich; a condition that allows ruling political parties to develop resource rents in ways that undermine resource sustainable policies (Auty, 2003). Politicians' self-interest creates political governance that result in mismanagement and degradation of natural resources. In governance, a ruling political party is often motivated by the desire to maintain power. They are also concerned to regain power when the party is out of office. In power, they make political decisions with party objectives and choose resource policies that they perceive will directly or indirectly keep them in power (Makinda, 1996). Asher and Novosad (2014); Carreri and Dube, (2014); Makinda, (1996) in their works perceive political offices in developing countries as fast means to acquire personal riches: where politics is largely viewed as a zero-sum game in relation to wealth and prestige of office. Abdulai (2009) also identified political offices in most developing countries as self-service rather than public-service: an avenue to benefit one's family and clan from national resources rather than benefits to the society or nation as a whole. Ireland and Tumushabe (2005) in their work in East African countries reported on political mismanagement in Kenya, Uganda and Tanzania which has caused severe economic and environmental damages to those countries.

In such developing countries, there are no mechanisms that allow political leaders to be accountable or to impose collective discipline on them, in order that capital resources are allocated and managed in ways that support resource sustainability: rather, their collective actions are often aligned with natural resource depletion and environmental degradation (Booth, 2011; Booth & Therkildsen, 2012).

### **2.3.5 Conceptual framework of corruption**

The concept of corruption has been examined as a challenge in natural resource management and sustainability (Misangyi et al. 2008). The latter describe corruption as an economic perspective that is dependent on self-interest and consequently, limits the success of development. It is an evidence of institutional weakness in natural resource governance.

Risk factors of corruption have been identified in relation to governance structures; administrative capacity and administration culture (Pillay & Kluvers, 2014). Dacin et al, (2002) describe institutional theory of corruption as individual and organizational actions and attitudes that often reflect a culture. According to them, these actions and attitudes are developed and becomes 'entrenched' or 'legitimized' in the organization or society over a period of time. Kamoche and Harvey (2006) also align institutional theory of corruption with the willingness of individuals and groups to follow an unacceptable pattern of attitude.

Luo (2005) argues that corruption is enhanced when uncertainty and power concentrates within an organisation and institutional pressures such as complexity, injustice and opaqueness develop. Becker (1968) and Klitgaard (1988) also explain corruption as a relationship that exists among three protagonists: the government, the citizen and the public official. According to them, public officials are prone to corruption when they enjoy a complete control over an activity or service as well as having wide opinion in decision making. Klitgaard (1988) associates the level to which officials have an opportunity to accumulate corrupt benefits to the degree of monopoly over a service or activity, their large opinions in resource allocation and the little or no level of accountability associated with their roles.

#### **2.3.5.1 Corruption as a challenge in natural resource management systems**

As identified in the previous section, corruption is an integral element that undermines natural resource management. It is evident in both developed and developing countries and within private and public sectors. However, evidence abound that corruption and its impact in natural resource management systems are more severe in developing countries than in developed countries (Pillay & Kluvers, 2014). Corruption is also known to be more pervasive in the public sector than the private sector.

It is any behaviour on the part of officials in the public sector, whether politicians or civil servants, in which they improperly and unlawfully enrich themselves or those close to them, by the misuse of public power entrusted to them (Transparency International, 1997).

According to Luo (2005), a bribed individual acts as an agent for another individual or organisation since the purpose of the bribe is to induce him to place his own interests ahead of the objectives of the organisation for which he or she works. Kolstad, Søreide and Williams (2008) identified a relationship between natural resources and corruption. They assume the existence of natural resource endowments in a country to enhance corruption. Thus, natural resources provide fruitful ground for corruption and their abundance encourages it.

Corruption has significant negative impacts on natural resource availability and management (Winbourne, 2002). Various sectors of the environment including wildlife, mining, forestry, water, oil exploitation, and fisheries are vulnerable and affected by corruption. In relation to natural resource and environment degradation within developing countries, corruption creates unfair allocation of natural resources and triggers environmental destruction. Corruption acts are greatly experienced in bribery in environmental inspections and permitting systems, bribery during permit acquisition, policy implementation and law enforcement (UNODC, 2010).

In ensuring resource availability and environmental performance, corruption diverts funds allocated for environmental programs and reforms into private pockets which make it impossible for environmental laws and policies to be effectively implemented (UNODC, 2010). It also heightens or stimulates the development of environmentally damaging policies as well as environmentally harmful practices. The act of corruption as identified by (Abdulai, 2009) undermines law enforcement and induces unauthorised practices in natural resource use and management.

UNODC (2010) reports deforestation in Southeast Asia where forests that is significant to environmental stability and social well-being of people are at constant risk of destruction through corrupt practices. According to the report, illicit logging within the region contributes to increased deforestation rate. Corruption networks have caused an irreversible environmental destruction, including biodiversity loss and increased forest carbon emissions that have contributed significantly to climate change.

Illegal timbers are acquired from corrupt officials within timber-source countries. These illegal loggers according to the report often rely on forged paperwork to move illegal timber across country borders. In doing so, protected timbers are sometimes affirmed as ordinary goods or certificates of origin are falsified to convey them. Illegal loggers in

this sector rely on corruption to maintain their business which makes them exploit to destroy forest resources. These unauthorised loggers employ the services of officials including forest rangers, local government officials, transport authorities, police and customs throughout the entire production line from forest to port for a successful operation. The concept of corruption as the report describes, denies local income and livelihood for the society at large through misallocation, misappropriation and over exploitation of capital resources.

## **2.4 Resource management in developing countries: a way forward**

Previous sections demonstrated factors that contribute to resource management failure in developing countries – property right failure and government failure. In view of the latter, various scholars including (Heslop, 2006) advocate the need for institutional change to efficient natural resource management in such countries.

Heslop (2006) identifies institutional arrangement and governance as critical in managing natural resources. The programme of work towards institutional change should incorporate improved methods that focus on implementation and enforcement; involving contributions from partnerships, local and regional dimensions, major groups as well as the scientific community (OECD, 2002).

### **2.4.1 Public participation in resource management**

Considering the challenges to natural resource management in developing countries and the relationship between natural resources and effective management as reviewed in previous sections, public participation has been identified as an essential tool for policy mechanisms to be effective in resource management systems (Bulkeley & Mol, 2003). The concept of public participation has been the need for interaction between the public and decision makers as well as deliberation among various stakeholders. Clark (2000) describes participation as the actual involvement of all social actors in social and political decision-making processes that affect the society in which they live and work. It has also has been cited by Du Plessis (2008):

The interaction between government and civil society... which includes the means by which government and civil society open dialogue, establish partnerships, share information and interact to design, implement and evaluate development policies, projects and programs.

Public participation as demonstrated by Rowe and Frewer (2000) is the interaction through different means such as views or concerns on public issues by the affected individuals. They identify public participation in decision making as a significant element that underpins efficient policy implementation. Ploger (2001) describes it as a tool to improve democracy. According to him, it shows that individuals and resource

users are valued and that their views are important to achieve management results. Public participation builds trust and confidence and demonstrates better reform to societal issues. These authors share their common views on public participation to allow resource users and managers to be more active and more responsible for their environment and quality of life. The mechanisms of public participation allow resource users and affected individuals to feel more part of the community and a better relationship is established among them and the authorities. Public participation according to these authors recognizes that individuals have a significant role to play in decision making as it involves the skills, knowledge and enthusiasm of the individual and the public as a whole in policy making.

Agarwal (2001) argues that through public participation, individuals have stake in protecting and sustaining their resources. As such, they should be the central involvement in decision making. He contends that reforms to achieve sound resource management can only be attained if the public is involved in an open discussion so as to obtain a wider range of experiences, ideas and approaches in resolving resource issues. Involving the public in policy making according to him often identifies various views and evaluates more risks as such, lead to better decisions. Better decisions he describes as decisions that are valid and better meet the needs of greater population of the society.

Castro and Nielsen (2001) however contend that public participation can have adverse outcomes. They attribute this to different interests and perceptions of various public bodies in policy planning and implementation. Alternatively, Innes and Booher (2003) contend that although different priorities and concerns may interrupt the decision process, involving the public at an early stage in a decision-making process helps to build consensus. It identifies concerns at early stages in the planning process where changes are easier to address, rather than latter part of the process which is more costly.

In addition, the final decision withstands scrutiny since the decision-making process is open, honest and more accountable. By being the central part of the process, resource users and managers are exposed to various factors that may influence a decision. Individuals are more likely to understand final decisions even if they do not agree to it because they were informed (Innes & Booher, 2003). The right of individuals' to participate in decisions that affect them as a matter of principle contributes to an objective that creates a more inclusive society in which resource users, managers and the community feel more powerful, more fairly treated and more valued when government acts in co-operation with them (Gorter, 2011).

#### **2.4.2 Policy coordination in resource management systems**

Sustaining natural resources according to Brinkerhoff (1996) depends on coordinated efforts of a range of various actors. Brinkerhoff (1996) among various analysts propose coordination as a solution to the challenges of policy, project or programme implementation. He identifies uncoordinated projects, policies or programmes as one who's make-up or framework conflict and as such its elements do not interact evenly to produce the desired results or that which the interactions between them generate various frictions and conflicts.

Means to improve policy coordination are described as not just building harmonious linkages but also considering the nature of interdependent linkages among the connected members within the network; the various elements or tools various actors need from each other to function in order to accomplish their respective tasks and objectives (Alexander, 1995; Alter & Hage, 1993). In relation to the latter, policy coordination requires multiple agencies and groups to work in harmony to achieve desired objectives. Multi-actor linkages and effective coordination are needed for these joint arrangements to function effectively.

Brinkerhoff (1996) and Alter and Hage (1993) identify three types of linkage activities that are essential for improving policy coordination. Firstly, they consider effective information sharing that involves an open and effective communication among various agencies on board to increase transparency and accountability. Secondly, resource sharing which he explains as allocating resources to appropriate agencies for specific purposes. Thirdly, joint action, described as the effective collaboration between the right entities or agencies to execute a policy or programme together. Joint action activities among agencies include data collection, planning, training, service delivery, monitoring and supervision in policy coordination.

In the policy coordination literature, some authors perceive policy coordination in terms of whether actors assert control or assistance among themselves (Leonard & Marshall, 1982; Miller, 1992). Alter and Hage (1993) also question if the policy coordination purpose serve administrative ends or add to the technical aspects of attaining the policy objectives.

These various opinions according to them are significant in achieving the specifics of a policy. Brinkerhoff (1991) contends that for effective policy coordination, actors must consider inter-organizational challenges which include; threats to autonomy, lack of task consensus and conflicting requirements from both vertical and horizontal levels of governance.



In improving policy coordination, the right rules must be developed (Ostrom, 1990&1985). She argues that no single actor is solely in charge of implementing and meeting policy objectives of natural resources, rather it is implemented among various organizations. In view of that she suggests that the set rules and policies need specification on who is eligible to make decisions and in which arenas, which actions are required, the procedures to be followed, information to be provided, the cost and benefits to be assigned to agencies or groups or resource users' as a results of their actions and also enforcement mechanism to be undertaken to meet policy objectives. Ostrom (1985 & 1990), argues that rules and policies are ineffective unless the people they affect identify their existence such that the rules monitor attitudes and anticipate formal or informal sanctions to be applied for non-compliance.

#### **2.4.3 Science-policy integration in resource management**

In the literature, some social analysts, including Clark et al (1998), identify science-policy integration as an effective tool to efficiently manage natural resources. Involving science--policy integration in resource management systems has been cited as a significant element in resource allocation and management. According to Clark et al (1998), there has been an increased need to integrate sciences for a better sustainable resource policy-making. Policymakers according to (Gibbons et al., 1994) are often seen to create policies and programs that often conflicts scientific and societal values and requirements. In view of that, their knowledge base decision are often seen as weak and undermined.

In developing countries, the integration between science and policy in natural resource management systems are mostly weak and policy failures are often attributed to lack of scientific evidences in policies. The latter has increased concerns of stakeholders' to resolve these complicated and often controversial resource issues and for policy makers and policy implementers to seek concrete knowledge on which to base their decisions. Scientific knowledge is expected to be embedded in policy creation and evaluation to effect change which is the central requirement across policy formulation. Understanding change and managing transformations according to Rayner (1996) should be the main focus in which scientific progress, policy development and their interactions are enhanced. McFadden et al. (2009) described science policy integration as understanding the small variations in human activities that make a difference to the ecological, economic and social sustainability in decision-making.

The integration is described to blend both elements (science and policy) into a functioning unit. The concept provides a means to integrate a strong science base and evidence into resource policies. Greater integration between the two will provide an

evidence base that is transparent and adaptive to support complex systems and functions to prioritise policy issues or tasks on resource management (McFadden et al, 2009). An even integration of policies, natural and social science according to (Schmidt, 2007) enhances their implementation to achieve successful resource management objectives.

Science has significant contributions to make in decision making as well as specific policy challenges to be addressed. It helps to rigorously analyse the dynamics of resource management systems and provide policy-makers and implementers with the knowledge necessary to determine reasons including, the reasons for the failure of well-intended policy, which effects can result from a proposed actions or better means to achieve social and economic desirable objectives (Clark et al., 1998). The latter explained the role of scientists in science-policy integration to quantify complex systems and to provide information to decision-makers so that decisions are made with respect to precautionary policies to avoid unforeseen consequences. In addition, scientists draw policy makers' attention to resource sustainability. In natural resource management, the integration of science and policy should be maximized to evaluate the bases and effects of policy measures and to move towards a more effective means of working together to identify more ecologically, economically and socially desirable options and actions for better natural resource management systems.

#### **2.4.4 Collaborative process in resource management**

A collaborative approach to decision planning and making processes has also been identified as an essential mechanism to effective resource management (Conley & Moote, 2003). Kreuter, Lezin, and Young (2000) among numerous scholars have argued collaborative approaches to offer greater opportunity for more proactive and adaptive means to resolving resource management issues. In resolving natural resource challenges, effective collaborative management has been demonstrated to include different stakeholders associated with the pressing issue; to create and enact solutions cooperatively as opposed to acting as advocates purely on individuals' interests.

Although resource management challenges are often characterised by conflicting social views and often seen as difficult to ensure wider stakeholder participation to support the change needed, evidence from case studies of collaborative approaches in various literatures cite this approach to generates high quality and more creative and lasting agreements that are successfully implemented as a result of increased public involvement and reduced conflicts (McGuire, 2006). Collaboration creates social capital that facilitates good relationships among stakeholders. It also generates new

stakeholder networks and enhances better communication skills that create new knowledge and ideas among stakeholders (Morton et al. 2011; Podestá et al. 2013).

Collaborative process is well understood in aspects of resource management and considered in most developed countries (Hall, 1999). According to Lennox, Proctor and Russell (2011), the process allows stakeholder deliberations, clarity and transparency in decision-making processes. The latter identified some benefits of collaborative process to include; resource users' and managers' priorities as they have the ability to bring out different ideas on issues and also increase their understanding of other people knowledge and points of views. Lennox, Proctor and Russell's (2011) case studies on collaborative process concluded that collaboration approach over resource policy-making is beneficial and necessary to resolve challenges and tensions around natural resources governance.

## **Summary**

In most developing countries, managing natural resources is a challenge to governments seeking to ensure optimal benefits for the larger society while enhancing resource sustainability. The role of government in resource management is the practice of stewardship over resources in order to maintain their stability and availability. However, a large body of literature exists on government failure and reasons governments' efforts fail in natural resource management. Government failure in this scene focuses on depletion of resources in instances where the government has tried to conserve the resources and failed. Agrawal and Ribot (1999) among many authors identify the reasons as the inability of governments in developing countries to set conservation policies and to exercise effective, accountable public authority over natural resources.

In some instances, the challenge lies in the nature of property rights over resources. For example, water is not owned, and this makes regulation difficult. However, governments have property rights over many of such resources to successfully manage them. In this scene the abuse of such resources is attributed to mismanagement of state-owned property which stems from government oversight. For various reasons, governments in developing countries are unable to generate effective management mechanisms.

Some challenges faced by governments in executing their functions include ineffective policies binding the use and management of natural resources, governments' inability to prevent exploitive behaviours, to create mechanisms to establish accountability, transparency, to build human capacity of various organizations and its inability to efficiently moderate various oppositional interests of relevant stakeholders as well as

equal resource wealth distribution. The impacts of corruption and political influence in resource governance cannot be left out as these factors were also described as evidence of institutional failure in natural resource management systems.

The literature matched some resource challenges with governance institutions and presented policy coordination, public participation, science-policy integration and collaborative management as some specific management mechanisms to adequately include in natural resource management systems to meet management objectives.

## **CHAPTER 3: RESEARCH DESIGN**

### **3.0 Introduction**

This study seeks to identify mechanisms for managing rivers successfully within Ghanaian small scale mining communities. The previous chapter identified some challenges that obstruct developing countries from managing their natural resources. To identify challenges in Ghana's mineral and water resource management system, a case study was undertaken in Amansie Central District to assess the roles of institutions that manage mining operations in the district. The district is rich with huge deposits of gold as well as numerous water resources: however, many water resources have been polluted due to small scale mining operations. This chapter presents a framework for assessing public perception on mining operations and water pollution within the district. It also describes approaches used to access public perceptions and opinions on natural resource management specifically on gold minerals and rivers within the district.

### **3.1 A framework for assessing mining operations and water management within Ghanaian mining communities**

The previous chapter identified some dimensions that affect the effectiveness of natural resource management in developing countries. Drawing on the latter, a framework is developed to evaluate their impact in Ghana (Table 3). The dimensions to be evaluated are: the impacts artisanal small scale mining has on the selected district, the drivers to environmental degradation, particularly, water resources and the challenges that undermine management efforts. Motivations for change and incentives to change to meet environmental obligations are also dimensions that will be evaluated in this study.

**Table 3: Framework for data analysis**

Dimension	Indicator	Criterion
<b>Impacts of mining</b>		
Physical environment	Environmental performance	▪ Improved or reduced environmental performance
Social/Economic value	Quality of life	▪ Improved or reduced life quality
<b>Drivers</b>		
Resource ownership	Government& traditional ownership	▪ Issues with resource allocation
Policy and regulations	Mining regulatory policies	▪ Policies and regulations meet environmental obligations
Government structure	District regulatory offices	▪ Appropriate representations of mining regulatory bodies in the district
<b>Challenges</b>		
Administrative capacity	Law enforcement	▪ Environmental challenges corresponds to administrative capacity
Corruption	Environmental compliance	▪ Extent of prosecution in the district
Political influence	Prosecution	
<b>Motivation for change</b>		
State of the environment	Quality and flow of rivers	▪ Community dependency on rivers
<b>Incentives to change</b>		
Strategies & mechanisms	Public perceptions	▪ Stakeholder interest in the environment ( water quality)

Source: Author

### 3.2 Research design and strategy

Research design according to (Hakim, 1987) is a plan that describes how, when and where data are to be collected and analysed. Malterud (2001) also explained it as the researcher's overall in answering the research question or testing the research hypothesis. Research design is also defined by Oppenheim (1992) as the basic plan or strategy of research that is possible and valid to draw conclusions. This study is focused on managing rivers in artisanal small scale gold mining communities in Ghana. As a research strategy a case study in a district that is noted for gold mining and water pollution will contribute to the knowledge of managing minerals and water resources in Ghana.

### 3.3 Case study method

A case study research is recognized by Zainal (2007) as a tool that allows the understanding and exploration of complex issues. A case study research approach allows the researcher to go beyond statistical results and able to understand the behavioural aspects through participants perspectives (Zainal, 2007). This approach

according to her helps to describe both the qualitative and quantitative information through observation and analysis of the topic under investigation. Noor (2008) defines case as an individual, event, entity or a unit of analysis. Anderson (1993) describes case study as the 'how' and 'why' of events that allows an investigation of the differences between what was planned and current occurrences. A case study approach allows researchers to retain meaningful characteristics of real life including attitudinal change, individual life cycle as well as managerial and organizational processes. Although this approach is criticised as providing little basis for generalization, Yin (2013) contends that the results, like other experiments are generalizable to theoretical hypothesis and not to populations or universes.

The case study approach will include a qualitative descriptive approach. Qualitative aspects which include interviews and observations will explore attitudes, perspectives, experiences and feelings of participants to conceptualise the underlying research objectives. The rationale for using the latter approach in this research is to explore the opinions of participants and also to assess the nature and extent to which people value their natural resources in terms of utilization and conservation. The research will also analyse regulatory documents relevant to mining and water pollution. Documents will be interpreted by researcher to give voice and meaning on assessment of relevant regulatory frameworks.

The qualitative research in this study will be complemented by quantitative data which will provide a complete picture of the research topic and to identify research aim and objectives. These various approaches will broaden the scope of the research data. Quantitative research assumes that there is an objective truth existing in the world that can be measured and explained. The concerns of the quantitative method according to Cassell and Symon (1994) are that measurements are reliable, valid and generalisable in predicting relationships that exist among issues. Quantitative aspects will be used through the administration of questionnaires to collect participants' perceptions including the economic and environmental impacts of gold mining on the district as well as roles of regulatory bodies and regulations for managing minerals and water resources.

### **3.3.1 Interview technique**

Interviews are a better way to uncover sensitive issues Wimmer and Dominick (1997); Oatey (1999). According to the Oatey, it requires understanding between respondent and interviewer. To uncover and explore deep rooted emotions and attitudes of some sensitive issues such as which institution fails to perform its responsibility to meet environmental obligations; in depth interviews will explore and acquire such

information. According to Jensen and Jankowski (2002) the techniques of interviews are useful, in that they generate further research areas and allow the researcher to probe for answers, ask further questions as well as acquire information by observation.

