UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION

THE EFFECTS OF SAND MINING ON SUB-STRUCTURE OF BUILDINGS IN NEW JUABEN MUNICIPALITY IN THE EASTERN REGION

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DISSERTATION SUBMITTED TO THE DEPARTMENT OF CONSTRUCTION TECHNOLOGY EDUCATION, UNIVERSITY OF EDUCATION, WINNEBA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF CONSTRUCTION TECHNOLOGY EDUCATIONS.

OCTOBER, 2018

DECLARATION

STUDENT DECLARATION

I, **STEPHEN KPONYO**, declare that this Dissertation, with the exception of quotations and references contained in published works which have been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another master degree elsewhere.

Candidate's Signature: …….

Date: ……

SUPERVISOR'S DECLARATION

I hereby declare that, the preparation and presentation of this project work was supervised in accordance with the guidelines and ethics on supervision of project work laid down by the University of Education,Winneba.

Candidate's Supervisor: **MR. MICHAEL KORBLAH TSORGALI**

Supervisor's Signature: …….……....

Date: …….……..……...

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DEDICATION

I dedicate the project work to my kids: Lovia Kponyo and Lordina Kponyo.

A special dedication also goes to the entire Kponyo family especially to Mr. Leonard Kponyo for his immeasurable support. May God be their guide and bless them with their heart desires.

The final dedication goes to, my two sisters: Sena Kponyo and Peace Kponyo at New Tafo Akim.

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ABSTRACT

The purpose of the study was to study the effects of sand mining on sub-structure of buildings in New Juaben Municipality in the Eastern Region. The research design used for this study was a case study. The population for the study involved sand miners and chiefs of Koforidua (New Juaben Municipality). The purposive sampling technique was used to select a sample size of 200 for the study. This was made up of 176 household respondents, 7opinion leaders, 15 informants and 2chiefs. Data collection instruments used includes questionnaire, interview and observation. Both quantitative and qualitative techniques were used to analyse the data for the study. The Statistical Package for Social Sciences (SPSS version 20) software was used to analyse data. The study results concluded that sand mining communities are associated with destructions to the sub-structures of buildings, vegetation cover, creation of gullies on farmlands and other damages to the physical environment. Unfortunately, these degraded sites become unproductive because no measures are put in place to reclaim the lost lands. Consequently, several acres of lands are lost annually to the activities of sand mining in various parts of the region. All efforts must therefore be put in place by the district assemblies, in collaborations with the Environmental Protection Agency and the Ministry of Food and Agriculture; to restore the lands that are destroyed in the wake of sand mining activities. The study recommended that the Environmental Protection Agency should intensify operations to combat illegal sand mining activities in the New Juaben Municipality.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

The chapter presents the background to the study which illuminates the subject matter in a way which easily leads to defining the problem to be investigated in this project work. It is then followed by the objectives of the study, significance of the study and scope and limitations of the study. The chapter ends with the structure of the study which gives an overview of the project work.

1.6 Background to the Study

Sand is a cheap natural resource made up of gravel, sand, clay, loam which constitutes the different types. Pit sand, river sand and gravel are components of soil which take years to be formed but extracted in a matter of days. Sand and gravel are underground geological resources formed from eroding mountain rocks carried by streams and rivers. According to Mwangi (2007), sand has many uses: it is needed for construction works but the genesis of cash economy brought many profit driven companies to be involved in its mining both legally and illegally with some having no regard for the environment. Sand mining and harvesting has both positive and negative environmental impacts.

Stebbins (2006), gave the background to formation of sand and gravel deposits, a legacy of the continental ice sheets that melted thousands of years ago. As the ice melted, fast moving rivers were formed leaving deposits of coarse sand. The rivers ran into the sea, large deltas were formed with layers of sand and silt. Now there is no more ice and rivers but scattered deposits of sand and gravel which are used as important natural resources.

Sand and gravel deposits are porous, water can pass through this geological material, making it a source of high quality water (Stebbins, 2006).

Draggan (2008), discussed sand and gravel as commodities used in industry, especially construction. In construction, the components are used either mixed with other materials or as is, while in industry, sand and gravel are used in production of other materials like aggregates. Sand mostly quartz grains (Silicon dioxide) formed from weathering of granite rocks. The quartz grains accumulated in rivers, streams, deltas and beaches. Therefore, quartz is very valuable as sand because of its silica content. The physical properties of sand and gravel particularly in abrasive property make the resources useful for traction on icy roads, roadways and rail road including sand blasting (Draggan, 2008).