### **3.3.2 Observation**

According to Hoepfl, (1997), research observation is a classic form of data used for the purpose of describing the setting, activities, people and the perspectives of respondents. He further explained that information potentially more open for discussion is acquired through observation of phenomenon. This research will involve naturalistic observation which involves making systematic observations of participants' perceptions and the state of environment particularly water resources. Pictures on the state of environment specifically; water bodies will be taken as part of research observation to include in the study.

### **3.3.3 Document analysis**

Document analysis is a systematic procedure for evaluating or reviewing documents: both electronic and printed materials. Document analysis like other analytical approaches in qualitative research, requires that data will be examined and interpreted in order to elicit meaning (Glenn, 2009). Documents that may be used for general evaluation as part of the study will include regulatory frameworks on mining and water resources, maps, photos and background documents on study area.

### **3.3.4 Questionnaire**

A questionnaire according to (Witzel, 2000) is a tool for gathering and recording information on specific issues of interest. This model will be used to obtain information from respondents. A group-administered survey will be considered as well. It is defined by Denscombe (2014) as a questionnaire that is given to a group of participants in a research experiment with the hopes of generating many different answers and opinions that have a general focus on the research topic.

## **3.4 Case study selection criteria**

In most developing countries, the literature chapter identified aspects of institutions including corruption, political party regulation, property rights and local level management that undermine natural resource management. Since the research could not be undertaken in all Ghanaian mining regions due to limited study period, a case study in Amansie Central District was used to ascertain challenges that undermine Ghanaian institutions that manage natural resources.

In particular, Amansie Central District was selected due to its recognised gold deposits, unauthorized mining operations and resulting water pollution. Having served as



voluntary personnel in the district, the researcher also had an added advantage in terms of familiarity with some government officials, miners and some local community members.

### **3.5 Research population**

Berg and Lune (2004) defined population as the total number of units from which data can be collected such as events, artefacts, individuals or organisations. According to them, it includes all elements that meet the criteria for inclusion in a research. Fink, (2003) explains the eligibility criteria of a population as list of characteristics that are required for the membership in the target population. The criteria for inclusion in this study were:

- National departments responsible for mining operations including Mineral Commission
- Local government departments within Amansie Central District responsible for the district's well being
- Regional agencies responsible for mining operation within Amansie Central District including Environmental Protection Agency, Regional Coordinating Council and Minerals Commission
- Local chiefs responsible for managing natural resources within Amansie Central District
- Both authorised and unauthorised miners within Amansie Central District
- Concern citizens of Amansie Central District who are affected by water pollution from mining operations.

#### **3.5.1 Research sample**

Research sample according to (Berg & Lune, 2004) is a proportion of the population. It provides data representation of the population from which it is drawn. The sample was selected from local government officials employed within Amansie Central District. Stakeholder participation in the selection within the community was carried out strategically in a manner that the research study targeted heads of department, community leaders as well as the affected local community members. The researcher perceives these people have knowledge on issues pertaining to the research topic. Some community members indirectly affected by mining operations in the district were also selected randomly to obtain information on research topic. There were some overlaps among the three groups of stakeholders where some local community respondents were also small scale miners.

### **3.5.2 Research sample size**

The sample size does not influence the significant or quality of the research study (Berg & Lune, 2004). Findings from them show that the number of people in the research beforehand are not specifically known to a qualitative researcher as the sample usually change in type and size of research. They further explained that sampling continues until saturation has been achieved; where no new data or information is generated. In this study the total number of different categories of stakeholders listed was forty-four. The research was undertaken between 2 -25 July 2015. A total of 44 responses were received on the cut-off date. The forty-four responses from participants meant 100% of the population and represented the entire district.

### **3.6 Research instruments**

Kumar and Phrommathed (2005) described a research instrument as a tool used to collect data. Data were collected through observational fieldwork, interviews, questionnaires and documents. Data collection from varied respondents with different experiences and knowledge prevented information bias and increased researcher's credibility on information received.

#### **3.6.1 Research Interviews**

In this study it was vital that the voices and opinions of people be heard; therefore the researcher made interviews a major data collection method. To support the choice of interviews in this research, the researcher used structured questionnaire to guide all discussions. An advantage the researcher derived from the interview exercise was the collection of detailed information during the interview process to allow deeper analysis of research objectives. The researcher also enjoyed flexibility as the order of questions was changed in response to respondents' reactions. During the interview, the researcher had control over the interview proceedings and kept interviews on track and focused to completion. The researcher also enjoyed a level of enthusiasm for topics being discussed as some respondents completely opened up and gave information that the researcher has not considered. The researcher was friendly as possible which enhanced maximum participation of respondents who voice out on issues that affected them. The researcher engaged in the following during the interview session:

- Face to face interviews that allowed better relationship between the interviewer and respondents
- Researcher used both open and close ended questions to elicit information from participants. Open ended questions such as 'how has water pollution from small scale mining operations affected your use of rivers in the district? Close

ended questions were specific questions such as ‘are rivers and streams in Amansie Central District badly polluted’?

- The interview techniques of exploring, including observing attitudes of respondents such as anger and silence were used. The researcher used phrases such as “Could you elaborate your opinion? The researcher also maintained eye contact with respondent to encourage better communication.
- Open-ended questions allowed the researcher to probe deeper into initial responses from respondents to acquire detailed and more information.
- The researcher maintained flexibility and consistency on the line of questioning and responses from participants.

However, the researcher encountered time limitation as interviews proceedings consumed a lot of time. Interpretation of responses and distractions such as phone calls and interruptions during some interview sessions took much time which made the interview process time consuming. To close the interview, the researcher asked respondents if there were extra comments or questions. The researcher concluded interviews proceedings by summarizing opinions of respondents to ensure understanding. Participants were assured of follow-up interviews should there be the need for further clarification.

### **3.6.2 Research observations**

In the researcher’s observation technique, the researcher observed perceptions that were accessible through discussions and conversations. In this study observations were made in the natural setting so as to provide additional information on given opinions. The instrument was used to describe the setting, activities, individuals and the state of environment. Observation of community conditions and processes was included as a means to provide additional data and clarification on how mining and water management was being done and by whom. It allowed the researcher to develop a deeper understanding on small scale mining and water pollution in the district.

Observation on such phenomena such as siltation of rivers, colours of rivers, cleared vegetation and open pits were prominent in the research. Individualistic attitudes towards questions including anger, pride, sadness, willingness, stubbornness, fear, aggressiveness and defensiveness were also observed during the same period in which interviews were conducted.

### **3.6.3 Document analysis in research**

The use of documents was integral to the grounded theory of institutional failure in natural resource management systems in Ghana. General analysis was conducted on documents relating to small scale mining operations and water-use and conservation

(Appendix 1&2). No documents were made available at research sites. However, the researcher reviewed electronic Mineral and Mining Act, 2006 and Water use regulations, 2001: place them in context and analysed them for their tendency to meet obligations.

#### **3.6.4 Research questionnaire**

The research questionnaire designed for this study was made up of list of questions with clear instructions and spaces for answers (Appendix 3). Group-administered questionnaire were also given to some groups of artisanal miners that were identified on mining sites. The aim of this approach was to generate different responses and opinions on the research topic. The researcher assisted with clarification of questions to enhance successful completion of forms. This approach allowed for rapid data collection with high responses from different groups of stakeholders.

Respondents' opinions were sought using a multiple choice response scale. A five-point Likert scale (Likert, 1932) was used and respondents were asked to tick the number that best describes the extent to which they agreed or disagreed to each of the given statements.

1	2	3	4	5
Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

Structured questions under headings: impacts of gold mining, policy and regulations and management challenges provided information that classified respondent's opinions relating to the research aim. The design also sought information on respondent's demography. This approach was used as it was relatively easy to analyse and communicate findings. The researcher rendered assistance with instructions and clarification of questions where needed.

#### **3.7 Ethical considerations**

Ethical considerations relate to ethical standards that the researcher considers during the research design and processes (Berg & Lune, 2004). A good ethics application was required of the researcher by the university to provide a clear and reasoned explanation of, and justified for the research proposal on safety during field work. For the application to be approved by the university, the researcher completed a low risk notification form that described a clear and comprehensive explanation of all aspects of the research proposal as the foundation of obtaining information from respondents under safety mechanisms. The low risk notification form that addressed how risks

would be mitigated on research field was peer-reviewed by the supervisor who also had a peer-reviewed with a colleague.

After approval from Massey University was obtained to conduct the study (Appendix, 4), permission was obtained from individual participants to be involved in the study. Physical harm was not considered likely in this study; however, the researcher was sensitive to the participants' emotions in exploring questions that were likely to psychologically traumatize participants.

Respondents according should be protected from adverse situations in research procedures. They should feel secure that information given will not be used against them by any means. In view of that the voice records and notes taken from respondents were safely stored and meant to be used only for the study and be discarded after the study. A risk-benefit ratio according to Berg and Lune (2004) in this study was that participants benefited by means of improving their knowledge on natural resource management systems. They were also satisfied that information provided would assist in managing the district's endowed natural resources.

### **3.8 Limitations**

The fieldwork had some limitations. These included hostility and lack of participation by some miners, particularly unauthorized miners who were attributed with causing environmental degradation. Also, some miners considered the researcher as an intruder invading privacy and possibly to cause their arrest due to similar encounter with previous researchers including journalists.

Some respondents also sought to preserve their information due to security reasons. Issues of small scale mining and its consequences on the environment were considered political in Ghana, therefore any information on such issues were highly reckoned and protected. In that regard convincing some participants was a challenge the researcher needed to overcome. Also there were no available records from the various institutions visited by the researcher on water quality parameters needed to justify results and findings as well as available structured policies used in managing rivers.

### **Summary**

This chapter developed a framework for conducting research in Amansie Central District (Table 3). It sought out means for assessing the management of mining and water resources using instruments including, interviews, questionnaires, observations and documents (Table 4). Research information was acquired through open and close ended questions. Interviews were organized face to face to allow researcher handle

sensitive and thought-provoking questions. The research was undertaken ethically. The next chapter presents the results and findings of the research undertaken.

**Table 4: Case study framework**

<b>Research instrument</b>	<b>Assessment focus</b>	<b>Organizations</b>
Questionnaires	<ul style="list-style-type: none"> <li>▪ Impacts of mining</li> <li>▪ Mining policy and regulations</li> <li>▪ Administrative challenges</li> </ul>	Government officials, miners, local community
Interviews and focus groups	<ul style="list-style-type: none"> <li>▪ Roles and responsibilities of regulatory agencies</li> <li>▪ Miners attitudes</li> </ul>	Government officials, miners, local community
Observation	<ul style="list-style-type: none"> <li>▪ Respondents perspectives and attitudes</li> <li>▪ Current environment (water quality and flow)</li> </ul>	Government officials, miners, local community
Document Analysis	<ul style="list-style-type: none"> <li>▪ Strengths of regulatory frameworks for mineral and water resources</li> <li>▪ Weaknesses in regulatory frameworks for mineral and water resources</li> </ul>	Mining and water regulatory agencies

Source: Author

## CHAPTER FOUR: ARTISANAL SMALL SCALE MINING IN GHANA

### 4.0 Introduction

This chapter presents the context of artisanal small scale mining in Ghana. In Ghana, artisanal small scale mining activities are at least as important as large scale mining activities particularly, in relation to the number of people employed. It represents the most promising and income opportunity available in almost all Ghanaian mining communities. However, many continue to view it as dirty and fundamentally unsustainable due to its high environmental cost particularly on land and water resources. This chapter delves into artisanal small scale mining in Ghana and presents an overview of its management system. It finally presents the study area Amansie Central District.

### 4.1 Ghana's demography

Ghana is a West African country (Figure 1). It is bordered to the east by Togo, west by Ivory Coast, north by Burkina Faso and to the south by the Atlantic Ocean. The country has a warm equatorial climate with two seasons, the wet and dry seasons. Average temperatures range between 24°C and 36°C. Its area is estimated to be 238,500 km<sup>2</sup> with 40% forest cover. The country has a population over 25 million with 17% of its total population in Greater Accra, the capital city.



**Figure 1: Ghana Source: fibelreservation.com**

Ghana is one of the better researched African countries in recognition of its natural resources. Natural resources in Ghana include gold, diamonds, silver, bauxite,

manganese, rubber, fish, petroleum, limestone, salt and timber. Mining is its largest export; cocoa and timber are its second and third largest export respectively (Debrah, 2002). Ghana is relatively poor and her population is largely rural with the urban population skewed towards the southern regions.

#### 4.2 Institutions

The country is a unitary state with multiparty democracy provided by the 1992 constitution of Ghana. It has ten administrative regions and practices administrative decentralization each of which is headed by a regional minister appointed by the president. The ten administrative regions of Ghana are subdivided into 216 distinctive metropolitan, municipal and district assemblies (Table 5). These various divisions have their administrative capitals and political heads who are the Chief Executives.

The local government system in Ghana is made up of the regional coordinating councils (RCCs) and a four-tier metropolitan and three-tier municipal/district assembly. The district assemblies are the highest political and administrative authority with deliberative, legislative and executive functions. A key function of the district assembly is to initiate programmes for the district's development including the provision of clean water. The assembly also has sub committees that coordinate plans and programmes.

**Table 5: Local government structure in Ghana**

CENTRAL GOVERNMENT President Council of Minister Council of State Unicameral Parliament		
REGIONS (10) Regional Coordinating Council, RCC Regional Ministries		
LOCAL GOVERNMENT		
Metropolitan Assembly (6) Population over 250000	Municipal Assembly (49) Population over 95000	Districts (161) Population over 75000
Sub-metropolitan district council	Zonal council	Urban/Town/Area councils
Town/Area council		
Unit committees		

#### 4.3 Small scale mining in Ghana

Ghana is one of the oldest nations with rich mineral resources in gold, bauxite, diamond and manganese. According to Hilson (2001), small scale mining in Ghana can be traced to the arrival of the Europeans. As a developing country, the small scale mining sector has been a source of livelihood to significant number of people. The sector provides support in poverty alleviation in fostering rural development within various Ghanaian communities. Garvin Hilson (2001) identified Ghana to be highly reliant on small scale gold mining in due to its ability to generate wealth quickly to the



local community. It makes a significant contribution to rural employment and national mineral output. In Ashanti region, artisanal small scale mining operations are found in areas including Amansie West, East, Central and Obuasi Municipality. Mining operations are also found in areas of Western region, Eastern region and the northern regions of Ghana. Over the past decade, small scale mining operations have risen in Ghana due to rising mineral prices (Tschakert and Singha, 2007). Over one million miners are involved in the unauthorised sector (Aryee, 2012) with slightly over three hundred miners registered with the Mineral Commission.

#### **4.3.1 Overview of the Ghanaian mining legislative**

The Minerals and Mining Law 1986 and 2006 as modified by the 1993 Ghana's constitution establishes a framework for mining in Ghana. The mining law makes the state the owner of all minerals occurring in their natural state within Ghana's land and sea territory and 'That of whom owns the land upon or under which minerals are situated, the exercise of any mineral rights required by law, a licence to be granted by the minister of mines who acts as an agent of the state for the exercise of powers relating to all minerals.' Legally, minerals rights are defined to include the right to reconnoitre, prospect for, and mine minerals. The minister of mines is also authorised to exercise with define limits, the authority to transfer, amend, renew and cancel mineral rights.

The authority conferred on the minister is exercised contingent upon the advice of the minerals commission which has the power under the constitution to manage and regulate the usage of mineral resources and coordinate policies relating to minerals. Noticeably, the state owns all minerals in Ghana and Ghana government has property rights over all Ghana's mineral resources. Government manages and makes decisions and rules for access and use as well as benefits from the state owned property.

The law specifies the forms of mineral rights that the sector minister is empowered to grant, the concessions size, the eligibility criteria for the grantee and the procedure for application of the mineral rights. The law also specifies the rights and obligation of a holder of mineral rights as well as terms and conditions on which a mineral right should be made. Mineral rights granted are not tradable or transferable in any case except with the prior consent of the sector minister.

#### **4.3.2 Overview of mining regulations**

Various mining related laws and regulations have been put in place to regulate the mining sector in Ghana. These regulations seek to develop the Ghanaian mineral sector to enable it contribute to a sustainable economic and social growth. These various mineral regulations were strengthened by the introduction of the Minerals and

Mining Act, 2006 (Act 703). The Minerals and Mining Act 2006 establishes the main legislative framework used to regulate mining in Ghana.

The Act clearly spells out the ownership of minerals and minerals rights. The Act also explains minerals royalties, rentals and fees. The Minerals and Mining Act 2006 indicates prospecting licences and mining lease. It clarifies how to apply for a licence as well as who should be denied or granted mining licence. It specifies the period of a given license and the rights and responsibilities of a licence holder. Surrender, suspension and cancellation of mineral rights are also indicated in the Act. Surface rights and compensation by landowners are also defined in the Act. Also records of and reports by minerals holders as well as forestry and environmental protection practices are explained in the Act. In general the extent of information indicated and explained in the Act seems adequate and relevant for regulating mining operations.

Mechanisms and regulations for monitoring and compliance in the small scale mining industry involve roles performed by different regulatory agencies under Ghana's administrative decentralization system of governance (Table 6). The system redistributes authority and responsibility of public functions from the central government to field units of government agencies or subordinate units. However, the system of governance in Ghana appears to be deconcentration which is often considered to be the weakest form of decentralisation (McGuire, 2010). The perceived deconcentration redistributes management of minerals resources among different levels of central government. It rarely shifts authorities and responsibilities from central government officials and regional agencies in capital towns and cities to those working in districts. This system creates strong field administration capacity in the industry, under the supervision of central government ministries.

Owing to the weak system of decentralisation in the small scale mining industry, management has only involved turning over mining responsibilities to central agencies that are centred in regional capitals and towns. Although the local government is the highest regulatory body at local level, the central government has not devolved control and authority of mineral and water resources to them. Mineral allocations are centrally determined and allocated. The central government continues to be the primary source of authority in the Ghanaian small scale mining industry.

Resource management according to Agrawal and Ribot (1999) requires strong local rights over resources which must be conferred on local people by central governments. However, the pattern of decentralisation in natural resource governance in most developing countries including Ghana is often driven by an array of interests that

revolves around the exercise of political power within central government (Agrawal et al., 1999).

**Table 6: Regulatory agencies in the Ghanaian mining industry**

Ministry/Agency	Responsibility
Ministry of Lands and Natural Resources	Overall responsibility for the mining industry.
Minerals Commission	Administers the Mining Act, recommending mineral policy, promoting mineral development, advising the government on mineral matters, and serving as a liaison between industry and the government.
Geological Survey Department	Geological studies including map production and maintenance of geological records.
Inspectorate Division of the Minerals Commission	Health and safety inspections and maintenance of mining records.
Lands Commission	Legal records of licenses and legal examination of new applications.
Environmental Protection Agency	Overall responsibility for environmental issues related to mining including enforcement of environmental regulations.
Water Resource Commission	Has responsibility for the regulation and management of the utilization of water resources and for coordination of any policy in relation to them.
Forestry Commission	Has responsibility to regulate the utilization of forest resources as well as conserving and managing the resources and the coordination of related policies.

#### **4.3.3 Land ownership and use in Ghanaian small scale mining areas**

Land ownership and use in Ghana play a pivotal role in mineral resource allocation and use. There are many controversies over property rights and land ownership in Ghana. Larbi, Antwi, and Olomolaiye (2004) identified three main types of land ownership; state land, vested land and customary land, with customary land having an estimate of 70% of Ghana's land system. Aubynn (2006) also identified two categories of land ownership in Ghana namely, state lands and stool land with 20% and 80% portions respectively. The existing land ownership (customary lands or stool lands) give traditional authorities the absolute land title ownership on behalf of their people (Asumadu, 2003). For commercial and economic purposes, land acquisition, leases and rentals over a period are attainable and require permission by traditional title holders of the land. However, at the end of the lease or acquisition period, the land is returned to the allodial titleholder from whom the cessation was granted (Nyame & Blocher, 2010).

Boundaries between state land ownership and customary ownership as cited by Nyame and Blocher (2010) is difficult to comprehend due to multiple overlapping interest. The highest title is the allodia title and it is held in traditional leaders (chiefs) which make chiefs administer and hold the lands in trust to their people. The overlapping interests according to them makes it a challenge to access who is entitled to a compensation or benefit share from mining on lands, however, that is not the scope of the study. The scope of the study is confined to examine the interaction between land ownership and water pollution from small scale mining activities.

Gold bearing rocks which are significant resources for small scale miners are located within lands under traditional or stool ownership due to their ownership right. Property rights over such lands can be argued as a closed access public property rather than state property; where there is limit to access and use lands and communal management is jointly own by the community but entrusted to traditional leaders.

#### **4.3.4 Artisanal and small scale mining operations**

The Mining Minerals and Sustainable Development (MMSD) Final Report (2002) distinguishes between individuals and families are involved in artisanal mining and is solely manual and small scale mining involving organized group of people who use mechanised equipment in their operation. According to Aryee et al., (2003); Hruschka and Echavarría (2011), artisanal miners are often classified as subsistence miners who undertake mining activities independently or in groups, panning for minerals with simplified tools including, pickaxes and shovels while small scale mining operators use mechanised equipment including excavators in mineral extraction, exploration and processing. In this study, both terms were used together without differentiation as either parties mine for minerals using their own resources and also mine archaeological deposits of gold rather than geological deposits (Akabzaa et al., 2007).

In Ghana, authorised miners have the legal authority to mine while unauthorised miners operate undercover. All mining operations that are not big mining companies or cooperation fall under the small scale mining sector and in Ghana, such miners are referred to as “Galamsay” (gather them and sell) operators. The sector is primarily low capital intensive and requires high labour intensive technology (T. Akabzaa & Darimani, 2001; Hilson, 2001). The target of the mining is basically gold, derived from either veins in the bedrock or from gold bearing gravels in river beds (Kristensen et al, 2013; Ofosu-Mensah, 2011; Steckling et al., 2011).

In this scene, mining operations are extremely dangerous as their operations involve huge risks of working in harsh and often very insecure conditions to make a living. The main stages in the entire operation are pit construction (Figure 2), water pumps and

washing plants to obtain gold bearing ore from the soil sediments, disposal of tailings and finally the mercury amalgamation process (Kessey & Arko, 2013). During pit construction, the vegetation cover together with various layers of the soil is removed until the gold bearing ore is reached and scooped out. Scooping out mud in or around water bodies to obtain the gold bearing sediments is done as well. The gold bearing sediment removed while overburden is deposited all-round the pit with various layers of soil containing humus lumped together (Kessey & Arko, 2013).



**Figure 2: Pit under construction by an excavator (Source: ResearchGate.Net)**



**Figure 3: Tailing directly discharged from washing plants into water (Source: Ibrahim Bawa, Minerals Commission, Ghana)**

When the minerals from the overburden are exposed, they oxidize and become acidic when washed. The acidic solution which is known as leachate are discharged into former mined pits to be used again and finally discharged into surface waters. For sites

Page | 42



close to surface waters, leachates are discharged directly into the waters (Figure 3). The final step, mercury amalgamation process (Figure 4 & Figure 5) also releases mercury fumes that diffuse into the air, soil, crops and water resources (Steckling et al., 2011).



**Figure 4: Mercury amalgam subjected to open flame (Photo credit: George Young)**

Even though government ministries, departments and agencies exist with their respective policies and regulations to manage the sector, environmental challenges particularly surface water pollution continue to deteriorate. The sector regulation is poor in protecting the environment and the environment particularly water pollution is a challenge the country faces as a result of the sector's operations.



**Figure 5: Refined gold for the market (Source: George Young)**

#### **4.4 State of Ghana endowed water resources**

Water is a fundamental resource for life. The quality and availability of water is significant in determining peoples' quality of life. Irrespective of its source, its availability and access to meet quality and quantity requirement is significant for sustaining a nation. Like other developing countries, Ghana's landscape is significantly influenced by water resources. These water resources are central to the identity of Ghanaians and are highly valued for their economic, recreational and scenic values. They also represent different cultural heritage. However, the quality of Ghana's water bodies has deteriorated remarkably. Most riverine systems in Ghanaian mining communities have been severely polluted and rendered useless due to small scale mining operations (Figure 6, 7&8). Although various regulatory agencies provide respective legislative mechanisms to protect these water resources, they are perceived by public to be continuously polluted by mining operations.



**Figure 6: State of River Offin (source: [www.kweiquartey.com](http://www.kweiquartey.com))**

The use of water in small scale mining communities affects the quality and flow of fresh water to residents. Pollution occurs when substances that negatively modify water quality are discharged directly or indirectly into it. The underlying effect of water pollution is directly suffered by aquatic organisms and vegetation that survive in them. On human level, several people are denied the varied uses of such natural resources.

In the small scale mining sector, water pollution is seen as a major concern among stakeholders as mining operations continue to pose threat to potable water resources. In mining operations, the most significant water use has been identified with alluvial mining and mineral processing (washing sediment to obtain gold bearing ore). The latter render water infested with waste from extraction and processing of mineral



resources. Armah et al. (2010) among numerous researchers have identified high levels of toxic heavy metals including, arsenic, mercury and zinc in most water bodies within various mining catchments. Sedimentation and siltation from mining operations have also clogged such water resources and rendered them low in quality and flow.



**Figure 7: State of River Pra (source: m.myjoyonline.com)**



**Figure 8: Ankobra River (source: m.myjoyonline.com)**

Due to the negative impacts of mining activities on community water resources, small scale mining operations are seen to put high pressure on natural water resources. Water resources are rendered unsafe for domestic chores, aquatic life as well as recreational and scenery values. Its negative impacts on community water resources



#### 4.5 Study Area: Amansie Central District

##### Physical and natural environment

DISTRICT MAP OF AMANSIE CENTRAL



The main vegetation of the district is semi-deciduous forest which contains diversity of tropical hardwood including, Odum (*Iroko*), Wawa (*Obeche*) and Mahogany (*Mahogany*). The districts' vegetation is a semi-equatorial forest. It has two main forest

reserves: the Oda and Subin. Major areas of operations are farming and mining. Within the district, crop farmers cultivate food crops, tree crops and vegetables. The major tree crops are cocoa, oil palm and citrus with cocoa covering 50-60% of the arable land. Major food crops include maize, cassava and plantain. Vegetables include tomatoes, pepper and garden eggs. Amansie Central District's vegetation has been seriously disturbed by human activities such as mining and farming systems, bush fires, lumbering thereby reducing the primary forest to secondary forest. However, some primary forest remains in a few areas.

### **Geology and minerals**

Amansie Central District is underlined by three geographical formations. These are the Tarkwaian, Birimian and Granite rocks which are rich in mineral deposits. Gold is abundant in the district. This has resulted in the spread of small scale mining operations within the district. AngloGold Ashanti is the only mining company located in Obuasi Municipality and operates in the district. Within the district, unauthorised mining is highly patronized by all gender and age groups, particularly youth. Sand and gravels are natural resources that are abundant in the district as well.

### **Drainage**

There are three main rivers in the district, the Oda, Offin and Fena Rivers. In addition, there are a number of rivers and streams within the district. Most rivers (Figure 10 & Figure 11) including, River Offin (Figure 6) which flows along the south eastern border and forms boundary between Ashanti and the Central Region are severely polluted particularly as a result of artisanal small scale mining activities along the banks of these water bodies.



**Figure 10: Oda River, Amansie Central District (Photograph: Author)**



**Figure 11: Akaasum River, Amansie Central District (Photograph: Author)**

### **Governance**

The office of the local government (Amansie Central District Assembly) is located in the district; however, offices of Environmental Protection Agency, Mineral Commission, Water Resource Commission and Forestry Commission are not present in the district. The assembly is made up of the District Chief Executive, assembly members of whom two-thirds are elected by universal adult suffrage and one-third appointed by the president in consultation with chiefs and interest groups of the district. The Member of Parliament for the constituency is also present in the district. The assembly is chaired by the presiding member of the district who is elected from within assembly members.

### **Social and culture**

People with homogeneous culture make up the district, however, majority of the people are Akans of Ashanti origin and they hold strong belief in Ashanti traditions and customs. They have strong belief in certain taboos. Generally, the people are friendly and sociable. They are sensitive to government issues and participate fully in public flora including, festivals, funerals and other social programmes.

### **Traditional set up**

Communities in the district are traditionally ruled by local chiefs and supported by their elders including family heads. Traditionally, queen mothers also play significant role in decision making; they are part of the king makers. The highest traditional authority in the district is the Bekwai Traditional Council and all chiefs in the district owe allegiance to the paramount chief of Bekwai. Traditional rulers are custodians of stool lands in the districts and also ensure peace and order as part of their responsibilities. They collaborate with unit committees to make decisions for the development of their

communities and help with the implementation of projects through the organization of communal labour as well as other communal initiatives.

### **District's economy**

The economy of the district can be divided into agriculture, industry and service. The agricultural sector is mainly crop farming with relatively smaller livestock and fish farming. The industrial sector mainly involves artisanal and small scale mining operations, majority of which are unauthorized. Wood based industries that operate in sawmill and carpentry are also present in the district. The service sector include the sale of farm produce, sale of some manufactured goods, hairdressing, tailoring, communication and the public and civil services including teaching and health services.

### **Summary**

This chapter presented the background study of the research. It identified employment and wealth creation as the main economic impacts small scale mining has on the country. It also identified its pressure on the wider and immediate environment of Ghana particularly, water quality and flow. The chapter presented the bad conditions of some significant rivers in Ghana. It also presented the context of small scale mining and management in Ghana. It presented an overview of information indicated and explained in the Ghanaian mining framework and identified it to be relevant in regulating mining operations. The chapter also presented a brief profile of the study area; a district rich in gold deposits with influx of small scale mining particularly unauthorised operations. Although the Ghanaian mining regulatory framework appears relevant to manage the sector, the next chapter presents respondents' perceptions in Amansie Central District on elements that hinder the fulfilment of the regulatory framework.

## CHAPTER FIVE: RESULTS

### 5.0 Introduction

The previous chapter presented the background to establish the impact of artisanal small scale mining in Ghana. This chapter presents responses from participants including, government officials, miners and the local community members to access the context of mining and water management in Amansie Central District.

### 5.1. Respondents profile

Forty-four participants within Amansie Central District were surveyed through interviews, observations and questionnaires. The data was analysed using Nvivo and Microsoft Excel into descriptive statistics, percentages and themes. In this study analysis, three groups of stakeholders were involved; government officials, miners and the local community members of Amansie Central District (Table 7).

**Table 7: Survey respondents by affiliation**

Affiliation	Sector	No. of Respondents	Response Rate
<b>Government officials</b>	<b>National level</b>		
	▪ Minerals Commission (National Office)	1	
	<b>Regional level</b>		
	▪ Environmental Protection Agency (Regional Office)		
	▪ Regional Coordinating Council (Ashanti Region)	4	50%
	<b>Sub Regional level</b>		
	▪ Mineral Commission ( Zonal Office)		
	<b>Local level</b>		
	▪ District Assembly ( District Office)	17	
	▪ Member of Parliament		
<b>Community Members</b>	▪ National Disaster Management Organization ( District Office)		
	▪ Police ( District Office)		
	<b>Traditional Leaders</b>		
	▪ Chiefs	4	
	▪ Assembly Members		27%
<b>Miners</b>	<b>Community Members</b>		
	▪ Natives of Amansie Central District	8	
	▪ Non-natives of Amansie Central District		
<b>Miners</b>	<b>Miners</b>	5	
	▪ Authorised miners		23%
	▪ Non-authorised miners	5	

Questionnaires accounted for all 44 participants of whom 22 were government officials, 10 miners and 12 community members. Interviews accounted for 24 respondents of

which 5 were representatives of both national and regional agencies and the Member of Parliament for the constituency. The interview also accounted for 2 local chiefs, 6 miners (3 authorised miners and 3 unauthorised miners), 1 farmer and 6 heads of department within Amansie Central District. Two respective groups of artisanal miners and community members were interviewed as well. The six miners interviewed used mechanised equipment including, excavators and bulldozers in their operations while artisanal miners interviewed used non-mechanised equipment including shovels and pick axes.

Agencies responsible for water resource management as well as non-government organizations (NGO's) and social groups engaged in water resource management activities were not present in the district. All respondents were stakeholders responsible for mining operations and/or affected by water pollution from mining activities within Amansie Central District.

Half of the respondents were government officials responsible for mining operations within Amansie Central District. These included the Ashanti Regional Coordinating Council, Amansie Central District Assembly, and Ashanti Regional Environmental Protection Agency, both national and zonal Mineral Commission, National Disaster Management Organization (district office) and the district police.

Nearly one quarter (23%) of the respondents were miners within Amansie Central District who engaged in either authorised or unauthorised operations. Only 10% of these miners were natives of the district while 90% of the miners were non-natives who resided in the district purposely for mining. Nearly all (89%) of the miners had mining as their full time job while 11% operated on a part time basis (Table 8).

**Table 8: Miner profiles**

		Legal miners	Years of mining experience			
			(0-5 years)	(6-10 years)	(11-15years)	Full time
<b>Natives</b>	10%	0	100%	0	0	100%
<b>Non-natives</b>	90%	40%	67%	22%	11%	89%

From the research, miners who are natives of Amansie Central were not actively into small scale mining operations within the period of 6-15 years; however, all have been involved in mining operations over the past 5 years (Table 8). Non-native miners who have been mining within the district had also increased from 11% to 67% within a period of 10 years. Interestingly all 10% of native miners were unauthorised operators while 40% of the non-natives operated with authority.



Community members who participated in the study made up 27% of the total population, including, two local chiefs and an assembly member. Participants were both natives and non-natives of the district who were affected by mining operations within the district. The highest occupation obtained from natives of the district were farmers and traders while teachers and health workers made up the highest population of the non-native members who resided in the district but also affected by the district's mining operations.

## **5.2 Respondents perceptions**

In order to ensure mining and water management in the district, it was essential to better understand stakeholders' views on the sector and its impacts. What do respondents think about small scale mining and the environment particular water resources?

### **5.2.1 Impacts of small scale mining on the district**

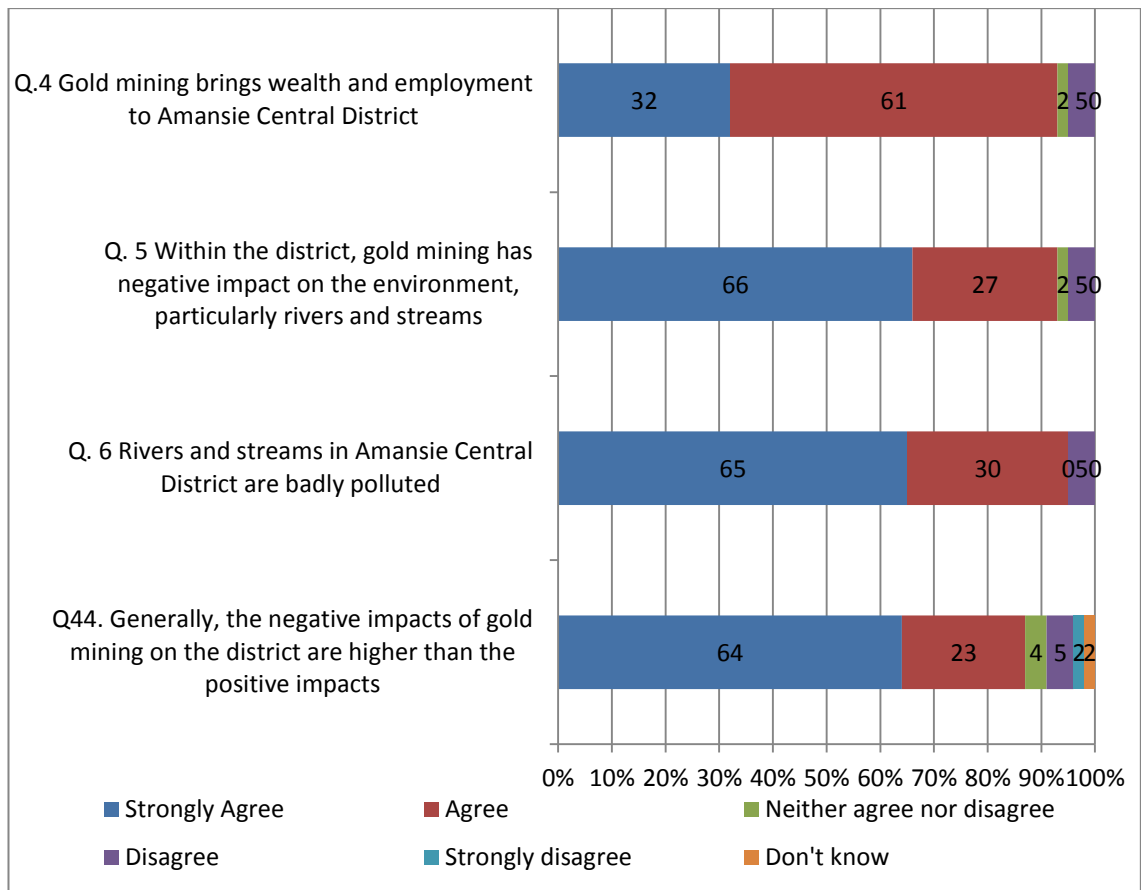
Amansie Central District is known for its huge gold deposits and mining activities are prominent within the district. Respondents' perceptions were sought to obtain views on the impacts of gold mining on the district. Respondents perceive small scale mining has positive influence on their socio-economic life and admit it also has negative impact on their environment (Figure 12; Q.1).

Nearly all (93%) respondents consider wealth creation and employment as benefits artisanal small scale gold mining has (Q.4 32% strongly agree: 61% agree) on the district. Interview responses also confirmed the researcher's statement that mining operations contribute to improving people lives within Amansie Central District in terms of wealth creation and employment and to meet basic family needs:

I am a miner and this is what I do for living. I find mining to be lucrative and I don't see myself working for anybody again (Interview: Unauthorised miner).

After secondary school, my parents had no intention to further my education because there was no money at home to pay for my fees, I wish I could be in school like others but I can't, I have to survive, therefore I must work and this is the only job my friends and I find available and attractive in the district. Although it is very tedious and stressful, we do it to keep our families and to provide our needs (Interview: Artisanal miner).

Five percent respondents who were government officials considered gold mining had no positive impact on the district due to the greater negative impacts they perceive small scale mining has on the district's environment particularly, land degradation, water pollution and abandoned pits (Figure 12; Q.4).



**Figure 12: Gold mining impacts on the district**

Respondents also perceived the environment, particularly all rivers and streams within the district, to be badly polluted from gold mining operations (Q.5 & 6). Nearly all respondents (95%) agreed that all rivers and streams within Amansie Central District are badly polluted (65%, strongly agree; 30%, agree) as a result of mining activities. Only 5% respondents disagreed to the statement and supposed there were some existing rivers and streams that were not polluted. Significant difference was noticed in strong agreement for mining benefits (32%) and bad state of rivers in the district (65%):

Small scale mining goes with water; we use the rivers and divert water all the time, I don't believe authorities really care about what we do (Interview: Unauthorised miner).

Alluvial gold is contained in the rivers. People cannot mine without polluting the waters (Interview: Local government official).

Government officials also agreed and recognised the inevitable pollution from mining operations. Most respondents (87%) perceived the negative impacts of gold mining operations on the district to be higher than the positive impacts (Q.44: 64% strongly agree; 23% agree). Respondents (7%) who disagreed to the statement as displayed in



(Figure 12, Q5, 6 & 44) were some miners who appreciated the wealth and employment gold mining bring to themselves as well as some government officials who deemed themselves to be responsible for the position they occupy to manage mining operations within the district.

### **5.2.2 Causes of water pollution from mining operations**

Within the district, respondents were asked to identify the causes of water pollution from the small scale mining sector (Figure 13). The following were identified as causes of water pollution from the industry:

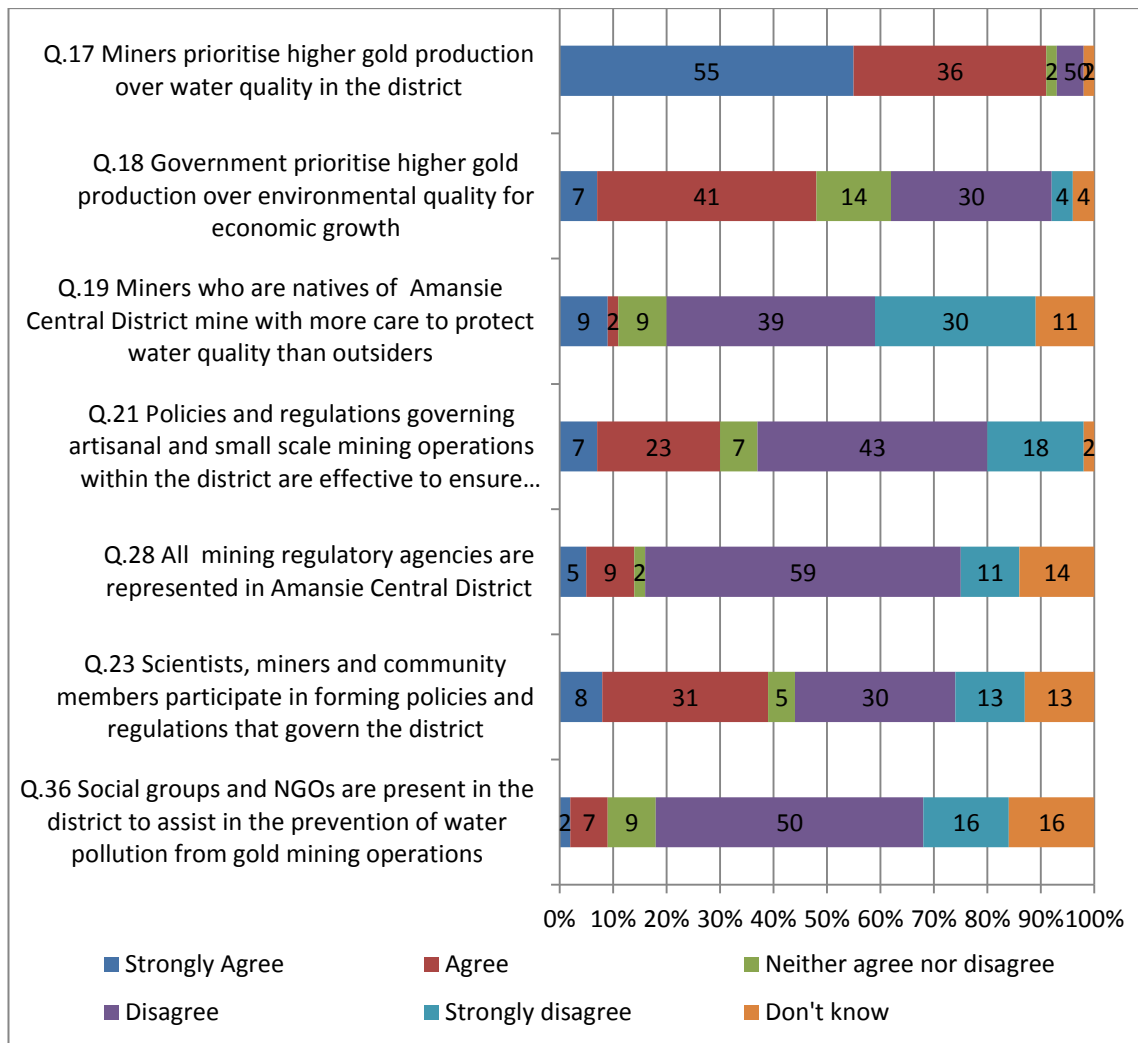
- Gold prioritization over water resources
- Uncontrolled unauthorised mining operations
- Ineffective policies governing mining operations
- Inappropriate representation of regulatory agencies within the district
- Less participation of miners in decision making
- Lack of water quality advocates in the district (NGOs and social groups)

Almost all respondents (91%) agreed that mineral-resource prioritization over water resources is a cause of water pollution within the district (Q.17: 55%, strongly agreed; 36% agreed):

We need money to survive, we can't stop mining. I chose mining over farming  
(Interview: Illegal miner).