Sand mining can be described as the practice of extracting sand mainly through an open pit. It is a type of open-cast mining that provides materials for the construction industry (Mensah, 1997). Sand and gravel constitute the largest volumes of all materials that are mined in various parts of the world. The global estimate of all materials mined is up to 59 billion tonnes per year (Steinberger, Krausmann, Eisenmenger, 2010), of which gravel and sand make up the largest portion ranging between 68% and 85%. Notwithstanding the fact that sand is amongst the most abundant resources on earth, how long one can keep tapping this resource before it runs out has become a great concern to many. Sand has the ability to renew itself of nutrients, but the rates of its extractions are far greater than their renewal (United Nations Environment Programme, 2014).

However, since time immemorial, sand and gravel have been exploited to aid in the construction of development projects (Mensah, 1997). Apart from being a source of strategic minerals, sand has other common uses such as making of cooking utensils and

containers for food items (Aqua-know, 2012). Sand, most importantly, provides habitat for living organisms and it is the main medium for agricultural activities.

The demand for sand and gravel continues to increase due to rapid urbanisation and the need for sand based products. The global trade value of stone, sand and gravel imports for the year 2010 was estimated to be $40.3 billion with China, Singapore, Italy, Germany and the Netherlands being the highest importers, respectively (United Nations Commodity Trade, 2010). Also, the global value of construction or the sand industry is expected to reach 12 trillion United States Dollars per annum in 2020 or about 13 percent of global GDP (Global Construction Perspectives, 2012). Therefore, the significance of sand mining to the economic development of countries all over the world cannot be over emphasized (Rabie, Blignaut, Fatti, 1994). For instance, the Mumbai high court ban on sand dredging in September, 2010 brought the construction industry in the region to a standstill. Many projects were halted and as a result almost 10 million people who were employed in the building industry lost their means of livelihoods (Hindustan Times, 2010).

There are numerous reports about sand mining related problems in many regions of the world (Young and Griffith, 2009). For example, the extraction of coastal sand in Jamaica, Grenada and Maldives has led to severe sea erosion and encroachment of the coastline (Jacob, 2010). Sand mining affects wildlife negatively, and it is the direct cause of massive erosion, deforestation, pollution of water sources and destruction of the habitat of living organisms (Kamis, 2011). The environmental problems associated with sand mining are also of great concern to many people, because they have direct effect on livelihoods. For instance, the livelihoods of thousands of local fishermen in many

communities in the Maharashtra State of India have been endangered by sand mining due to the destruction of their fishing nets by sand barges (Asha, 2011). In the same way, sand mining has led to the loss of coastal lands, public infrastructure and people's properties in Ghana (Musah, 2009). It is for this reason that the growing activities of sand miners in the New Juaben Municipality required investigation.

1.7 Statement of the Problem

Mining of sand is a major source of income and employment for some people in New Juaben municipality. Many people are increasingly being influenced into sand mining on daily basis. This trend of mass movement of people into sand mining has become major concern for people living in the sand mining communities in the New Juaben municipality. However, all the efforts by the various authorities in-curbing this phenomenon have not been very successful, due to the benefit associated with sand mining and other factors. This phenomenon has created problems for the sub-structures of buildings and threatened human lives. Issues relating to environmental sustainability and the protection of other residential properties during sand mining, call for concerted efforts by all the stakeholders in the sand industry to find a way out. However, the roles of local authorities or established institutions in the sand mining industry are not properly researched, hence, there is a need for this study.

1.8 Purpose of the Study

The purpose of the study was to minimize the effects of sand mining on sub-structure of buildings in New Juaben Municipality in the Eastern Region.

1.8.1 Objectives of the Study

The objectives of the study are to:

1. Examine the issues of sand mining on sub-structures of buildings in New Juaben Municipality;
2. Identify the effects of sand mining on the people in the study area;
3. Suggest strategies to minimize the effects of sand mining on sub-structure of buildings;

1.9 Research Questions

The research seeks to answer the following questions

1. What are the issues of sand mining on sub-structure of buildings in New Juaben Municipality?
2. How does sand mining affect the people in the study area?
3. What strategies can be adopted to deal with the effects of sand mining on sub-structure of buildings in New Juaben Municipality?

1.6 Scope of the study

The study was conducted in Koforidua in the New Juaben municipality of the Eastern Region in the two main location in the municipality namely; town and village. The targeted population was sand miners and chiefs. The research work was confined to the effects of sand mining on the environment. The study will cover the following sub-headings. Sustainable livelihood, sand mining activities, effects of sand mining, the role of institutions and local authorities.

1.10 Significance of the study

The study is significant for the following reasons:

- This study was necessary because there are many information about how sand mining relates to livelihood and the environment in the Eastern Region. Meanwhile, sand mining has become a key component, of livelihood activities for many communities in the area.
- The study would provide information on land degradation as a result of sand mining activities and the extent of how the sand wining has affected the substructure of most buildings in the study area.
- This study recommendation will serve as a guide for the local authorities in the New Juaben municipality to come out with laws to protect the land and buildings within the new Juaben Municipal area.
- Students and policy makers would use this study as the basis for further studies in managing the environment relating to sand mining.
- The outcome of this study would add knowledge to existing literature regarding environmental protection.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed literature to cover the concept of sustainable livelihood, overview of sand mining activities, sand mining activities in the world, sand mining activities in Africa, effects of sand mining on livelihood, positive effects on livelihood, negative effects on livelihood, effects of sand mining on environment, the roles of institutions and local authorities in providing livelihood security and conceptual framework of the study.

2.2 Concept of Sustainable Livelihood

Issues associated with the concept of sustainable livelihoods are fundamental to the debate on rural development, wealth creation and the management of the environment (Scoones, 2009). Helmore and Singh (2001), identified sustainable livelihood as one that maintains the integrity of the environment. The term livelihood has however attracted different definitions from many scholars. According to Chambers (1995), a livelihood consists of the resources that are used by individuals in undertaking an activity, with the aim of making ends meet or gaining a living. A livelihood as explained by Ellis and Freeman (2004), comprises the occupation that help people to earn a living as well as the resources, capabilities and institutions that constraints or assist people in pursuing a given livelihood activity. Chambers and Conway (1991), also provided their definition for livelihood. A livelihood in their view „consists of the assets of individuals, their capacity or potentialities and all the activities that are needed for their survival or a means of living. A livelihood is said to be sustainable when it has the ability to withstand

difficulties and regain its strengths from stress and shocks to enhance its capabilities, whilst not subverting the natural resource base (Chambers & Conway, 1991).

2.3 Overview of Sand Mining Activities

Sand mining refers to the gathering and carrying away of parts of the solid earth such as sand and gravel as raw material for construction of roads and buildings (Hull, 2001). The United Nations Environmental Programme (UNEP, 1992), observed that, sand mining has the capacity of reducing the productivity levels of agricultural lands. Globally, the basic sources of sand for human activities are terrestrial deposits. These are made up of sand from the channels of rivers and residual soil deposits on agricultural lands. Sand can also be sourced from deposits at the shores and from the floors of the ocean bed (marine sand mining). Marine sand mining consists of sand from the beaches, inland dunes, and dredging from the ocean beds (Peck Yen, Zulfarina, Rohasliney, 2010). There is overabundant supply of sand in the desert regions; however, such sand is not suitable for the construction industry. The sources of appropriate sand for industrial activities are therefore limited hence; continuous excavation can deplete sources in decades (The Greensand Trust, 2010).

The activities of sand and stone mining in Ghana dates back to time immemorial. However, there is limited information about the exact period this phenomenon began in the country (Biney, 1982). This could be explained by the fact that most of the sand miners fail to register their activities. Sand for constructional projects in Ghana are sourced primarily from agricultural lands, forest, and coastal lands across the length and

breadth of the country (Peprah, 2013; Mensah, 1997). This practice is often very destructive and poorly managed. The activities of sand miners are pervasive on the country's beaches and farmlands. In-spite of the potential dangers associated with sand mining, it has also become a major source of generating revenue for a lot of people at various locations in the country (Mensah, 1997). Chiefs and land owners give out lands to the sand miners caring little about the consequences involved. This has led to severe damage to streams, vegetation, roads and other public infrastructure (Imoru, 2010; Mensah, 1997).