Very few respondents (5%), particularly some miners who were unable to take a stand on the statement, opposed it due to the financial benefits they acquire from mining operations. Figure thirteen; question eighteen also illustrate government concern for environmental quality within the district. In total, 34% respondents appreciated government priority for environmental quality. They perceive government prioritises environmental quality over higher gold production. However, nearly half (48%), disagreed to the statement and considered government efforts to support higher gold production for economic growth. Also, 14% respondents neither agreed nor disagreed to the statement by reason that government has structures in place including, regulations to regulate mining and sound environment.

Perceptions on effectiveness of mining policies to ensure compliance by miners and to minimize water pollution were also sought (Q. 21). Over half of respondents (61%) considered policies and regulations governing mining operations within the district as ineffective to ensure compliance by miners; hence, the pollution.



**Figure 13: Causes of water pollution from mining operations**

However, 30% respondents agreed to the effectiveness of policies and regulations and assign responsibility to miners' attitudes and policy regulators who undermine underlying policies:

Policies and laws are good but implementation and enforcement are the main challenges to non-compliance particularly on unauthorised miners (Interview: Government official).

Mining policies are weak; this has resulted in enormous environmental problems (Interview: Government official).

Respondents also revealed that not all authorities responsible for regulating mining operations were present within the district. Hence, lack of guidance and monitoring to ensure compliance by miners (Figure 13, Q. 28). Most respondents (70%) attributed water pollution from mining operations to regulators that were not represented in the district. Some respondents grumbled as they explained that each regulatory agency or

authority had a role to play to ensure compliance, hence, the absence of such agencies including the Environmental Protection Agency, Mineral Commission and Land and Water Resources give added incentives to miners to mine and degrade water quality. Some respondent's aggressively complained:

We don't have Mineral Commission's office in the district; miners go for permit at the head office in Accra and come here to mine. We have no authority over them because they come with a mining permit and those who issue the permit are not here. It is not my responsibility to monitor them. [The] Environmental Protection Agency is not here as well; they should have an office here to effectively monitor the environment they grant permit for (Interview: Chief).

An idea to probe whether miners who are native of Amansie Central District mine with more care to protect the district's environment and natural resources scored 69% disagreement and 11% agreement (Q.19). An appreciable number of respondents perceived both native and non-native miners mine in the same manner with disregard to the district' environmental performance:

We all mine the same way, no clear difference, we pump and divert water together and use them (Interview: Artisanal miner).

Over a third of respondents (39%) agreed that policies governing mining operations had scientific basis and had miners and local community participation in policy formulation. However, 43% respondents disagreed and perceived government authorities do not incorporate the views of miners and the local community in policy formulation. Two thirds (66%) of the overall respondents also perceive the absence of social groups and NGO's advocacy in the district to be an underlying factor to water quality degradation:

I do not know about any scientific information in policy making. However, we are sometimes called to share our views on mining issues particularly through Small Scale Mining Associations. I don't know of any social group or NGO in the district tackling water quality... The media sometimes create general awareness on water pollution (Interview: Legal miner).

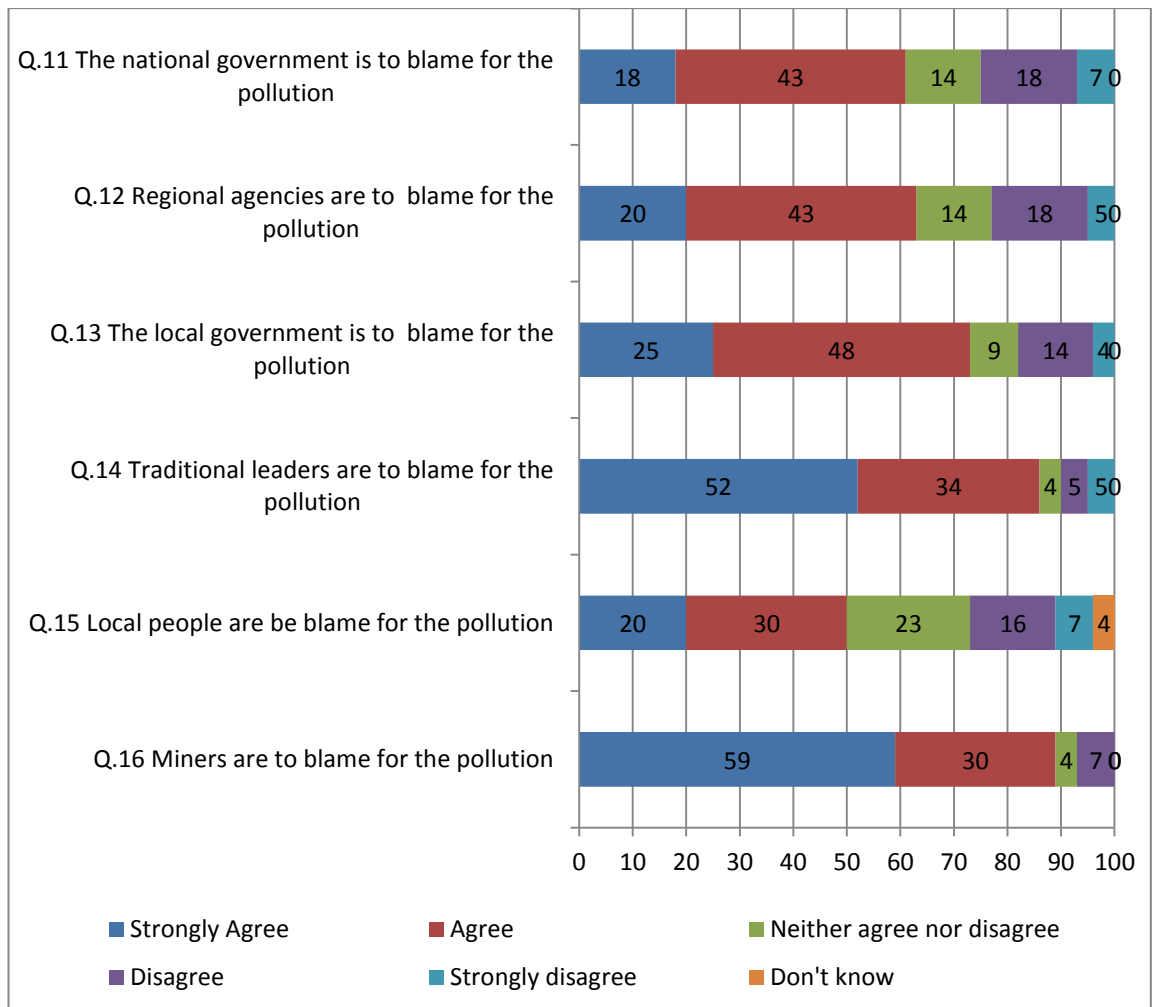
#### **5.2.2.1 Regulatory bodies responsible for mining and water pollution**

Research conducted also solicited how well mining operation and water resources were managed by various level of governance (Figure 14). It identified regulators and stakeholders and their responsibility towards mining and good environmental performance: the national government, regional agencies, local government, traditional leaders, the local community as well as miners. Responses revealed stakeholders who

are perceived to be less responsible in mining and water management. During interview sessions it was observed that specific responsibilities towards mining and water management were not clearly defined among regulators as each regulatory body consulted shifted and apportioned management responsibility to other regulatory body:

We do not have electronic database on miners. The national and regional offices do not provide the district assembly with electronic database of information including, land concessions, water quality and mineral quantity to be mined. Miners come with their permit and our duty is to issue them publication (public notice) to go ahead and mine. We do not have authority over the mining industry; the district assembly only charges publication fee which is not enough for site monitoring to ensure compliance (Interview: Local government official).

The local government is responsible for the pollution. Unauthorised mining operations occur at the local level and should be solved locally. Illegal miners are not under the Mineral Commission; they are not under any regional agency. The Minerals Commission regulates registered miners. It is the responsibility of the law enforcement agencies (national security and police) to prosecute illegal miners (criminals). The district chief executive represents the national security coordinator within the district and it is his responsibility together with district authorities and the police to arrest and prosecute unauthorized miners who are “criminals” within the district (Interview: Minerals Commission).



**Figure 14: Perception about stakeholders responsible for mining and water pollution within the industry**

Security agencies are responsible for unauthorised operations. Mineral Commission allocates land concessions, we work to reduce environmental impacts, and we do not give concessions. The district assembly is on the ground; they receive permits and should be able to deal with unauthorised miners. (Interview: Environmental Protection Agency).

Yes! The regional governments are responsible for mining and water pollution. Regional agencies responsible for mining and water management do not have offices in the district. For instance, the Mineral Commission and Environmental Protection Agency are not present here to regularly monitor, cause arrest and prosecute offenders. They have their specific roles in law implementation and enforcement to monitor mining operations and protect the environment. We do not have enough funds and logistics to perform their responsibilities within the district (Interview: Local government official).

A reasonable number of respondents criticised both regional (73%) and local (63%) governments respectively as regulators at the grass root level, (specifically the local government) that are inefficient in their management duties to manage the small scale mining industry and to ensure the district's water quality. The national government (50%) and the local community (61%) were the least to be criticised due to the wide distance and less authority respondents perceive exist between the miners and those bodies in regulating and enforcing obligations.

Interestingly, miners and traditional leaders scored the highest critics with 89% and 86% respectively (Figure 14: Q.14 & 16). Eighty-nine respondents confidently criticised miners attitudes as inconsiderate individuals who mine in their own interest regardless of the environment (Q16; 59%, strongly agree; 30% agree). Respondents also considered traditional leaders (chiefs) as main stakeholders (Q14; 52%, strongly agree; 34% agree) in the industry that compromise and undermine good management performance. Almost all respondents sincerely perceived traditional leaders as stakeholders who tolerate unauthorised mining operations in the district, as such they were perceived as the backbone to mining and water pollution.

I strongly agree that chiefs are responsible for water pollution in the district. Chiefs promote illegal mining within the district. They are not bound by any mining law to be prosecuted. They give out lands and orders to mine without authorised permits. They are involved in almost all illegal mining operations here (Interview: Government official).

Traditional rulers are the custodians of the land; they should be worried about the pollution on their lands. However, they are not. They don't complain because they are involved (Interview: Government official).

### **5.2.3 Challenges that undermine management efforts**

The survey identified varied challenges (Figure 15) that are perceived to undermine management efforts in managing mining operations to ensure good water quality in the district. These challenges include:

- Less-enforcement of rules and regulations
- Non-prosecution of mining offenders
- Corruptions within the industry
- Weak mining policies and laws
- Inappropriate representation of regulatory agencies within the district
- Administration capacity of mining regulators
- Political influence

The research conducted identified inappropriate representation of regulatory agencies within the district and corruption as the main challenges respondents perceive undermine management efforts. Eighty-four percent respondents perceive corruption as an element that exist in the industry and undermine management efforts (Q43. 45% strongly agree; 39% agree). They perceive corruption to be an undeniable practice that stems from the highest authority through to the least authority and counters various management mechanisms to attain sound mining operations.

We acquire concessions without permits, we able to move excavators in and out of the district; and we succeed because we pay our way through out our entire operation (Interview: Illegal miner).

A significant number of respondents (Q40. 82%) also agreed an inappropriate decentralization structure allows a non-uniform representation of all mining regulatory agencies and authorities within the district. They however perceive this as a significant cause and a challenge that enhances inappropriate mining practices within the district.

Another challenge respondents identified was lack of policy enforcement. Nearly three-quarters of the respondents (Q.26, 71%) perceive lack of mining policy enforcement as a challenge that perpetuates the unauthorised mining sector. However, 22% of some government officials who supposed rules and regulations within the mining sector were properly enforced opposed the statement.

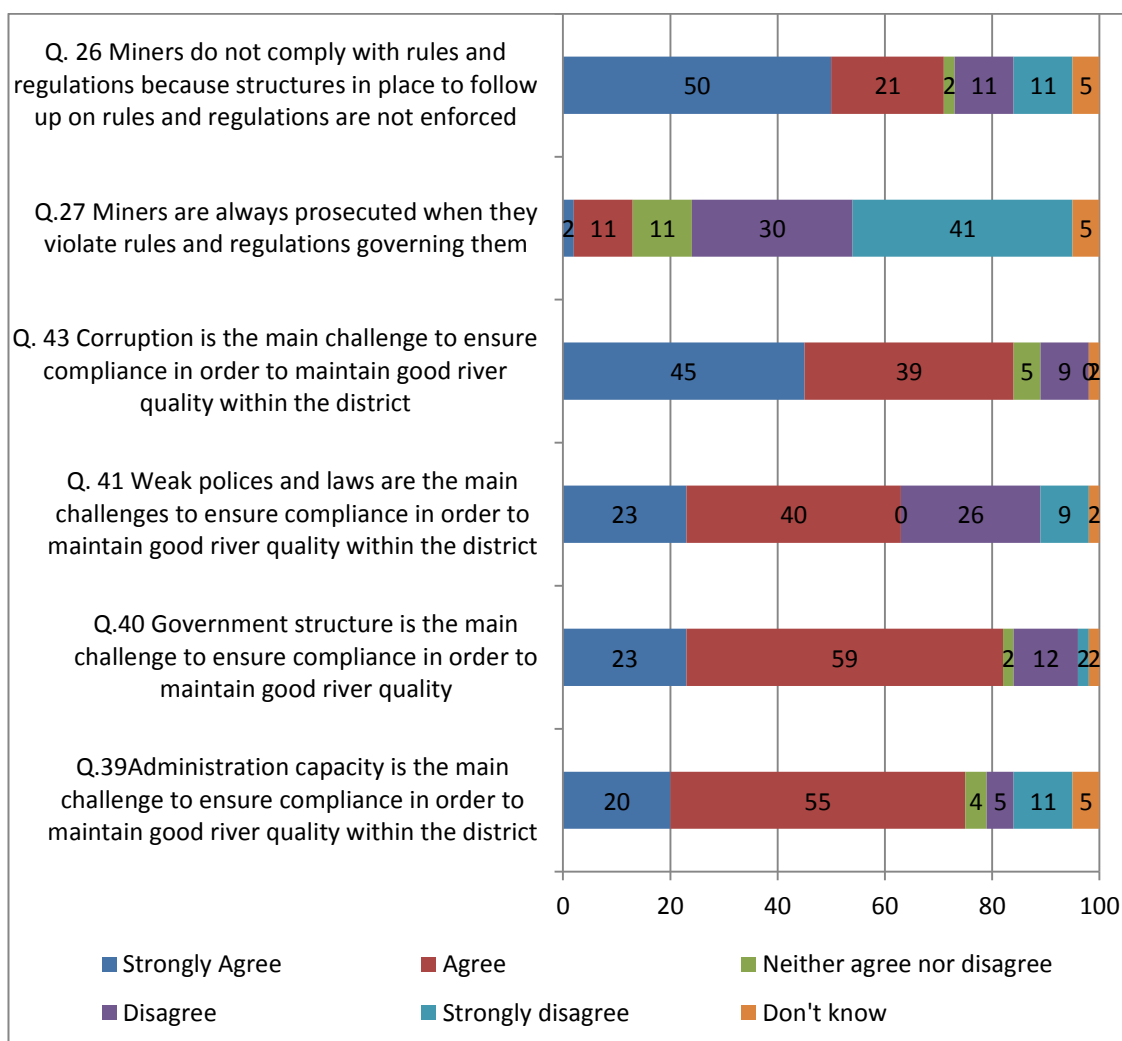
Lack of prosecution in the industry was also identified as a challenge that perpetuates inappropriate attitudes in the industry. Only 13% agreed (Q.27; 71% disagreed) miners were prosecuted when they violate mining rules and regulations. Eleven percent neither agreed nor disagreed to the statement. The larger number of respondents (71%) who disagreed miners were always prosecuted explained that, lack of prosecution and stringent punishment in the industry, warrants unauthorised rampant operations within the district. Nevertheless, those who neither agreed nor disagreed were government officials who explained offenders were prosecuted and punished when found guilty of offences:

We do not have upper hand on mining issues. Gold mining is a national security issue therefore we do not arrest in own capacity; we receive national orders through the region to arrest illegal miners (Interview: District police).

The Mineral Commission and Environmental Protection Agency as well as all other regulatory agencies are to come and request for escort to certify licences, cause arrest and prosecute offenders, however, these agencies do not come;

the police cannot arrest and prosecute without orders. In most cases the arrests we make do not lead to prosecution because we receive orders from authorities above us (politicians) to release culprits (Interview: District police).

Most of these unauthorised mining activities are done by politicians, policy makers and law enforcers. This makes it difficult to arrest and prosecute: and that explains why we have numerous unauthorised operations in the system (Interview: Assembly Member).



**Figure 15: Challenges that undermine management efforts**

More so, a reasonable number of respondents (Q.41: 63%) also perceived lack of effective policies and regulations governing mining operations as a challenge the industry faces; hence, the pollution. Notwithstanding, 30% respondents agreed to the effectiveness of the policies and regulations and assign responsibility to attitudes of miners and policy regulators who undermine underlying policies.



The policies are good, however; our challenge is implementation and enforcement to deal with unauthorised operators. I am a registered miner and under regulation. I follow regulations and all procedures. I have a clean mining site and I don't work to pollute rivers (Interview: Legal miner).

The policies are good, but currently undergoing amendment so regulators can prosecute unauthorised miners and possibly regulate unauthorised mining if given the mandate (Interview; Mineral Commission).

Three quarters (Q.39: 75%) of respondents also perceived administration capacity as a challenge that undermines good mining practices within the district. They perceive more personnel's and logistics' are required by various regulatory bodies to effectively manage mining operations. However, 16% perceived regulatory bodies have full capacity and skills to manage the district's' mineral and water resources.

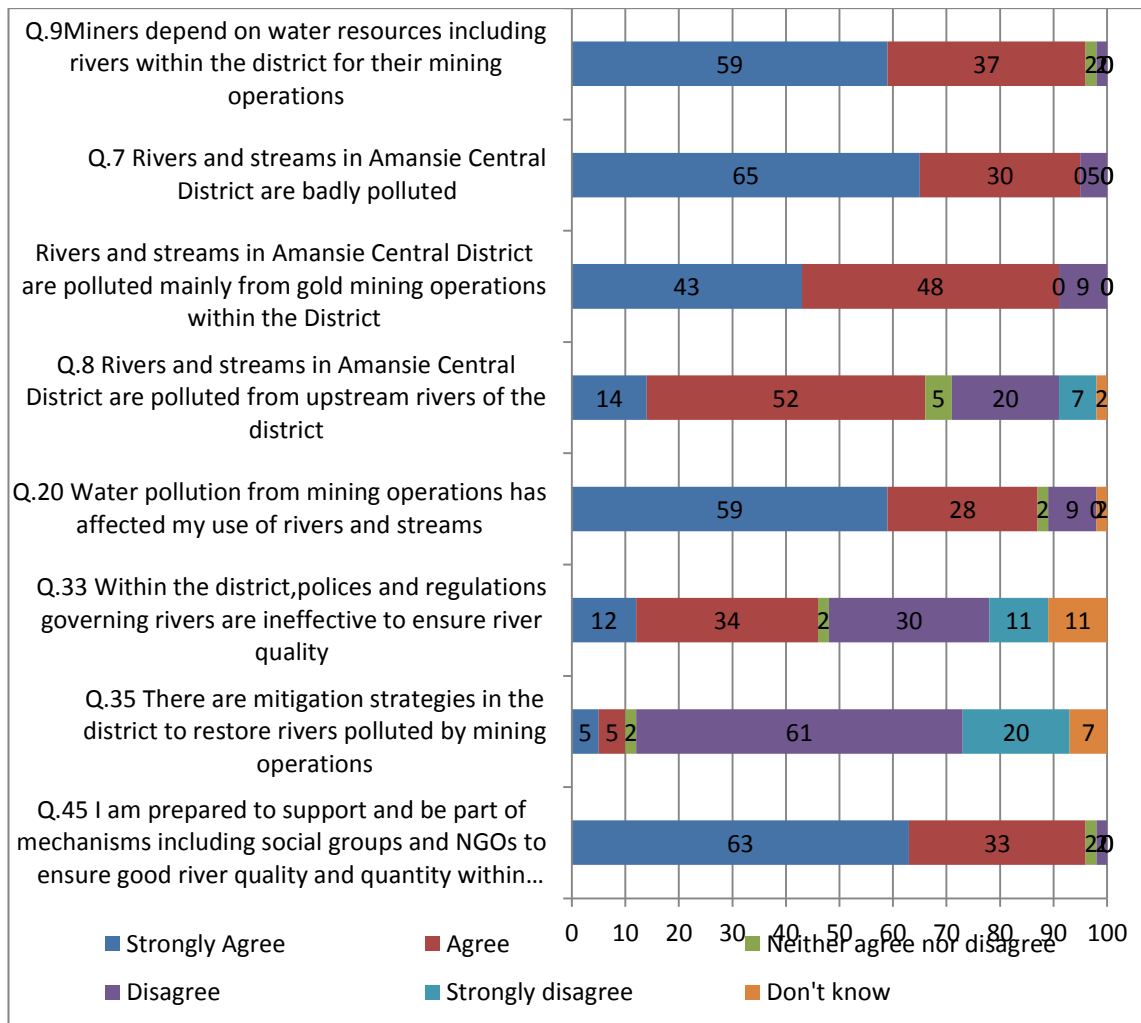
We have skilled personals; we are capable to monitor and enforce our policies and laws but our absence at the district level is a challenge (Interview; Environmental Protection Agency)

#### **5.2.4 Motivation for better management systems**

The preparedness of respondents to change to better management systems to restore the district's water quality was also explored (Figure 16). Respondents were motivated by the state of rivers. A significant proportion of respondents (Q.6:95%) perceived all rivers and streams within the district to be polluted. Only 5% of some miners and officials perceived there were some existing water bodies that were unpolluted. The majority of the total respondents (Q.20: 87%) agreed most rivers within the district were badly polluted and has caused changes in their lifestyles; with respect to fishing, swimming and other domestic use of rivers and streams. They also agreed they are deprived from the use of rivers and streams as natural resources within the district and nearly all (Q45, 96%) respondents were prepared and motivated to support mechanisms that will ensure good water quality and flow within the district:

My heart is saddened anytime I see the Oda River. It was such a joy being in this community because the river was part of our livelihood. We no longer drink, swim or fish in our rivers; there are no lives in our rivers anymore, they are all useless (Interview; Farmer).