2.3.1 Sand Mining Activities in the World

Sand mining and gravel extraction are a worldwide activity in both developed and developing countries as was realised by Draggan (2008). Industrial sand and gravel are produced, processed and used in construction and industry all over the world. The leading nations in mining and processing sand and gravel are United States of America, Australia, Austria, Belgium, Brazil, India, Spain, Nigeria, Kenya and South Africa. As a cheap and readily accessible resource many companies are involved in its mining both legally and illegally without considering the damage they are causing to the environment (Draggan, 2008).

Soil mining and gravel extraction is a common activity in United States of America. A publication by Schaetzl (1990), showed that historically, from 1920s many states in USA relied on mining of gravel and sand for road and cement aggregate. The uses had doubled by 2008 to date. Sand and gravel are mined more than all other minerals in most States in

America. According to Draggan (2008), USA is the largest producer and consumer of sand and gravel in the world as well as the leading exporter of silica sand to every region of the world. This is because it has extensive high quality deposits of the resource combined with technology to process it into any product. Construction sand and gravel are produced in all fifty states. The highest producers are California, Texas, Michigan, Minnesota, Ohio, Arizona, Utah, Colorado and Washington. They all produce about 52% of total amount of construction sand and gravel. More than a billion tonnes of sand and gravel are produced and used annually. Due to high demand in these States, some sand and gravel are still imported from Canada, Mexico, Bahamas, and Australia (Draggan, 2008).

Schaetzl (1990), realized that in California and Michigan, many prime sources of sand and gravel are glacial deposits, eskers, deltaic deposits and old lake beds. These states have an abundant of sand and gravel which are well distributed. Many minerals are mined but sand and gravel are extracted most. Sand and gravel have been exhausted, and the area is now covered by housing developments and farmland. Schaetzl (1990), further noted that river sand, pit sand and gravel are mined around large expanding urban areas. The most urbanised and largest states have greatest areas of sand and gravel pits.

Stebbins (2006), highlighted that in State of Maine, sand and gravel deposits cover up to five percent of the land. The resources are mainly used in construction and pumping drinking water which had increased demand so there are many sand and gravel pits. Approximately two hundred and sixty acres of land is used for mining by both companies with and without licenses. Construction grade sand and gravel has high volume; hence

the resources cannot be transported over long distance. Large trucks are used as transport for up forty-eight kilometers; therefore most pits are near the consumer as these bulky commodities normally cannot economically stand costs of long distance transportation. Most mining is done near the consumer in USA. The once abundant supply of gravel and sand is rapidly diminishing in areas surrounding cities (Stebbins, 2006).

Schaetzl (1990), noted that there are four basic operations used to extract sand and gravel from open pit mines in USA. The operations include site clearing to remove vegetation, then mining, processing and finally reclamation of the mined area. Machinery commonly used for mining includes bulldozers, tractor scrapers, front end loaders and stone crushers. The mining is done almost twenty-four hours in order to keep up with the high demand internally and externally for sand and gravel (Schaetzl, 1990).

According to Goddard (2007), soil mining operations began in 1930s in Australia to supply the expanding Sydney building market and continued into 1990s with an estimate of seventy million tonnes of sand removed. Most important commercial sources of sand and gravel are river floods, river channels and glacial deposits. Goddard (2007), further noted that soil extraction and processing have significant impacts on scenic landscapes. Excessive extraction intensifies coastal and exposed hillside erosion, causing accumulation of seawater upstream of rivers, leaving the coasts more vulnerable to extreme weather conditions. Soil mining contributes to construction of buildings and development but can cause permanent loss of soil as well as major habitat destruction (Goddard, 2007).

Kuttipuran (2006), reviewed sand mining in Indian communities and explained that as urban areas grow, less wood is used with more concrete structures being required leading to demand for low cost sand. Sand and gravel are most accessible cheap and basic raw materials for construction industry in India. There is a business of indiscriminate sand mining in public spaces in India. Sand mining is an environmental issue in India and public awareness of illegal extraction in states of Maharashtra and Goa is going on (Pereira, 2012). Bagchi (2010), supported Kuttipuran (2006), on that construction boom fueled the demand for sand and gravel facilitating uncontrolled extraction which threatens existence of river systems. Illegal mining of minerals resources is rampant in India such that the country's natural resources are destroyed as forests are clean felled.

Pereira (2012), researched on sand mining in India by studying three villages in Maharashtra and realised that as global demand for sand is exploding and rising rapidly, the sources of sand and gravel such as riverbeds, beaches, creeks are being mined faster than nature can replenish. This creates a highly skewed supply-demand situation. Pereira noted that India has the third largest construction business in the world after USA and China, so sand and gravel are required in large quantities. Mining is done both legally and illegally. The country did not have a regulatory and monitoring framework for excavation of sand sustainably which increased the illegal mining rampantly. There had never been much control because people thought that the resources are low value minor minerals and inexhaustible. This has led the Mumbai High Court to issue a ban on sand mining in 2010 to all licensed and unlicensed miners who were damaging the riverbeds increasing threat of floods. Demand and prices of sand had increased from US$ 110 to 300 US$ per truck load (Pereira, 2012).

Saviour (2012), discussed direct and indirect impacts of mining to the environment in Kerala region of India. The activity has increased since 1990s due to the boom of construction industry. River Bharathapuzha has become a victim of indiscriminate sand mining which has lowered the water table and reduced rice harvest. Illegal mining is high in Papagani catchment area in Karnataka.

According to Kuttipuran (2006), illegal mining is rampant in the Central Province of Madhya Pradesh with contractors emptying river beds of Narmada, Chambal and Wainganga. In the Southern Province of Kerala, miners loot sand from the second longest Bharathapuzha river and third river Pamba, which have become victims of indiscriminate sand mining. In India, soil mining is regulated by law but is still done illegally. Illegal sand mining is rampant on banks of Painganga river creating hundred by fifty feet tunnels across agricultural land. Bagchi (2010), further noted that the state government exempted mining of sand through Minor Minerals Rules of 1996 but this increased illegal extraction of sand. Many leases were issued by the Indian Mining Cooperation of Madhya Pradesh to excavate sand from state land, disregarding environmental regulations.

Bagchi (2010), reported on how the communities view sand mining and gravel extraction. Generally, communities in Palakkad and Goa expressed dissatisfaction with the uncontrolled illegal mining. The miners created one hundred feet long by fifty feet deep tunnels across their farmland as well as creating deep pits through crop fields. According

to villagers' reports, approximately eighty trucks were seen passing through villages on daily basis. Their reports to authorities seemed not to be heard.

2.3.2 Sand Mining Activities in Africa

There is a great concern on the way the environment is disturbed by excessive removal of sand for construction industry especially in urban development in Africa. Mwangi (2008), noted that for thousands of years, sand and gravel had been used to construct strong houses, roads and dams in Africa since they are cheap and readily accessible resources. Today demand has increased as socio-economic life of Africans has improved generally. Sand mining and gravel extraction are common in most African states but done both legally and illegally.

Lawal (2011), examined sand and gravel mining activities both on land and in rivers as a business venture in Minna Emirate Council of Niger State. Stakeholders from the mining activities were listed as landowners of quarry sites who sold the sand and gravel to private and government contractors. Local government authorities and Niger State where quarries are located, were also listed as beneficiaries. The activities also involve farmers whose cultivating and grazing lands are destroyed, wildlife community whose habitats are mined areas, aquatic community members as well as miners themselves. Aromolaran (2012), carried out a study to examine effects of sand mining activities on rural people living in Ogun State, Nigeria. Many people supported the good uses of sand but the negative impacts on their land were more than the benefits. Lawal (2011), highlighted that sand mining is rapidly becoming an ecological problem as demand increases in many

states of Nigeria's industry and construction sectors. The mining is done both legally and illegally leading to environmental devaluation.

Mwangi (2007), discussed sand mining as a threat to the environment in Kenya though with both positive and negative impacts. The sand mining and gravel extraction are done legally and illegally on rivers, beaches and plain fields. Wachira (2009), supported Mwangi by reporting on a case study survey on sand mining in Machakos District of Kenya which is increasing due to the need for sand in construction industry. The survey showed that approximately two hundred thousand tonnes of sand are harvested and mined for construction every year. Streams around Machakos and Mwala Districts are seriously damaged as trucks transporting sand pass along Mombasa and Thika highways. The trucks pass at intervals of five every half an hour.