Sometimes I wish the river (Akaasum River) is clean so we can drink from it or swim when we run out of water or break from our job but it is polluted. We can't use it (Interview: Illegal miner).



**Figure 16: Motivation for better management systems**

### 5.2.5 Incentives for better management systems

Interview with respondents' outlined mechanisms they perceive could generate better management systems in the industry if properly applied. They identified varied means by which they perceive uncontrolled operations in the industry could be dealt with to restore and preserve water quality (Table 9).

**Table 9: Incentives for better management systems**

Incentives	Quote from respondents
1. Reduced or subsidies on mining permit fees	Mineral Commission and Environmental Protection Agency should consider subsidizing permit fees and also allow faster permit processes (Legal Miner).
2. Severe culprit punishment on offenders	We are revising the mining laws to prosecute and to put more weight on culprit punishment (Minerals Commission).
3. Minimizing corruption in the mining sector	For a successful arrest and prosecution of offenders, corruption within the industry must be minimised. Regulatory personnel's who take bribe must also be sanctioned (Legal miner).
4. Reducing political influence in the small scale mining industry	I believe politicians in the small scale mining sector prevents the rule of law, offenders can be arrested and prosecuted without any political influence. For instance an illegal miner once told me to go and inform one famous politician to reclaim his land before coming to him (Interview: District assembly).
5. Implementing command and control policies on water resources	Water resource policies should contain both qualitative and quantitative standards and limits on all water bodies to guide water quality (Interview: NADMO).
6. Implementing the green tax approach in the small scale mining industry to benefit the district	Miners' should be charge environmental taxes to act in an environmentally responsible manner. Those revenues can be used to promote water conservation efforts within the district (Interview: Community member).
7. Introducing social groups and NGO's to advocate water quality	Pollution persists because everyone is quiet; we need awareness creation on water quality in the district as a wake-up call on all stakeholders (Interview: District assembly).
8. Introducing deposit - refund system in the industry	Miners should be mandated to deposit huge sums of money prior to any operation and refund given to them after a successful environmentally friendly operation ( Interview: Regional Coordinating Council)

### Summary

This chapter presented critical patterns of responses identified with mining and water pollution that is obvious in Amansie Central District. Themes related to impacts of gold mining, drivers, challenges, motivation and incentives for better management were identified from questionnaires, interviews, observations and supported with existing information. As an economic activity, small scale mining operation contributes to the development of the district through job and wealth creation. However, despite its significance, it is also recognized to damage the district's environment, specifically water resources. Inferences from the results revealed that drivers of mining and water pollution within Amansie Central District were perceived as aspects of institutional failure including weak policies, corruption and lack of law enforcement.

Respondents also attributed mining and water pollution to unregulated mining operations within the district which is perpetuated by all stakeholders particularly miners (gold priority) and traditional rulers (chiefs). Respondents were however unhappy about the bad state of rivers in the district and agreed to support mechanisms to manage and preserve water quality. They also suggested mechanisms including, introducing deposit refund system in the industry, implementing command and control policies on water resources and reducing political influence in the industry as incentives to manage mining and water pollution in the district. The next chapter discusses managing mining and water pollution within the Amansie Central District and in Ghana.

## **CHAPTER SIX: DISCUSSION**

### **6.0 Introduction**

This chapter explores the difficulty facing formal institutions in managing rivers within small scale mining communities in Ghana. The study reveals an image of various forms of institutional failure in managing natural resources in Ghana. The chapter discusses the perceptions of various stakeholders in Amansie Central District on managing rivers in small scale mining communities. It firstly explores the impacts of small scale mining as well as the challenges to sound management practices. It finally presents motivation and incentives for positive change as well as implementation of new reforms for better management practices to attain good water quality in Ghanaian small scale mining communities.

### **6.1 Conflicts of interests: Human welfare and environmental degradation**

The impacts of small scale gold mining in Amansie Central District demonstrate a positive social and economic effect for mining communities directly and indirectly. However, it also displaces communities, pollutes water and land, destroys pristine environment and endangers the health of people and ecosystems. The need to utilize the environment while improving the welfare of the district presents itself as a conflict between the society and government, thus a conflict of interest between human welfare and environmental degradation. The condition is worse in managing mining operations that are unauthorised. It was observed that environmental damage in the district was further worsening due to management practices that sustains the unauthorised mining sector (Figure 15). Water pollution in the district is a challenge due to accumulated damages by mining and it was observed that neither the government nor society seem responsible for the damage or recovery.

#### **6.1.1 Socio-economic challenge of small scale mining**

A study on positive aspects of small scale mining in Amansie Central District showed that gold has improved the lives of the local community. Although the size of the workforce associated with mining was difficult to obtain due to widespread unauthorised activities, many people are involved within Amansie Central District and environs. The greatest incentive to small scale mining identified was the means to achieve faster financial and social independence for the miners. According to some miners, the sector has higher wages in comparison with other employment sectors such as agriculture and construction. Both authorised and unauthorised miners admitted small scale mining creates employment opportunities for people from all backgrounds of which they were pleased to be part. They explained that the business assist living conditions for them and most inhabitants within Amansie Central District.

Respondents also revealed that most of the revenues generated from small scale mining are reinvested into the local economy which contributes to socio-economic development of the district. They claim that small scale mining in the district creates essential local purchasing power that results in the demand of locally produced goods and services for both locals and foreigners, including housing, food, tools and equipment. It allows for the creation of small businesses that are well integrated in the local economy and has significant contribution to the development and living conditions people in the district. According to some authorised miners, the district also benefits from various social responsibilities from the industry including, provision of boreholes for safe drinking water.

Miners also considered their operations not to only provide jobs and income to themselves and the indigenous communities but also the mineral output they acquire contributes considerably to national mineral trade. According to them, they extract mineral deposits that are unable to be mined by large scale mining companies which contribute to the local economy as well as the national foreign exchange earnings. They identify the industry to generate gold production and revenue that has economic importance to Amansie Central District, Ashanti Region and Ghana's well-being.

However, small scale gold mining also has various negative environmental effects including, biodiversity loss, accelerated erosion, soil contamination as well as surface water and groundwater pollution. In some cases, deforestation results from increasing available mineral land for mining operation. This study is however, centred on the impact of mining on the district's rivers that are taken for granted. The interviews revealed that the most pressing challenge in small scale mining communities is water pollution. In developing countries such as Ghana, provision of safe water to Ghanaians while promoting sustainable use of water resources is an objective of the Millennium Development Goals (Kessey & Arko, 2013). As such sustainable development prerequisite aims to ensure uncontaminated water resources. However, the case studies showed that some Ghanaians take the presence of clean water for granted, neglecting its significance by prioritising high gold production over water quality. Respondents' perceptions revealed that small scale gold mining cannot be separated from water resources and it was identified as the most common cause of degraded water quality.

It was also identified that within the district, small scale mining has become more attractive and increased over a period of ten years which has in turn put more pressure on the district's water resources. Respondents reported that water pollution has been a major challenge in the small scale mining industry and affected many communities as

well. They indicate that mining operations occur along the stretches of the rivers as such these rivers are not only polluted within the district but also polluted from upstream rivers flowing through the district. Although there has been an increased awareness of the environment legacy of mining operations undertaken in Amansie Central District, it was noted that little concern was apportioned to water resources.

## **6.2 Local challenges with contemporary mining management systems**

Research suggests the local community still recognises and respects traditional authorities. They are seen in their communities as the form of governance closest to the local people and therefore they cannot be ignored in policy formulation, implementation and enforcement. It was however discovered in the study that the chiefs' obligations towards mining and the environment were ambiguous and not specific hence they compromise unauthorised mining operations in the district.

It was disclosed that most chiefs and elders who are custodians of the lands were involved in small scale mining. Most respondents identified traditional rulers to be the backbone of illegal mining operations and its enormous negative impacts on the district. According to them, chiefs are involved in land allocation to unauthorised miners. These land allocations are made without considerations by any regulatory body, such as the Mineral Commission or the District Assembly. Rather, negotiations are made between the chiefs and unauthorised miners with exchange of financial payment for land concessions. In small scale mining, chiefs have no legal authority to assign roles or allocate mineral lands to miners; they have no authority in general in regulating mining activities (Ofei–Aboagye, Thompson, Al-Hassan, Akabzaa, & Ayamdoo, 2004), yet the research revealed that they are the cornerstone of unauthorised mining operations and take payments to finance personal expenditures at the expense of growth and development of the local community. In another perspective, traditional leaders were seen as individuals with minimal interest in investing wealth derived from small scale mining in the district. Some members of the community expressed grievance in interviews that they do not benefit from mining royalties in the district and pinpoint traditional rulers as beneficiaries of these revenues.

Depending on the type of property right, (government ownership, public property, private property or co-management), management may fail or succeed in sustaining a resource. In view of the latter, resource ownership research-based initiatives have ultimately had challenges attaining its desired outcome in most developing countries including Ghana.

Throughout the study, respondents revealed that little attention is given to land ownership and its influence on small scale mining activities in Ghana. Responses on mining and water pollution within the district revealed that pollution within the district was as a result of rampant unauthorised mining operations. How and why these unauthorised operators get access to mineral lands is a question that was identified to stem from property rights over lands in the mining industry.

Mining and water pollution in Amansie Central District stems from property right in Ghana: where regulations fail to specify the roles of local chiefs in resource ownership and management and allow traditional rulers to advocate personal rights over public property. The issues of resource ownership in Ghana's local political arena as noted by (Standing & Hilson, 2013), generally give chiefs the unauthorised authority to seize natural resource wealth for personal expenditure under cover of maintaining and upholding 'stool image'. Within the district, the latter was identified to be a significant constraint to sound environmental practices in the artisanal small scale mining sector.

Instances where traditional authorities are ignored by the government or their jurisdiction interfered by the government, a community's desired goals are not achieved (Lutz & Linder, 2004). According to respondents, traditional rulers' involvement in small scale mining regulation can minimize illegal mining operation in the district due to the respect and authority they reckon in the community as well as being custodians of mineral lands. Some chiefs disclosed they do not have definite and constructive role to play in regulating the small scale gold mining business. Legislations dealing with small scale mining do not involve traditional leaders to enforce obligations hence; they feel irresponsible for the negative impacts of mining activities on their environment. In addition, they are not afforded the opportunity to perform their duties along with those performed by mining regulatory bodies and the local government. This study noticed the position of traditional rulers to assist mining and water pollution to be undermined; they are not involved in monitoring and ensuring that the district's environmental obligations are met.

### **6.3 Formal challenges with contemporary mining management systems**

Within the district, the research conducted identified various aspects of formal institutions that undermine management efforts in the mining industry. Institutional weakness in natural resource management within the district revealed themselves in the following:

#### **6.3.1 Weak decentralization in natural resource management**

The decentralised government structure in Ghana has its decentralised aspect of resource regulation using constitutional provisions and various legislations to transfer



authorities of central government to central agencies. There has been various concerns about government decentralisation structure on mining and water management; institutions involved in government policy formulation, their effectiveness and their roles in policy implementations. In Ghana, the research identified decentralisation as a challenge to meeting environmental obligations in the small scale mining sector. The system allows central agencies to regulate mining laws and policies in the district and decentralised fewer roles to the local assembly.

The study noted that the decentralization system of governance in the industry has resulted in challenges including, coordination across agencies, overlapping authorities and devolution of responsibilities without financial or technical support to district authorities. In Amansie Central District, the system poses a challenge for central agencies responsible for mining operations and the local government to clarify their lines of responsibility in monitoring and law enforcement to manage mining operations and to meet environmental obligations.

For instance, respondents revealed the Water Resource Commission, Forestry Commission among other agencies have no role or coordination with mining operations in the district. Interviews with miners also revealed that the Minerals Commission and Environmental Protection Agency were identified as the key controllers of the small scale mining industry in the district, however, their authorities were considered less since they were not represented at the district level. Some miners also disclosed the Water Resource Commission has no practical role to play in their mining operations. The degraded state of rivers in Amansie Central District demonstrates how government decentralisation has failed to oversee and regulate mining operations to preserve water quality. There is therefore the need for suitability of government agencies control over resources to be collectively managed by the informal intuitions as well.

### **6.3.2 Overlap of mining laws and policies**

Overlap of regulatory policies was also identified in the study as a challenge that undermines institutional effort in the small scale mining industry. Several regulatory agencies with respective laws and regulations regulate the industry. It was noted from the study that the hierarchy of legal frameworks from different agencies including, Environmental Protection Agency, Water Resource Commission, Minerals Commission, Forestry Commission were not consistent in administering responsibilities over the small scale mining sector. The point identified was that there are complexities of these various legislations and regulations that overlap and that not all relevant issues of interest to the environment are monitored and enforced. Contradictions and overlap of various mining legislations and regulations has created lack of coordination

among regulatory agencies and lack of clarity on the roles of national, regional and the local governments. Separate frameworks for mining regulators in ensuring environmental obligations in the small scale mining sector, makes it more difficult for regulators to effectively monitor and enforce their obligations.

### **6.3.3 Effectiveness of legal framework in the small scale mining sector**

All rules, policies and enforcement mechanisms that guide and coordinate human behaviour towards a desired outcome make up the concept of a legal framework (Pillay & Kluvers, 2014). Like other developing countries, the small scale mining sector in Ghana have established formal laws and structures to manage the sector however, it appears the legal framework is not good enough to sustain the sector due to persistent environmental degradation caused by mining operations.

Provisions in the small scale mining regulation for Ghana were examined for the sector's sustainability and compliance (Appendices1&2). Its level of appropriateness was examined against sustainability indicators cited in articles including (Davis, 2012). Davis argues that for relevant laws and policies of any project to be successfully achieved, there should be high level of enforcement. While some respondents perceived mining regulatory frameworks as effective in managing the sector, others perceive them as not effective to ensure compliance and to enhance sustainability of the industry. The research conducted showed that mining regulations were weak and were also undermined by lack of monitoring and law enforcement.

Monitoring is the mechanism through which regulatory bodies track compliance (Christmann & Taylor, 2006). The later argue that no matter the quality of a legal framework, challenges may arise from failure to effectively monitor and enforce it. It is a significant mechanism to access if compliance on paper is the same implemented on the ground. However, the study showed that while small scale mining has increased over the past decade in Amansie Central District, monitoring and enforcement of mining operations have not kept pace. The research identified monitoring and enforcement as significant elements to ensure compliance of legal framework however, they are compromised in the district. The research discovered deficiencies in capacity, monitoring incentives, transparency and accountability as challenges that account for insufficient monitoring and enforcement practices in the industry.

**Capacity and monitoring incentives:** Capacity reflects an essential element that contributes to sustainable and effective governance (Lockwood, 2010). In Amansie Central District, an observation on compliance of mining regulation and environmental performance showed that regulators are unable to conduct inspections to verify

compliance with environmental protection policies and programmes. Capacity was an obvious challenge to monitoring mining operations in the district. The challenges to capacity were linked to incentives that reflect the Central Government's failure to devote resources to improve monitoring and enforcement. This was a common challenge among all regulatory bodies interviewed in the study. Some explained they lack staff to complete the required monitoring at the district level while some admitted they have the required staff and the necessary skills for monitoring and enforcement, but lack logistics and financial resources to plan and budget for effective monitoring of mining operations in the district. Some officials admitted the Central Government failed to ensure that mining regulators have the required resources needed to exercise authority to overcome unauthorised and unwarranted mining operations. These deficiencies in capacity perpetuate insufficient and inconsistent monitoring of mining sites to ensure environmental compliance by miners and to check unauthorised mining operations in the district.

**Transparency:** Transparency according to Stirton and Lodge (2001) is essential to monitoring. Transparency relies on the access to information and lack of it inhibits effective monitoring. Lack of information sharing includes access to ongoing operation sites, access to permits and revenue collection figures among the levels of governance. In Amansie Central District, research discovered lack of transparency inhibits monitoring of mining operations to meet environmental obligations. It obstructs the system of reporting and feedback and clear procedures to arrest and prosecute offenders in the industry. The research conducted identified the necessity for information needed for monitoring in the industry to be made accessible among all level of government to enforce laws and obligations in the industry.

**Accountability:** Stirton and Lodge (2001) contend accountability as key to effective democracy and good governance. According to them, accountability is an element in governance that compels regulatory bodies to develop clear objectives, to create effective strategies, focus on results as well as monitor and report on performance. In Amansie Central District, the system of accountability was identified as a challenge to managing mining operations in the industry. An observation made was that there were no obligations on some regulatory agencies to be accountable to one another. Each regulatory body visited appeared independent in administering its roles and responsibilities in the industry which the research discovered as a challenge in meeting environmental performance in the industry.

#### **6.3.4 Corruption**

Corruption was an element nearly all respondents mentioned throughout the research. As in many developing countries, the Ghanaian small scale mining sector was also identified as vulnerable to corruption and graft. According to some respondents, opportunities for corruption start at the beginning of the process with the application and granting of mining licenses and mineral land allocation (Figure 15, Q 43). Others also disclosed it comes in the form of request for cash or assistance from miners to acquire land concessions. The research aligns with the literature on corruption that it risks policy implementation and prevents sanctions of detected and prosecuted miners.

Admittedly, in Amansie Central District, challenges in the Ghanaian small scale mining industry has part of its roots in broader patterns of corruption that seem difficult to be solved; where some government officials take bribe and authorise unauthorised miners to operate and where unauthorised miners bribe security and judicial personals to resist arrest and sanctions. Within the industry, bribery and corruption also reveal itself in cases where miners pay their way to produce inappropriate environmental impact assessment reports and where some security and judicial service personnel take bribe to induce less or no punishment on culprits.

In Amansie Central District it was observed that corruption in the small scale mining sector had weakened law enforcement and monitoring efforts. It was also identified as a significant factor that sustains unauthorised mining operations and its negative consequences on the district's environment, particularly land degradation and water pollution. It is therefore prudent that efforts to resist corruption and other forms of graft in the industry be strengthened to allow compliance and to sustain the industry and improve the environmental performance particularly on water quality and flow.

#### **6.3.5 Political influence in the small scale mining industry**

Like other developing countries as reviewed in the literature chapter, politics and its negative influence on natural resource management was identified in the case study conducted in Amansie Central District. This was evident in the research carried out in Amansie Central District, where some politicians create political governance that sustains the unauthorised mining sector in the district. Most developing countries including Ghana are rich in natural resources that should be utilised to the benefit the people. However, political leaders in such countries often feel the need to exercise control over such resources that are meant to benefit the society at large.

In Amansie Central District for instance, some political leaders were criticised to have been involved in unauthorised mining operations. Within the district, political leaders in authority are seen to dominate resource exploitation. Their personal involvements in

the small scale mining business create higher authorities in the sector that overshadow regulatory authorities within in the industry. Their authorities are perceived as supreme powers that subdues and undermine all other regulatory authorities in meeting obligations. Political influence in the small scale mining sector as identified within Amansie Central District weakens law enforcement, undermines environmental compliance and compromised unauthorised and malpractices in the small scale mining industry.

#### **6.4 Motivations for better management systems**

The research conducted explored respondents motivation for new reforms in the small scale mining industry. Decline in water quality and flow that has adversely affected river health and biodiversity values was identified as motivation to water quality solutions.

Public concern about water quality and use has increased significantly, particularly with the increasing rate of small scale mining in Ghana. The research noted that intensification of mining activities has increased pressure on the district's water resources. Respondents admitted most rivers within the district were badly polluted and no longer serve them. They were however concern whether Ghanaian rivers can accommodate the increasing pressure while providing for needs such as domestic, fishing, healthy ecological functioning and other activities.

#### **6.5 A focus on water quality solutions**

The devastating nature of small scale mining on the environment particularly water resources calls for a focus on water quality solutions in the industry in all Ghanaian small scale mining communities. Despite the various challenges identified with mining and water pollution, there are some specific mechanisms and strategies the government and society can take to improve efforts to effective mining and water management. This section presents incentives for better practices that have been proposed throughout the case study or implemented in some resource rich countries to manage mining and water resources.

##### **6.5.1 Governance and Regulations (Formal Systems)**

Water governance constitutes a range of political, economic, social and administrative systems that have developed to manage water resources and to implement water quality solutions. The study identified the issue of water pollution in Ghanaian mining communities as crisis of governance. Strategic changes to drivers including, ineffective policies, weak enforcement and corruption can contribute to solving water quality challenges in mining communities. There is therefore the need to strengthen governance and underling regulatory frameworks including, regulations, laws, policies

and mining regulatory bodies to improve compliance and to focus on water quality in small scale mining areas.

#### **6.5.1.1 Providing clearly defined standards to simplify monitoring and enforcement in legal frameworks**

Provisions of defined standards to simplify monitoring and enforcement in legal frameworks have been identified in the study to strengthen compliance in the small scale mining industry. Monitoring and enforcement become more difficult when institution's legal obligations are vague or unclear. Clearly defined rules with objectives can be easily monitored and enforced. However, a closer look at mining and water regulatory frameworks for the small scale mining industry revealed no objectives towards water quality solutions. While most respondents perceive water resources in Ghana not to bind by water quality standards, others perceive water quality standards contained in regulations are unrealistically stringent and limit capacity to preserve water quality.

The poorly designed or out of date mining and water policies and regulations fail to address water quality issues. Better enforceable regulations should follow the creation of water quality policies and standards with clear objectives to aid monitoring and enforcement. Most countries implement water quality standards to meet water resource obligations. In most cases, these standards are in the form of limits on contaminants loads or overall quality of the water body. In Ghana, establishing binding water quality standards on water bodies can assist efforts to improve water management by increasing accountability for policy implementation on pollution control measures in the small scale mining sector.

A policy framework with established water quality standards will accounts for water takes and relevant sources of contaminants and monitor water quality standards to meet obligations. The framework accounting requirements will also provide regulatory agencies with the necessary information to monitor and enforce water quality objectives and limits to manage rivers. Clear limitations on pollution levels on water resources as implemented in other countries will allow regulatory bodies to also improve water management in Ghana. There is therefore the need to develop legal framework for compulsory water use to create mechanisms to enforce water quality.

#### **6.5.1.2 Establishing defined roles and responsibilities to increase accountability**

Throughout the study, interviews with government officials identified conflicts of interests in 'who' should be accountable for 'what' responsibility within the small scale mining industry. A level of confusion and uncertainties was observed among interviewed regulatory bodies as they shift blame and responsibilities among

themselves. As such it was obvious no clear monitoring roles and responsibilities towards mining and water quality existed among regulatory agencies.

Set goals and obligations often slip through cracks without assigned or defined roles and responsibilities to implement and monitor (Davis, 2012). Establishing defined monitoring and enforcement roles among regulatory bodies will be necessary to increase accountability and to check environmental compliance in the industry. Regulatory bodies with defined roles and responsibilities on water quality will be appropriate to ensure compliance with mining and water resource obligations in the industry.

#### **6.5.1.3 Creating separate monitoring unit in all mining districts**

Creating separate monitoring unit in small scale mining areas was also identified as an element to monitor environmental performance in the industry. As noted in previous sections, regulatory agencies often face conflicting priorities in administering their roles. As such miners whose operations are not regulated are rampant in the industry and they turn to be root of environmental degradation. To counter this challenge, creating a separate monitoring and enforcement unit will be necessary to avoid conflicts of interest that exist among regulatory bodies that feel uncertain about their roles to monitor environmental compliance and performance in the industry.

Distinct functional units to monitor mining operations in every district can be established to avoid overlap that exist between staff or agencies responsible for approving permits or reviewing plans and those responsible for monitoring ongoing mining projects and compliance with legal obligation. Providing separate groups or staff for monitoring will ensure that monitoring is consistence and will also ensure significant monitoring resources are not be utilised for other priorities but to ensure and promote environmental compliance and performance.

#### **6.5.1.4 Participation of government oversight institutions**

The research conducted also identified the participation of government oversight institutions to complement mining and water management. Findings from scholars including (Goetz & Jenkins 2001) revealed that the non-executive branch government officials can play essential role in ensuring that the small scale mining industry is managed effectively. The Parliament, Human Right and Supreme Audit Institutions can all be part and take on monitoring roles to aid the small scale mining industry. Their reports and advocacy efforts can call attention to concerns and shortcomings in the small scale mining sector and to provide more information to local governance and help improve law enforcement and monitoring within mining districts. For instance the

parliament of Ghana can strive for more transparency and accountability in sharing information with stakeholders who provide monitoring efforts.

With the ultimate goal of improving small scale mining and water quality, the Parliament and other non-executive institutions can conduct special investigations to understand governance concerns in small scale mining districts and provide the needed logistics and resources to effective management efforts that meet policy obligations.

#### **6.5.1.5 Government agency partnerships to counter capacity challenges**

With respect to capacity challenges identified in the study, partnership across government agencies can provide some level of assistance to check compliance in the industry. As part of partnership within the industry, regulatory agencies can share necessary information with their counterparts to allow better enforcement and monitoring across all mining sites. Better partnership will allow good communication mechanisms that will maximize information sharing on unauthorised operations among agencies and to implement corporate decisions within the sector. It will also allow logistics and resource sharing for a common purpose in the industry.

Beyond information sharing, the study identified that partnership will also improve coordination to inspect and enforce objectives in the industry. Improved coordination through joint monitoring and patrols will minimize the challenges of insufficient logistics such as vehicles. Through partnership and coordination, multiple agencies are able to visit the same mine site at once or are able to submit specific information or questions for other agencies to monitor or inspect while on site. Joint committee will allow different regulating agencies to share information and to identify opportunities to approach and solve shared challenges mutually and strategically.

#### **6.5.1.6 Judiciary: Enforcing compliance in situations of non-compliance**

Law enforcement schemes and institutions are important for achieving desired obligations. In Ghana law enforcers including, the judiciary, prosecutors, judges and magistrates should advocate environmental performance in administering their responsibilities in the small scale mining sector. Lack of such advocacy has negative impacts on the environment which was evident in Amansie Central District; where the judiciary and security personals were perceived to play minimal roles in prosecuting miners to promote and improve desired practices in the industry.

The study identified that in order to improve law enforcement to attain good environmental performance in the Ghanaian small scale mining sector, regulatory agencies must partner effectively with the judiciary. The judiciary as partners should see the need to work effectively to improve environmental performance in the industry



by prosecuting offenders to serve as deterrent to others who compromise compliance in the industry

### **6.5.2 Local level involvement**

Local level actors can play important roles in promoting and defining the future of sustainable small scale mining in their respective communities. The research noted that making local actors responsible for mining obligations will give local authorities greater control over conditions that affects their lives. To build up confidence to tackle community challenges with local action.

#### **6.5.2.1 Involving traditional rulers in mining regulatory frameworks**

The study identified traditional rulers as a challenge rather than a solution to mining and water pollution within Amansie Central District. They were however discovered in the study as a solution to managing mining and water pollution in mining communities when involved in mining regulatory frameworks. Due to the conflict of interest identified between economic development and environmental performance, sustainable management of natural resources in Ghana should be a key focus to balance both economic and environmental development. In order to build a sustainable resource management system that consolidates environmental quality in the small scale mining industry, it should be well-rooted in the social traditions of local actors' involvement. It has been demonstrated from this study that in order to balance livelihood and conservation objectives in the small scale mining industry, it is significant to engage local actors' present at the district level particularly traditional rulers (chiefs) in regulatory frameworks.

Chiefs are the centre of social cohesion and virtually every segment of the community revolves round them. Hence assigning roles to them in mining regulatory frameworks will promote participation and activism for a collective better environmental outcome. A new reform to effective mining regulations should integrate traditional rulers into the formal legal system. In that context they will have the legal responsibility to protect, conserve, develop and manage the district's environment for all people based on fundamental traditional principles and values that underpin traditional concepts of preserving community endowed natural resources.

In addition, traditional leaders are considered spiritual leaders and traditional beliefs paly an essential role in preserving natural resources in Ghana. As recorded in an interview with a government official; natural resource practices were previously reinforced through spirituality and scared resources including, forests and rivers were highly respected and preserved. The association of spirituality to natural resources enhanced conservation practices which conserved and preserved natural resources.

Indigenous knowledge attached to traditional beliefs made people aware of which natural resources contributed to their well-being. Restrictions were thereby imposed to ensure they were adhered to by invoking spiritual powers on non-compliance.

Although it can be argued that it is primitive to adhere to traditional resource management systems in such case, good aspects of chiefs and their beliefs in tradition cannot be disregarded. The decreasing significance of traditional rulers and their beliefs; sacred forests, rivers and trees is disadvantageous to natural resource management in Ghana. Therefore assigning resource management functions to chiefs are likely to have positive influence on resource conservation and functions. Thus their have authority as custodians of mineral lands in mobilizing collective action will be fundamental to effective natural resource management within their communities.

#### **6.5.2.2 Community partnership with government agencies**

A new reform to improving water quality in small scale mining areas will be the need to involve the community in meeting desired objectives. Community partnership will allow community members to focus more on monitoring social and environmental commitments of miners as they directly bear pressures from mining operations. Due to their proximity to mining operations, they will have information on environmental compliance such as observing mining operations and non-compliance. They are also able to have information to observe social compliance and to inspect miners' social responsibility towards the community.

Some countries have recognised the need of partnering with the local community, building strong relationships and obtaining local support. Such countries link community efforts with aspects of monitoring mining operation to gather and exchange information and to allow the local community to voice concerns on relevant issues to be addressed within the industry.

Community partnership can meet monitoring needs in various ways. Community partnership with government agencies is a significant ability that will enable people to act together and influence the economic, social, political and environmental issues that affect the district. While each partnership functions to promote environmental performance within a community, the following concept can be considered to encourage community members to become involve at the local level and to assist mining and water pollution:

- Regulatory agencies can partner with the local community to identify areas of concerns to the local community and collaboratively monitor miner's efforts to address those concerns.

- Regulatory agencies can also train community monitors to obtain information they need to effectively monitor mining operations.
- The local community can also be inspired to independently monitor areas of concern and report their findings to authorities to improve areas of non-compliance.

## **CHAPTER SEVEN: CONCLUSION AND WAYS FORWARD**

This study argued that water pollution from small scale mining operations cannot be separated from institutional arrangements that bind mining operations. It demonstrated that although economic issues allowed environmental degradation in the mining sector, degradation persists with institutional weaknesses. Multicultural developing countries including Ghana have challenges in reconciling their economic and environmental policies. This study demonstrated the challenge for Ghana to strike the harmony and balance between economic and environmental needs of the country. The greatest environmental challenge for Ghana identified in the study is the trade-off between poverty alleviation and environmental degradation.

The research conducted in Amansie Central District presented artisanal small scale mining in Ghana as significant in improving rural livelihood and national foreign earnings through wealth and employment creation. However, it also presented small scale mining to have adverse impacts on the district's environment particularly, water quality. In Ghana water resources in small scale mining areas are continuously polluted. Water abstraction for mining operations has put more pressure on rivers. The study revealed the influence of small scale mining on water quality. Acid mine drainage and sedimentation from mining operations degrade water quality. In addition to acid mine drainage and sedimentation, water quality is also degraded as a result of chemicals used in mining operations. Specifically, there is significant increased trend in heavy metals including gold, lead, arsenic, copper and cadmium which demonstrates anthropogenic impacts from mining operations. It was observed in Amansie Central District that many rivers have been modified by this degradation which has resulted in malfunctioning in state with natural water flows. Reduced water quality and flow in almost all mining communities in Ghana has affected aquatic life and human access to water for various usages.

Arguably, significant interests and values of rivers which include natural characters of rivers, recreational use, domestic use and the need for biodiversity preservation for future generations are not adequately protected in respective legislative mechanisms. Environmental degradation in the small scale mining industry was identified as immense number of unauthorized miners in the sector compared to the authorized ones. The proliferation of uncontrolled mining operations in the industry has resulted in total damage to Ghanaian riverine systems. Although the effect of mining operations on water quality appeared insignificant to some populations, its cumulative effects needs to be mitigated to minimize the impacts on marginal people within such district. Thus, for populations to enjoy the benefits of water quality and flow, sustainable means of

small scale mining in the district is highly significant. There is therefore the need to curb unauthorised mining operations to protect Ghana's water resources.

In Ghana, taking bold steps at national and local levels to restore and protect water quality in mining communities will mean a much different future for the nation. Ghanaian rivers can again become the centrepiece of communities; their intrinsic values can be restored and residents can once again turn towards the rivers that gave them life. The lost art of fishing and swimming for recreation and sustenance can be thrived again if a consensus is made to restore and protect water quality.

It was evident from this research that avoiding artisanal small scale mining currently is not a reasonable solution due to its socio-economic benefits to the local community and the entire nation. Therefore there is the need for the government and mining communities to develop appropriate implementation strategies that seek to minimise unauthorised mining operations on the district's' environment. While an enabling agency-regulatory framework is essential for positive change within the industry, government regulations alone as demonstrated in this study will be insufficient for genuine way forward in the sector. A better understanding and involvement of traditional rulers are likely to go farther than the regulatory-agency mechanism approach solely used in the industry.

This report concludes that the most significant element of change to managing mining and water pollution in Ghanaian small scale mining communities is more likely to be the legal involvement of chiefs in regulating mining operations. New legislations regarding traditional authorities should be created with active involvement and participation of local chiefs and traditional rulers due to their presence, authority and being custodian of mineral lands. They should be involved at the initial stages of mining, implementation and monitoring stages to ensure compliance with their community environmental goals. In that regard, their legal involvement in monitoring and law enforcement in the sector will render them responsible and accountable to their community's environmental performance and to meet obligations regarding community resource management.

Lessons learnt in Amansie Central District revealed that, a focus on minimising unauthorised mining operations in Ghana should be tailoring a solution that recognises traditional rulers as pillars to minimize unauthorised mining operations in various mining communities. As such a way forward in dealing with mining and water pollution in the industry should create barriers for miners who operate undercover. There is the need for government regulatory agencies to be legally supported by traditional rulers to reach those involved in unauthorised mining operations and to protect their interests as

well as the environment. In the instance of Amansie Central District and Ghana as a whole, the following action plans are recommended.

- Developmental functions of chiefs in the small scale mining sector should describe their roles in administration including land allocation and site monitoring to ensure environmental compliance. Their administrative roles should be set out as well as their roles in implementation of related policies. From the study it was observed that traditional rulers can be more responsible and committed to environmental performance in their communities if their administrative authorities in the small scale mining industry are spelt out clearly.
- Legislations regarding traditional authorities in various mining communities should be rationalised with relevant stakeholders including the chiefs themselves. Legislations should be introduced at both the national and community level to establish structures to ensure traditional leadership in the small scale industry and to facilitate the participation by the local community on mining issues affecting them and the way forward.
- There should be legally established structures to delineate local authorities and functions between democratically elected or appointed government mining agencies and traditional rulers on small scale mining operations and the environment
- Monitoring, implementation and obligation enforcement should closely involve local communities and the chiefs. The principles of accountability of environmental performance should be legally linked to traditional rulers and should be entrenched in legislations
- There should be the need for a timely national review of environmental performance in all small scale mining communities to allow regulatory agencies, traditional rulers and the local community to be more committed, responsible and accountable to community environmental performance.
- There is the need of an interdepartmental steering committee (involving relevant regulatory agencies) to be established with the aim of formulating a policy and establishing sufficient partnership with traditional rulers in the restoration of water quality and the prevention of pollution from the small scale mining sector. An accord on roles of chiefs in community environmental development should be reached between the Central Government, regulatory agencies and traditional rulers. There should also be the need for penalties on traditional rulers who fail to meet environmental obligations within their local community.

Admittedly, if only the roles of chiefs are executed as regard monitoring, implementation and enforcement, a positive environmental outcome can be achieved. However, if their roles are not legally spelt out, development and law enforcement cannot be achieved as they possess high authority to permit or halt any activity on their land. Although, formal institution have significant role to play to ensure good participation and co-operative management in the small scale mining sector, environmental goals can be met if the roles of chiefs and the local community are legally enhanced and entrenched to restore, preserve and protect their community endowed water resources.

## REFERENCES

- Abdulai, A. G. (2009). Political will in combating corruption in developing and transition economies: A comparative study of Singapore, Hong Kong and Ghana. *Journal of Financial Crime*, 16(4), 387-417.
- Acheson, James M. (2003). *Capturing the commons: devising institutions to manage the Maine lobster industry*. Upne.
- Acheson, James M. (2006). Institutional failure in resource management. *Annu. Rev. Anthropol.*, 35, 117-134. Action. San Francisco: ISC Press.
- Agarwal, Bina. (2001). Participatory exclusions, community forestry, and gender: An analysis for South Asia and a conceptual framework. *World development*, 29(10), 1623-1648.
- Agrawal, Arun, & Ostrom, Elinor. (2001). Collective action, property rights, and decentralization in resource use in India and Nepal. *Politics & Society*, 29(4), 485-514.
- Agrawal, Arun, & Ribot, Jesse. (1999). Accountability in decentralization: a framework with South Asian and West African cases. *The Journal of Developing Areas*, 473-502.
- Akabzaa, T. M., Seyire, J. S., & Afriyie, K. (2007). *The glittering façade: effects of mining activities on Obuasi and its surrounding communities*. Third World Network-Africa.
- Akabzaa, T., & Darimani, A. (2001). Impact of mining sector investment in Ghana: A study of the Tarkwa mining region. *Third World Network*.
- Alchian, Armen A, & Demsetz, Harold. (1973). The property right paradigm. *The journal of economic history*, 33(01), 16-27.
- Alexander, E. R. (1995). *How organizations act together: Interorganizational coordination in theory and practice*. Psychology Press.
- Alter, C., & Hage, J. (1993). *Organizations working together*. Newbury Park, CA: Sage Publications.
- Anderson, G., 1993. *Fundamentals of Educational Research*. Falmer Press, London, pp: 152-160.
- Ankobra River. Available from: <http://www.myjoyonline.com/news/2015/october-27th/ankobra-river-a-haven-for-fish-turned-into-gold-washing-tailings.php>
- Armah, Frederick A, Obiri, Samuel, Yawson, David O, Onumah, Edward E, Yengoh, Genesis T, Afrifa, Ernest KA, & Odoi, Justice O. (2010). Anthropogenic sources and environmentally relevant concentrations of heavy metals in surface water of



- a mining district in Ghana: a multivariate statistical approach. *Journal of Environmental Science and Health Part A*, 45(13), 1804-1813.
- Aryee, B. N. A. (2012). Contribution of the minerals and mining sector to national development: Ghana's experiment. *GREAT Insights*, 1(5).
- Asante, Kwadwo Ansong, Agusa, Tetsuro, Subramanian, Annamalai, Ansa-Asare, Osmund D, Biney, Charles A, & Tanabe, Shinsuke. (2007). Contamination status of arsenic and other trace elements in drinking water and residents from Tarkwa, a historic mining township in Ghana. *Chemosphere*, 66(8), 1513-1522.
- Ascher, William, & Healy, Robert G. (1990). *Natural resource policymaking in developing countries: Environment, economic growth, and income distribution*: Duke University Press.
- Asher, S., & Novosad, P. (2014). *Dirty Politics: Natural resource wealth and politics in India*. Working Paper, Oxford University (April).
- Asumadu, K. (2003). Reform of Ghana's Land Tenure System—An Opportunity to Enhance Socio-Economic Development.
- Aubynn, A. K. (2006). 19. 'Live and let live': The relationship between artisanal/small-scale and large-scale miners at Abosso oldfields, Ghana. In G. Hilson (Ed.), *Small-Scale Mining, Rural Subsistence and Poverty in West Africa* (pp. 31-5). Practical Action Publishing.
- Auty, Richard M. (2003). Natural resources, development models and sustainable development.
- Average, Chigwenya, & Desmond, Manatsa. (2007). The history of natural resource management in Zimbabwe: A chronicle of how sustainable resource management has remained an elusive concept. *Journal of Sustainable Development in Africa*, 9(2), 102-115.
- Banomugisha, A. (2006). Political Parties, Political Change and Environmental Governance in Uganda: A Review of Political Parties Manifestos. *ACODE Policy Research Series*(16).
- Baskerville GL. (1995). The forestry problem: adaptive lurches of renewal. *Barriers and Bridges to the Renewal of Ecosystems and Institutions*, ed. LH Gunderson, CS Hollings, SS Lights, pp. 37–102. New York: Columbia Univ. Press
- Becker, G.S. (1968). Crime and punishment: An economic approach. *Journal of Political Economy* 76: 169-217.

- Benjaminsen, Tor Arve, Cousins, Ben, & Thompson, Lisa. (2002). *Contested Resources: Challenges to the Governance of Natural Resources in Southern Africa: Papers from the International Symposium on 'Contested Resources: Challenges to Governance of Natural Resources in Southern Africa: Emerging Perspectives from Norwegian-southern African Collaborative Research' Held at the University of the Western Cape, Cape Town, 18-20 October 2000*. Programme for Land and Agrarian Studies, School of Government, University of the Western Cape.
- Berg, B. L., Lune, H., & Lune, H. (2004). *Qualitative research methods for the social sciences* (Vol. 5). Boston, MA: Pearson.
- Berg, B. L., Lune, H., & Lune, H. (2004). *Qualitative research methods for the social sciences* (Vol. 5). Boston, MA: Pearson.
- Berkes, Fikret. (1989). *Common property resources: ecology and community-based sustainable development*. Belhaven Press. Berlin, available at: [www.transparency.org](http://www.transparency.org).
- Booth, David, & Therkildsen, Ole. (2012). *The political economy of development in Africa: A joint statement from five research programmes*. Paper presented at the Political Economy of Development in Africa Conference, Copenhagen.
- Booth, David. (2011). Aid, institutions and governance: what have we learned? *Development Policy Review*, 29(s1), s5-s26. Cambridge, UK: Cambridge Univ. Press
- Brinkerhoff, D. W. (1991). *Improving development program performance: guidelines for managers*. Lynne Rienner Publishers, Inc.
- Brinkerhoff, Derick W. (1996). Coordination issues in policy implementation networks: an illustration from Madagascar's environmental action plan. *World Development*, 24(9), 1497-1510.
- Bulkeley, Harriet, & Mol, Arthur P.J. (2003). Participation and environmental governance: consensus, ambivalence and debate. *Environmental Values*, 12(2), 143-154.
- Carreri, Maria, & Dube, Oeindrila. (2014). Do Natural Resources Influence Who Comes to Power, and How? Ciriacy-Wantrup, Siegfried V, & Bishop, Richard C. (1975). Common property as a concept in natural resources policy. *Nat. Resources J.*, 15, 713.
- Cassell, C., and Symon, G. (Eds.), (1994), *Qualitative Methods in Organizational Research*, Sage Publications, CA

- Castro, A. P., & Nielsen, E. (2001). Indigenous people and co-management: implications for conflict management. *Environmental Science & Policy*, 4(4), 229-239.
- Christmann, Petra, & Taylor, Glen. (2006). Firm self-regulation through international certifiable standards: Determinants of symbolic versus substantive implementation. *Journal of International Business Studies*, 37(6), 863-878.
- Clark, R. N., & Errol, E. (1998). Integrating science and policy in natural resource management: lessons and opportunities from North America.
- Clark, W. (2000). Activism in the public sphere : exploring the discourse of political participation. Aldershot: Ashgate. conflict management. *Environmental Science & Policy*, 4(4-5), 229-239.
- Colding, Johan, & Folke, Carl. (2001). Social taboos: "invisible" systems of local resource management and biological conservation. *Ecological applications*, 11(2), 584-600.
- Conley, Alexander, & Moote, Margaret A. (2003). Evaluating collaborative natural resourcemanagement. *Society & Natural Resources*, 16(5), 371-386.
- Da Rosa, C. D., Lyon, J. S., & Hocker, P. M. (1997). *Golden Dreams, Poisoned Streams: How reckless mining pollutes America's waters, and how we can stop it*. Washington, DC: Mineral Policy Center.
- Dacin, M. T., Goodstein, J., & Scott, W. R. (2002). Institutional theory and institutional change: Introduction to the special research forum. *Academy of management journal*, 45(1), 45-56.
- Davis, Christina L. (2012). *Why adjudicate?: enforcing trade rules in the WTO*: Princeton University Press.
- Debrah, Y. A. (2002). Ghana. *Thunderbird International Business Review*, 44(4), 495-513.
- Demsetz, Harold. (1967). Toward a theory of property rights. *The American economic review*, 347-359.
- Denscombe, Martyn. (2014). *The good research guide: for small-scale social research projects*: McGraw-Hill Education (UK).
- Dillon, J., Ekmekji, K., Feighery, A., Garrett, R., Gray, M., Johnson, T., & Reilly, K. (2006, April). Corruption & The Environment. In *A project for Transparency International, Environmental Science and Policy Workshop, Columbia University, School of International & Public Affairs*.

- Du Plessis, Anél. (2008). Public participation, good environmental governance and fulfilment of environmental rights. *PER: Potchefstroomse Elektroniese Regsblad*, 11(2), 170-201.
- Ensminger J. (1992). Making a Market: The Institutional Transformation of an African Society. Gibson C, Becker CD. 2000. A lack of institutional demand: why a strong local community in FEMAT as experiments in process. *Journal of Canadian Studies*, 31(1): 82-101.
- Fink, A. (2003). *How to sample in surveys* (Vol. 7). Sage.
- Ghana map. Retrieved from: <http://www.fibelreservation.com/atlas/country/ghana>.
- Ghana Statistical Service.(2014). District Analytical Report: Amansie Central District.
- Gibbons, Michael, Limoges, Camille, Nowotny, Helga, Schwartzman, Simon, Scott, Peter, & Trow, Martin. (1994). *The new production of knowledge: The dynamics of science and research in contemporary societies*: Sage.
- Gibson C, Becker CD. (2000). A lack of institutional demand: why a strong local community in Haller, Markus. (1998). Private, Public, and Common Ownership. *Analyse & Kritik*, 20(2), 166-183.
- Glenn A. Bowen, (2009),"Document Analysis as a Qualitative Research Method", *Qualitative Research Journal*, Vol. 9 Iss 2 pp. 27 – 40.
- Goetz, A. M., & Jenkins, R. (2001). Hybrid forms of accountability: citizen engagement in institutions of public-sector oversight in India. *Public Management Review*, 3(3), 363-383.
- Gorter, Rendt. (2011). *Towards deliberative environmental governance: rethinking participation*. ResearchSpace@ Auckland.
- Hakim, C. (1987). Research design. *Allen Unwin, London*.
- Hall, C Michael. (1999). Rethinking collaboration and partnership: A public policy perspective. *Journal of Sustainable Tourism*, 7(3-4), 274-289.
- Hardin, G. (1968) 'The Tragedy of the Commons', *Science*, 162, 1243-8.
- Haysom, Nicholas, & Kane, Sean. (2009). *Negotiating natural resources for peace: Ownership, control and wealth-sharing*: HD Centre for Humanitarian Dialogue.
- Helmke, Gretchen, & Levitsky, Steven. (2004). Informal institutions and comparative politics: A research agenda. *Perspectives on politics*, 2(04), 725-740.
- Hentschel, T., Hruschka, F., & Priester, M. (2002). Global report on artisanal and small-scale mining. *Report commissioned by the Mining, Minerals and Sustainable*

- Development of the International Institute for Environment and Development. Download from [http://www.iied.org/mmsd/mmsd\\_pdfs/asm\\_global\\_report\\_draft\\_jan02.pdf](http://www.iied.org/mmsd/mmsd_pdfs/asm_global_report_draft_jan02.pdf) on, 20(08), 2008.*
- Hentschel, Thomas, Hruschka, Felix, & Priester, Michael. (2003). *Artisanal and small-scale mining: challenges and opportunities*: lied.
- Heslop, Viv. (2006). Institutional capacity to progress sustainable development in New Zealand: What will it take. *A background paper prepared for The Office of the Parliamentary Commissioner for the Environment*. URL: <http://pce.parliament.nz/assets/Uploads/Reports/pdf/institution.pdf>.
- Hilson, G. (2001). A contextual review of the Ghanaian small-scale mining industry. *Mining, Minerals and Sustainable Development*, 76.
- Hilson, Gavin. (2002). *Small-scale mining and its socio-economic impact in developing countries*. Paper presented at the Natural Resources Forum.
- Hitchcock, G. & Huggers, D. 1995. *Research and the teacher: A qualitative introduction to school based research*. London: Routledge.
- Hoepfl, M. C. (1997). Choosing qualitative research: A primer for technology education researchers.
- Hruschka, F., & Echavarria, C. (2011). Rock-solid chances for responsible artisanal mining. *Arm Series on Responsible ASM*, 3.
- Hyden, G. (2008). Institutions, power and policy outcomes in Africa. *Power and Politics in Africa Discussion Paper*, (2).
- Innes, Judith E, & Booher, David E. (2003). Collaborative policymaking: governance through dialogue. *Deliberative policy analysis: Understanding governance in the network society*, 33-59.
- Institutional Logics, Resources, and Institutional Entrepreneurs', The Academy of Management Introduction to the Special Research Forum', *Academy of Management Journal*, Vol. 45, No. 1.
- Ireland, Claire, & Tumushabe, Godber. (2005). The Evolving Roles of Environmental Management Institutions in East Africa: From Conservation to Poverty Reduction. *Reducing Poverty and Sustaining the Environment: The Politics of Local Engagement*, 100.

- Jankowski, N. W., & Jensen, K. B. (Eds.). (2002). *A handbook of qualitative methodologies for mass communication research*. Routledge.
- Kamoche, K., & Harvey, M. (2006). Knowledge diffusion in the African context: An institutional theory perspective. *Thunderbird International business review*, 48(2), 157-181.
- Kessey, K. D., & Arko, B. (2013). Small scale gold mining and environmental degradation, in Ghana: Issues of mining policy implementation and challenges. *Journal of Studies in Social Sciences*, 5(1).
- Klitgaard, R. (1988), *Controlling Corruption* (Berkeley, University of California Press).
- Kolstad, Ivar, Søreide, Tina, & Williams, Aled. (2008). Corruption in Natural Resource Management-An Introduction. *U4 Brief*, 2008(2).
- Kreuter, Marshall W, Lezin, Nicole A, & Young, Laura A. (2000). Evaluating community-based collaborative mechanisms: Implications for practitioners. *Health Promotion Practice*, 1(1), 49-63.
- Kristensen, A. K. B., Thomsen, J. F., & Mikkelsen, S. (2014). A review of mercury exposure among artisanal small-scale gold miners in developing countries. *International archives of occupational and environmental health*, 87(6), 579-590.
- Kumar, S., & Phrommathed, P. (2005). *Research methodology* (pp. 43-50). Springer US.
- Lam, W. F. (1999). *Governing irrigation systems in Nepal: institutions, infrastructure, and collective action*. ICS Press Institute for Contemporary Studies.
- Larson, Anne M, & Soto, Fernanda. (2008). Decentralization of natural resource governance regimes. *Annual Review of Environment and Resources*, 33(1), 213.
- Larson, Anne M. (2002). Natural resources and decentralization in Nicaragua: Are local governments up to the job? *World Development*, 30(1), 17-31.
- Larson, Bruce A, & Bromley, Daniel W. (1990). Property rights, externalities, and resource degradation: locating the tragedy. *Journal of Development Economics*, 33(2), 235-262.
- Lennox, James, Proctor, Wendy, & Russell, Shona. (2011). Structuring stakeholder participation in New Zealand's water resource governance. *Ecological Economics*, 70(7), 1381-1394.
- Leonard, D. K., & Marshall, D. R. (1982). *Institutions of Rural Development for the Poor: decentralization and organizational linkages*.

- Likert, R. (1932). A technique for the measurement of attitudes. *Archives of psychology*.
- Lobo, C. (2009). Institutional and Organisational Analysis for Pro–Poor Change: Meeting IFAD” s Millennium Challenge. *The International Fund for Agricultural Development (IFAD)*. at: <http://www.ifad.org/english/institutions/sourcebook.pdf>, (accessed on 23 February 2009).
- Lockwood, M. (2010). Good governance for terrestrial protected areas: A framework, principles and performance outcomes. *Journal of environmental management*, 91(3), 754-766.
- Luo, Y. (2005). An organizational perspective of corruption. *Management and Organization Review*, 1(1), 119-154.
- Lutz, G., & Linder, W. (2004). *Traditional structures in local governance for local development*. University of Berne.
- Macdonald, Karunia, Lund, Mark, & Blanchette, Melanie. Impacts of Artisanal Small-Scale Gold Mining on Water Quality of a Tropical River (Surow River, Ghana).
- Makinda, Samuel M. (1996). Democracy and multi-party politics in Africa. *The Journal of Modern African Studies*, 34(04), 555-573.
- Malterud, (2001). Qualitative research: standards, challenges, and guidelines. *The lancet*, 358(9280), 483-488.
- Marshall, D. R. (1982). *Institutions of Rural Development for the Poor: decentralization and organizational linkages*. Institute of International Studies, University of California, Berkeley.
- Matveev, A. V. (2002). The advantages of employing quantitative and qualitative methods in intercultural research: Practical implications from the study of the perceptions of intercultural communication competence by American and Russian managers. *Bulletin of Russian Communication Association Theory of Communication and Applied Communication*, 1, 59-67.
- McFadden, L., Priest, S., Green, C. and Sandberg, A. (2009) Basic principles of science and policy integration, *Spicosa Project Report*, London, Flood Hazard Research Centre, Middlesex University.
- McGuire, J. M. (2010). Decentralization for satisfying basic needs: An economic guide for policymakers. IAP.

- McGuire, Michael. (2006). Collaborative public management: Assessing what we know and how we know it. *Public administration review*, 66(s1), 33-43.
- McNie, Elizabeth C. (2007). Reconciling the supply of scientific information with user demands: an analysis of the problem and review of the literature. *Environmental Science & Policy*, 10(1), 17-38.
- Mearns, Robin. (1996). Environmental entitlements: pastoral natural resource management in Mongolia. *Cahiers des Sciences Humaines*, 32, 105-132.
- Misangyi, V. F., Weaver, G. R., & Elms, H. (2008). Ending corruption: The interplay among institutional logics, resources, and institutional entrepreneurs. *Academy of Management Review*, 33(3), 750-770.
- Morton C, Gunton TI, Day JC 2011. Engaging aboriginal populations in collaborative planning: an evaluation of a twotiered collaborative planning model for land and resource management. *Journal of Environmental Planning and Management* 55, 507–523.
- Noor, Khairul Baharein Mohd. (2008). Case study: A strategic research methodology. *American journal of applied sciences*, 5(11), 1602-1604.
- North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge university press.
- Nyame, F. K., & Blocher, J. (2010). Influence of land tenure practices on artisanal mining activity in Ghana. *Resources Policy*, 35(1), 47-53.
- Oatey A. (1999) 'The Strengths and Limitations of Interviews as A Research Technique for Studying Television Viewers'. [Internet]. Available from: <http://www.aber.ac.uk/media/Students/aeo9702.html>
- OECD.(2002). Improving Policy Coherence and Integration for Sustainable Development. PUMA, OECD: Paris.
- Ofei-Aboagye, E., Thompson, N. M., Al-Hassan, S., Akabzaa, T., & Ayamdoo, C. (2004). Putting Miners First: Understanding the Livelihoods Context of Small-Scale and Artisanal Mining in Ghana. *A Report for the Centre for Development Studies. Swansea: Swansea University*.
- Ofosu-Mensah, E. A. (2011). Gold mining and the socio-economic development of Obuasi in Adanse. *African Journal of History and Culture*, 3(4), 54.



- Olowu, Dele. (2004). Property taxation and democratic decentralization in developing countries. *ISS Working Paper Series/General Series*, 401, 1-35.
- Oppenheim A.N. (1992) *Questionnaire Design, Interviewing and Attitude Measurement*. Pinter, London
- Ostrom, E., & Schlager, E. (1996). The formation of property rights. *Rights to nature*, 127-156.
- Ostrom, E., 1990. *Governing the Commons*. Cambridge University Press, New York.
- Ostrom, E., 1992. *Crafting Institutions for Self-Governing Irrigation Systems*. ICS Press, San Francisco.
- Ostrom, Elinor. (2014). Collective action and the evolution of social norms. *Journal of Natural Resources Policy Research*, 6(4), 235-252.
- Ostrom, V. (1985). Multiorganizational arrangements in the governance of unitary and federal political systems. In *Policy Implementation in Federal and Unitary Systems* (pp. 1-16). Springer Netherlands.
- Pillay, Soma, & Kluvers, Ron. (2014). An Institutional Theory Perspective on Corruption: The Case of a Developing Democracy. *Financial Accountability & Management*, 30(1), 95-119. pp. 45–57.
- Pit under Construction by an Excavator. Scientific Figure on ResearchGate. Available from: <https://www.researchgate.net/figure/282912603>.
- Ploger, John. (2001). Public participation and the art of governance. *Environment and Planning B*, 28(2), 219-242.
- Podesta GP, Natenzon CE, Hidalgo C, Ruiz Toranzo F 2013. Interdisciplinary production of knowledge with participation of stakeholders: a case study of a collaborative project on climate variability, human decisions and agricultural ecosystems in the Argentine Pampas. *Environmental Science & Policy* 26, 40–48.
- Presbitero, Andrea F. (2009). Debt-Relief Effectiveness and Institution-Building. *Development Policy Review*, 27(5), 529-559. Review, Vol. 33, No. 3, pp. 750–70.
- Rayner, J. (1996). Implementing sustainability in West Coast forests: CORE and FEMAT as experiments in process. *Journal of Canadian Studies/Revue d'Études Canadiennes*, 31(1), 82.

- Ribot, J. C. (2004). Democratic Decentralization of Natural Resources: Encountering and Countering Resistance. *Washington, DC: World Resources Institute.*
- Rose, Carol M. (2000). *Common property, regulatory property, and environmental protection: Comparing common pool resources to tradable environmental allowances.* Paper presented at the 8th Biennial Conference of the International Association for the Study of Common Property, Indiana University, Bloomington Indiana.
- Rowe, Gene, & Frewer, Lynn J. (2000). Public participation methods: A framework for evaluation. *Science, technology & human values*, 25(1), 3-29.
- Saunders, Peter. (1984). Beyond housing classes: the sociological significance of private property rights in means of consumption. *International Journal of Urban and regional research*, 8(2), 202-227.
- Schlager, E., & Ostrom, E. (1992). Property-rights regimes and natural resources: a conceptual analysis. *Land economics*, 249-262.
- Schlager, Edella. (2002). Rationality, cooperation, and common pool resources. *American Behavioral Scientist*, 45(5), 801-819.
- Schmidt, S. K. (2007). Mutual recognition as a new mode of governance. *Journal of European Public Policy*, 14(5), 667-681.
- Shamsul Haque, M. (1997). Local Governance in Developing Nations: Reexamining the Question of Accountability. *Regional Development Dialogue*, 18, iii-iii.
- Smith, Robert J. (1981). Resolving the tragedy of the commons by creating private property rights in wildlife. *Cato J.*, 1, 439.
- Standing, A., & Hilson, G. (2013). Distributing mining wealth to communities in Ghana: Addressing problems of elite capture and political corruption. *U4 Issue*, 2013(5).
- State of River Offin. Retrieved from: <http://www.kweiquartey.com/latest-news/all-that-glitters-illegal-gold-mining-in-ghana-chapter-four>
- State of River Par. Retrieved from: <http://m.myjoyonline.com/marticles/news/galamsey-worsened-in-2010-and-water-pollution-increased->
- Steckling, N., Boese-O'Reilly, S., Gradel, C., Gutschmidt, K., Shinee, E., Altangerel, E., ... & Roider, G. (2011). Mercury exposure in female artisanal small-scale gold miners (ASGM) in Mongolia: An analysis of human biomonitoring (HBM) data from 2008. *Science of the Total Environment*, 409(5), 994-1000.
- Stirton, Lindsay, & Lodge, Martin. (2001). Transparency mechanisms: Building publicness into public services. *Journal of Law and Society*, 28(4), 471-489.

- Tisdell, Clement A. (1993). Environmental economics. *Elgar, Aldershot*.
- Transparency International. (2005). Corruption Surveys and Indices, Transparency International,
- Tschakert, P., & Singha, K. (2007). Contaminated identities: mercury and marginalization in Ghana's artisanal mining sector. *Geoforum*, 38(6), 1304-1321.
- UNODC. 2010. 'Corruption and the environment'  
[http://www.unodc.org/documents/data-and-analysis/tocta/TOCTA\\_Report\\_2010\\_low\\_res.pdf](http://www.unodc.org/documents/data-and-analysis/tocta/TOCTA_Report_2010_low_res.pdf).
- Unsworth, Sue. (2010). *An upside down view of governance*: University of Sussex. Institute of Development Studies (IDS).
- Uphoff, N. 1992. Local institutions and participation for sustainable development. Gatekeeper Series 34. London: *International Institute for Environment and Development* (IIED). Cited in Hobley 2000.
- Verbruggen, H. (1994). Environmental policy failures and environmental policy levels. In *Economic incentives and environmental policies* (pp. 41-54). Springer Netherlands.
- Wilson JA. 2002. Scientific uncertainty, complex systems and the design of common-pool institutions. In *The Drama of the Commons*, ed. E Ostrom, T Dietz, N Dolsak, P Stern, S Stonich, EUWeber, pp. 327–59. Washington, DC: Natl. Acad. Press.
- Wimmer, R., Dominick, J., *Mass Media Research: An Introduction*, Belmont, MA: Wadsworth, 1997.
- Winbourne, Svetlana. (2002). Corruption and the Environment. *Management Systems International and USAID, Washington*.
- Witzel, A. (2000, January). The problem-centered interview. In *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research* (Vol. 1, No. 1).
- Yin, Robert K. (2013). *Case study research: Design and methods*: Sage publications.
- Zainal, Zaidah. (2007). Case study as a research method. *Jurnal Kemanusiaan*(9), 1-6.

## **Appendix 1: Mineral and Mining Act, 2006 (Ghana)**

### **Application**

81. Section 82 to 99 applies to small scale mining only.

### **Licence for small scale mining**

82. (1) Despite a law to the contrary, a person shall not engage in or undertake a small scale mining operation for a mineral unless there is in existence in respect of the mining operation a licence granted by the Minister for Mines or by an officer authorized by the Minister.

(2) An application for a licence shall be made in a form the Minister may direct to the office of the Commission in the designated area and shall be submitted with a fee the Minister may determine.

(3) Where a mineral licence has been granted over a parcel of land, another mineral licence of the same kind shall not be granted in respect of the same land.

### **Qualification of applicant for small scale mining licence**

83. A licence for small-scale mining operation shall not be granted to a person unless that person

(a) is a citizen of Ghana,

(b) has attained the age of eighteen years, and

(c) is registered by the office of the Commission in an area designated under section 90(1).

### **Conditions for the grant of a licence**

84. Except otherwise provided in section 82 to 99, a licence granted by the Minister shall be in respect of the mineral specified in the licence and shall be subject to conditions specified in the licence.

### **Duration of a licence**

85. (a) A licence granted under section 82 (1) to a person, a group of persons, a co-operative society or a company shall be for a period not more than five years from the date of issue in the first instance and may be renewed on expiry for a further period that the Minister may determine.

(2) The Minister may by legislative instrument and on the advice of the Commission, prescribe the fees payable for the grant and renewal of licences for small-scale mining.

### **Areas covered by licence**

86. The size of the area in respect of which a licence may be granted for small-scale mining shall be in accordance with the member of blocks prescribed.

### **Revocation of licence**

87. The Minister may revoke a licence granted under section 82 (1) where,

(a) the minister is satisfied that the licensee has contravened or failed to comply with a term or condition of the licence or a requirement applicable to the licensee,

(b) the licensee is convicted of any offence relating to the smuggling or illegal sale or dealing in minerals, or

(c) the Minister is satisfied that it is in the public interest to do so.

### **Transfer of licence**

88. A licence granted under section 82 (1) may be transferred only to a citizen and with the consent of the Minister.

**Designated areas**

89. Where the Minister, after consultation with the Commission considers that it is in the public interest to encourage small scale mining in an area, the Minister may by notice in the *Gazette*, designate that area for small scale mining operations and specify the mineral to be mined.

**Establishment of District offices of the Commission**

90. (1) The Commission may establish an area designated for mining operations, an Office to be known as the District Office of the Commission referred to in this Act as the "District Office".
- (2) There shall be appointed by the Commission a District Officer who shall be the head of the District Office of the Commission.
- (3) A District Office shall among other functions
- (a) compile a register of the small scale miners and prospective small scale miners specifying particulars that may be determined by the Minister,
  - (b) supervise and monitor the operation and activities of the small scale miners and prospective small scale miners;
  - (c) advise and provide training facilities and assistance necessary for effective and efficient small scale mining operations,
  - (d) submit to the Commission in a form and at intervals directed by the Commission, reports or other documents and information on small scale mining activities within the District; and
  - (e) facilitate the formation of Small Scale Miners Association.

**Registration of prospective licensees**

91. (1) A person engaged in or wishing to undertake a type of small scale mining operation shall register with the District Office of the designated area where the person operates or intends to operate.
- (2) A person shall not be granted a licence under section 82(1) unless the person is registered under this section.

**Small Scale Mining Committees**

92. (1) There is established in every designated area a Small Scale Mining Committee.
- (2) The Committee consists of the following members:
- (a) the District Chief Executive or the representative of the District Chief Executive who shall be the chairperson of the Committee;
  - (b) the District Officer appointed under section 90(2);
  - (c) one person nominated by the relevant District Assembly;
  - (d) one person nominated by the relevant Traditional Council;
  - (e) an officer from the Inspectorate Division of the Commission; and
  - (f) an officer from the Environmental Protection Agency.
- (3) The Committee shall assist the District Office to effectively monitor, promote and develop mining operations in the designated area. (4) The members of the Committee shall be appointed by the Minister and shall hold office for a period and on terms and conditions determined by the Minister.

**Operations of small scale miners**

93. A person licensed under section 82 may win, mine and produce minerals by an effective and efficient method and shall observe good mining practices, health and safety rules and pay due regard to the protection of the environment during mining operations.

**Compensation for use of land**

94. Where a licence is granted in a designated area to a person other than the owner of the land, the licensee shall pay compensation for the use of the land and destruction of crops to the owner of the land that the Minister in consultation with the Commission and the Government agency with responsibility for valuation of public lands may prescribe.

**Use of explosives**

95. A small-scale miner shall not without the written permission of the Minister on the recommendation of the Commission use explosives in the area of operation.

**Purchase of mercury**

96. A small-scale miner may purchase from an authorized mercury dealer the quantities of mercury that may be reasonably necessary for the mining operations of the small scale miner.

**Offences and penalties under section 81 to 99**

99. (1) A person who buys or sells minerals without a licence granted under section 81 to 99 or without a valid authority granted under an enactment for the time being in force commits an offence and is liable on summary conviction to a minimum fine of three thousand penalty units or to imprisonment for a term not more than five years or to both.
- (2) A person who,
- (a) without a licence granted by the Minister undertakes a small scale mining operation contrary to section 1, or
  - (b) acts in contravention of provision of this Act in respect of which an offence has not been specified, commits an offence and is liable on summary conviction to a minimum fine of one thousand penalty units or to imprisonment for a term not more than three years or to both
- (3) A court before which a person is convicted under this Act may in addition to a penalty that it may impose, order the forfeiture to the State of the mineral in respect of which the offence was committed.

## Appendix 2: Water use regulations, 2001 (Ghana)

In exercise of the powers conferred on the Water Resources Commission by section 35 of the Water Resources Commission Act, 1996 (Act 522) these Regulations are made this 24<sup>th</sup> day of July, 2001.

### **Water use permit**

1. Subject to the Act, a person may obtain a permit from the Commission for:

- (a) domestic water use
- (b) commercial water use,
- (c) municipal water use,
- (d) industrial water use,
- (e) agricultural water use,
- (f) power generation water use,
- (g) water transportation water use,
- (h) fisheries (aquaculture) water use
- (i) environmental water use
- (j) recreational water use, and
- (k) under water (wood) harvesting.

### **Application procedure**

2. (1) An applicant for a permit shall file the application form with the Commission.

(2) The applicant shall obtain an application form as specified in Schedule A for completion from the Commission

(3) The completed application form shall be accompanied by appropriate administrative and processing fees specified in Schedule B, and

(b) any other information and documents which may assist the Commission in taking a decision

(4) Upon receipt of a completed application form, the Commission shall publish a notice of the application in the mass media in a form that the Commission may determine

(5) Where an applicant

- (a) fails to pay the appropriate administrative and processing fees,
  - (b) submits an incomplete application form, or
  - (c) submits an application in error,
- the Commission shall notify the applicant in writing to rectify the situation within fourteen days

(6) Where the applicant fails to rectify the situation within fourteen days the Commission shall refuse to process the application.

### **Publications**

3. (1) The Commission shall prior to making a grant of a permit, publish in the Gazette and in at least one national newspaper a notice

(a) stating the purpose of the application, and

inviting objections from the public to be submitted to the Commission within three months from the date of the first publication

(2) Objections made in response to a notice under sub regulation (1) shall be submitted in writing to the Commission unless otherwise specified in the notice

### **Commission's Decisions**

4. The Commission shall within ten days of receipt of a completed application form

(a) acknowledge receipt of the application form in writing ,and

(b) shall within ten days and not more than four months inform the applicant in writing of the Commission's decision

**Investigations**

5. (1) The Commission shall in considering an application, conduct an investigation to ascertain whether the proposed use of the water

(a) is in accordance with the established water use policies and plans, and  
(b) will not cause irreparable damage to water resources, public health and the environment

(2) In conducting the investigations the Commission shall

(a) consider the technical and social aspects of the application' and  
(b) ensure public participation especially the people in the area likely to be affected by the proposed use.

**Public Hearing**

6. (1) The Commission shall hold a public hearing in respect of an application where

- (a) upon a notice issued under regulation 3(1) there is adverse public reaction to the proposed use;
- (b) the use of the water involves the dislocation, relocation, resettlement or in any manner cause the destruction of the natural water resources of the community; or
- (c) the Commission considers that the use of the water will have an impact on the natural resources of the basin

(2) For the purposes of conducting a public hearing, the Commission shall collaborate with

- (a) the Environmental Protection Agency
- (b) the traditional authorities of the community and
- (c) the relevant government institutions and agencies

**Priority of water use**

7. (1) In considering an application, the Commission shall be guided by

- (a) the prevailing water policy,
- (b) domestic water use, and
- (c) any other water use which fulfils the goals of national socio-economic development

(2) Where the priorities of two applications are the same, the first in time shall be given the priority

**Objections**

8. (1) Where

- (a) a person claims water right or other interest in a water resource which is the subject of a new application, or
- (b) conflicting claims of interest are made over the same water resources, the claim shall be referred by the Commission to the Water Users Committee of the Commission for resolution

(2) The Committee shall consider all statements from the parties and any information supporting the claims of the parties.

(3) The proceedings of the Committee shall be informal and shall be governed by the rules of natural justice.

(4) The Committee shall submit its report and recommendations to the Commission within fourteen days after completion of the hearing.

(5) On receipt of the report and recommendations, the Commission shall act on it within fourteen days.

**Exemptions**

9. (1) Any water use resulting from the abstraction of water by manual means is exempted from these Regulations

(2) These Regulations do not prevent the use of water resources for the purposes of fighting fires



10. (1) The following water uses are exempted from the permit requirement under regulation 2:

(a) water abstracted by mechanical means and used for any purpose where the abstraction level does not exceed five litres per second; and

(b) subsistence agricultural water use for land areas not exceeding 1 hectare.

(2) The water uses specified in sub regulation (1) are subject to registration under regulation 11.

### **Registration**

An application for the registration of water use in respect of regulation 10 (1) shall be submitted to the relevant District Assembly.

(2) The application shall contain the

(a) name and address of the applicant,

(b) category and level of the water use,

(c) water body or system affected, and

(d) location of the water use.

(3) Where the District Assembly is satisfied with the application, the District Assembly shall

(a) register the water use, and

(b) issue the applicant with a registration number.

(4) The District Assembly shall furnish the Commission quarterly, with a list of all registered water uses in its locality.

(5) The Commission shall

(a) enter the particulars of the registration in the Water Register, and

(b) publish annually water uses registered.

### **Environmental Assessment**

Where the Commission in consultation with the Environmental Protection Agency considers a proposed water use to constitute a use which requires an environmental impact assessment, the applicant shall attach to the application evidence that an environmental impact assessment has been approved by the Environmental Protection Agency.

(2) Where in the opinion of the Environmental Protection Agency the proposed or existing water use requires an environmental management plan, that requirement shall be one of the conditions for the grant of water use permit.

### **Grant of Permit**

13. (1) Subject to these Regulations, the Commission shall grant a permit to an applicant who satisfies the requirements of these Regulations.

(2) Where the Commission has reasons based on

(a) technical data,

(b) sustainability of the water resources,

(c) national security,

(d) public safety, or

(e) other reasonable justification

the Commission shall refuse to grant the permit to the applicant

(3) The Commission shall within fourteen days communicate the reasons for the refusal of a permit to the applicant

(4) A permit granted by the Commission is subject to the conditions specified in the permit

(5) Unless otherwise stated, a permit granted by the Commission shall be subject to ratification by Parliament

(6) Where the Commission grants a permit, the Commission shall

(a) enter the particulars of the permit in the Water Register, and

(b) publish the fact of the grant in the mass media in a form that the

Commission may determine

(7) The Commission shall furnish a District Assembly with a list of all approved permits granted within its area.

**Duration and Renewal of Permit**

14. (1) A permit granted under these Regulations

(a) shall be for the period specified in the permit; and

(b) may be renewed

(2) An application for the renewal of a permit shall be made to the Commission not later than ninety days before the expiration of the permit.

**Prohibition**

15. A person

(a) who fails to renew that person's permit, or

(b) whose application for the renewal is rejected by the Commission shall not use

the water resources to which the permit relates.

**Appeals**

16. (1) A person aggrieved by the refusal of the Commission to grant or renew a permit may lodge a complaint in writing with the Chairman of the Commission

(2) The complaint shall be submitted to the Chairman within thirty days of the Commission's decision

(3) The complainant shall

(a) state the nature of the objections or complaint,

(b) attach a copy of the decision objected to, and

(c) attach all documents relevant for the determination of the complaint.

(4) The Chairman shall within thirty days of receipt of the complaint take a decision on it.

(5) A person may appeal to the High Court where

(a) that person is dissatisfied with the decision of the Chairman, or

(b) on the expiration of the thirty days the Chairman has not acted on the complaint

**General Obligations**

17. (1) A permit holder shall at the holder's expense construct, secure and maintain to the satisfaction of the Commission or a person appointed by the Commission for the purpose, any work which is necessary for the passage of waste water flowing from any work constructed by the holder.

(2) Subject to the endorsement on the permit, the permit holder shall return the waters to the same body of water from which the water was originally diverted or abstracted.

**Cessation of permit**

18. (1) The Commission may within three months after the expiration or prior termination of the permit serve notice on the permit holder to

(a) remove the work, and

(b) restore the land on which the work was situated to its original state or in a good state as the land was before the works were constructed on the land

(2) Where the permit holder fails to comply with the notice under sub regulation (1), the Commission shall remove the work and restore the land to its original state.

(3) The permit holder shall pay the expenses incurred by the Commission in effecting the removal of the work and restoration of the land

**Transferability of permits**

19. A permit holder shall not transfer a permit granted under these Regulations except with the prior approval in writing of the Commission

**Water right**

20. (1) A person who holds a water right for an item specified in column 1 of Schedule C shall pay the raw water charge at a rate specified in column 2 of the Schedule.

(2) For the purposes of the Regulations, raw water charges represent the cost of used water resources.

**Payment of water charges**

21 (1) A permit holder may pay the assessed raw water charges in advance or as may be determined by the Commission in prior consultation with the holder.

(2) The raw water charge shall be used to defray the cost of water resources management and regulation.

**Keeping records**

22. (1) A permit holder shall keep a full and correct record of

- (a) all water abstracted, diverted or stored, giving the date, time, quantity and methods of the abstraction, diversion or storage, and
- (b) the purpose for which the water used

(2) The permit holder shall furnish to the Commission at the times that the Commission may demand the report made under sub regulation (1)

**Inspectorate**

23. (1) There is established by these Regulations an Inspectorate Division of the Commission

(2) In accordance with section 10 of the Act there shall be appointed a Chief Inspector and other inspectors to perform the functions that the Commission may determine for the purposes of giving effect to these Regulations.

(3) An Inspector appointed under these Regulations may enter any premises

- (a) which the inspector suspects to be used for a purpose to which these Regulations apply, and
- (b) ensure that there Regulations are complied with.

**Offence**

24. A permit holder who interferes with or who permits a person to interfere with a controlling or measuring device so that the quantity of water abstracted, diverted or stored is not in accordance with the terms of the holder's permit or is not in accordance with the terms of an order of the Commission commits an offence and is liable on summary conviction to a fine not exceeding two hundred and fifty penalty units or to a term of imprisonment not exceeding twelve months or to both.

### Appendix 3: Survey Questionnaire



QUESTIONNAIRE ID.....

DATE OF COMPLETION.....

#### Introduction

I am Gloria Boafo doing a Master's degree in Environmental Management at Massey University, New Zealand. I am currently carrying out a research on the management of rivers in artisanal small scale gold mining areas. You are humbly invited to participate in the research by providing your views and concerns on the impact of mining operations on water resources in Amansie Central District. Your contribution is significant and will assist in completion of this research. Any information provided will only be used for academic purposes. Participation in this study is voluntary and personal information of participants will not be published. All materials will be deposited at Massey University, Palmerston North.

#### Part 1: Background Information

☐ **Government Official**

1. Name of your institution: \_\_\_\_\_
2. What is your position in this institution \_\_\_\_\_
3. How long have you been in this position \_\_\_\_\_

☐ **Miner**

1. Is mining your main income? \_\_\_\_\_
2. How long have you been mining? \_\_\_\_\_
3. I am a native of Amansie Central District \_\_\_\_\_

☐ **Community Member**

1. Occupation \_\_\_\_\_
2. I am a native of Amansie Central District \_\_\_\_\_
3. How long have you been in Amansie Central District \_\_\_\_\_

## Part 2: Research Questions

For each question; please tick the number that best describes the extent to which you agree to each of the following statements.

Impacts of Gold Mining		Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
		1	2	3	4	5	0
4.	Gold mining brings wealth and employment to Amansie Central District	1	2	3	4	5	0
5.	Within the district, gold mining has negative impact on the environment, particularly rivers and streams	1	2	3	4	5	0
6.	Rivers and streams in Amansie Central District are badly polluted	1	2	3	4	5	0
7.	Rivers and streams in Amansie Central District are polluted mainly from gold mining operations within the District	1	2	3	4	5	0
8.	Rivers and streams in Amansie Central District are polluted from upstream rivers of the district	1	2	3	4	5	0
9.	Miners depend on water resources including rivers within the district for their mining operations	1	2	3	4	5	0
10.	Miners wash sediments and discharge tailings that end up in water resources including rivers within the district	1	2	3	4	5	0
11.	The national government is to blame for the pollution	1	2	3	4	5	0
12.	The regional government is to blame for the pollution	1	2	3	4	5	0
13.	The local government is to blame for the pollution	1	2	3	4	5	0
14.	Traditional leaders are to blame for the pollution	1	2	3	4	5	0
15.	Local people are to blame for the pollution	1	2	3	4	5	0
16.	Miners are to be blame for the pollution	1	2	3	4	5	0

		<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither agree nor disagree</i>	<i>Disagree</i>	<i>Strongly disagree</i>	<i>Don't know</i>
17.	Miners prioritise higher gold production over water quality in the district	1	2	3	4	5	0
18.	Government prioritise higher gold production over environmental quality for economic growth	1	2	3	4	5	0
19.	Miners that come from Amansie Central District mine with more care to protect water quality than outsiders	1	2	3	4	5	0
20.	Water pollution from mining operations has affected the use of rivers and streams	1	2	3	4	5	0
<b>Policy and Regulation</b>							
21.	Policies and regulations governing artisanal and small scale mining operations within the district are effective to ensure compliance by miners	1	2	3	4	5	0
22.	Miners participate in forming policies and regulations that govern the district	1	2	3	4	5	0
23.	Scientists participate in forming the policies and regulations that govern the district	1	2	3	4	5	0
24.	Community members participate in forming policies and regulation that governs the district	1	2	3	4	5	0
25.	Views and concerns of scientists, miners and the local community are considered in policy formulation of the district	1	2	3	4	5	0
26.	Miners do not comply with rules and regulations because structures in place to follow up on rules and regulations are not enforced	1	2	3	4	5	0
27.	Miners are always prosecuted when they violate rules and regulations governing them	1	2	3	4	5	0

		<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither agree nor disagree</i>	<i>Disagree</i>	<i>Strongly disagree</i>	<i>Don't know</i>
28.	All major stakeholders responsible for mining operations are represented in Amansie Central District	1	2	3	4	5	0
29.	Miners have the necessary education and quality scientific information on maintaining water quality within the district	1	2	3	4	5	0
30.	Education and scientific information from authorities are consistent and frequently provided to miners	1	2	3	4	5	0
31.	There are policies and laws governing rivers within the district	1	2	3	4	5	0
32.	These policies are good but badly enforced	1	2	3	4	5	0
33.	These policies and regulations are ineffective to ensure the quality of rivers within the district	1	2	3	4	5	0
34.	Awareness campaigns are organized within the district to educate miners and the local people on the need to preserve water quality and quantity	1	2	3	4	5	0
35.	There are mitigation strategies in the district to restore rivers polluted by mining operations	1	2	3	4	5	0
36.	Social groups and NGOs are present in the district to assist in the prevention of river pollution from gold mining operations	1	2	3	4	5	0
37.	I play my part to ensure good water quality of rivers and streams within the district	1	2	3	4	5	0
<b>Challenges</b>							
38.	I find challenges in my role in ensuring good water quality within the district	1	2	3	4	5	0
39.	Administration capacity is the main challenge to ensure compliance in order to maintain good river quality within the district	1	2	3	4	5	0
40.	Government structure is the main challenge to	1	2	3	4	5	0

	ensure compliance in order to maintain good river quality						
41.	Weak polices and laws are the main challenges to ensure compliance in order to maintain good river quality within the district	1	2	3	4	5	0
42.	Lack of quality education and scientific information are the main challenges to ensure compliance in order to maintain good river quality within the district	1	2	3	4	5	0
43.	Corruption is the main challenge to ensure compliance in order to maintain good river quality within the district	1	2	3	4	5	0
<b>Conclusion</b>							
44.	Generally, the negative impacts of gold mining on the district are higher than the positive impacts	1	2	3	4	5	0
45.	I am prepared to support and be part of mechanisms including social groups and NGOs to ensure good river quality and quantity within the district	1	2	3	4	5	0
Is there anything you would like to add?							

**Thank you!**



## Appendix 4: Ethics Approval Form



### MASSEY UNIVERSITY ALBANY

6 July 2015

Gloria Baofo  
20 Rakia Place  
Palmerston North 4410

Dear Gloria

**Re: Managing Ghanaian Rivers in Artisanal Small Scale Gold Mining Areas: A Case Study in Amansie Central District**

Thank you for your Low Risk Notification which was received on 24 June 2015.

Your project has been recorded on the Low Risk Database which is reported in the Annual Report of the Massey University Human Ethics Committees.

You are reminded that staff researchers and supervisors are fully responsible for ensuring that the information in the low risk notification has met the requirements and guidelines for submission of a low risk notification.

The low risk notification for this project is valid for a maximum of three years.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis that it is safe to proceed without approval by one of the University's Human Ethics Committees.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

**A reminder to include the following statement on all public documents:**

*"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research."*

*If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Dr Brian Finch, Director (Research Ethics), telephone 06 356 9099, extn 86015, e-mail [humaneethics@massey.ac.nz](mailto:humaneethics@massey.ac.nz)."*

Please note that if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to provide a full application to one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

Brian T Finch (Dr)  
**Chair, Human Ethics Chairs' Committee and  
Director (Research Ethics)**

Cc Dr Jeff McNeil  
School of People, Environment and Planning  
Palmerston North

Dr Allanah Ryan  
Head of School of People, Environment and  
Planning  
Palmerston North

---

Massey University Human Ethics Committee  
Accredited by the Health Research Council