Hill and Kleynhans (1999), carried out a research on authorization and licensing of sand mining and realised that it is important in South African economy but the processes of prospecting, extracting, concentrating, refining and transporting the resources have great potential in disrupting the natural environment. The research concentrated on river sand mining which has adverse impacts on the biota and the habitats. Steps in mining sand and gravel in South Africa were given as firstly, finding a mining location and removal of vegetation and topsoil using excavating equipment. Second step involves extraction using dredge machine to suck the resources. Thirdly, a separator is used to separate sand and gravel from large rock particles, while fine sand is removed from coarse sand. At the end, usually excess sand is returned to the pit using a discharge pipe. (Hill and Kleynhans,

1999). Methods of mining were noted as dry pit mining done when sand is extracted from dry streambed. Wet pit mining involves removing sand and gravel below water table using hydraulic machines while bar skimming is when top layer of soil is removed (Hill and Kleynhans, 1999).

According to Lupande (2012), sand mining had not been a common business in Zimbabwe. There had been massive construction of new buildings, extensions and renovations in Harare and surrounding areas since 2009 when the US$ began to be used in the country. This had led to the formation of cooperatives by youth groups to mine sand from nearby farms like Stone ridge. Bedford trucks are used to transport sand into the city and residential areas. An Environmental Management Authority (EMA) sand abstraction license is obtained first before mining. Steps followed in the mining process according to EMA are removal of topsoil, extraction of sand and gravel to a depth of one metre then land reclamation takes place.

Chimbodza (2012), noted that river sand is abundant in Zimbabwe's Zambezi Valley, particularly along the Ruckomechi and Chewore rivers such that a large mining company was awarded a license to mine the resource to be used in infrastructural development. Mining methods used by the company include dredging or suction which works like a vacuum cleaner, sucking up sand from the river. Earthmoving is done to dig and remove sand then trucking it away for processing in nearby Chirundu.

Botswana is not an exception in mining of resources. Mbaiwa (2008), noted that the country depends on mining of resources, including sand and gravel which contribute 34.2% of Gross Domestic Product (GDP). The Mines and Minerals Act of 1999 was introduced to control all mining activities in the country including sand mining and gravel extraction. National Policy on Natural Resources Conservation and Development (1990), commonly referred to as the National Conservation Strategy (NCS) was instated for all members of society to develop but conserving the natural resources. According to Mbaiwa (2008), the country depends on extraction of mineral deposits such as diamond, gold, nickel but there is mining of sand done both legally and illegally. For thousands of years, pit sand, river sand and gravel had been mined from various areas for construction of roads and buildings as part of urban development with Gaborone inclusive and demand has increased today.

Individual companies mine sand both legally and illegally causing land degradation and disturbance of ecosystems. Several communities had expressed their concern on excessive sand and gravel mining. A case was reported in an article in Mmegi Newspaper (2011), on sand mining in Moshupa, a village West of Gaborone. The article highlighted complaints on a lot of sand being mined and sold by individuals and companies. The Village Development Committee (VDC) a board responsible for running affairs of the community complained of lack of consultation by the Department of Mines, Land Board and miners who are the stakeholders in the activity. In a separate incident an article in the Daily News (2012), had a case in Mathangwane, a village near Francistown, a city in Northern part of the country, where a giant company was involved in harvesting sand

from the village without licenses and consultations with local authorities. Villagers were threatening to place stones across roads for company trucks not to pass.

The Mines and Minerals Act (1999), of Botswana highlights requirements for application of a mining license and minerals permit for any mining activity including sand and gravel. Anyone is eligible for a license, citizen or non-citizen but the prospecting miner should obtain surface rights from responsible land board on land authority. The identified area should be surveyed first, then prospected to ensure no one else has exclusive rights over that area. If the area identified is a game reserve, or national park, then clearance has to be given first, by Department of Wildlife and Parks. A feasibility study of the proposed area is done and submitted with details of Environmental Impact Assessment study report and Environmental Management Programme and Mining methods to be used. According to the Act, lease charges are P100 per square kilometer or part thereof. There are royalties' payments payable to Botswana government through Director of Mines paid monthly at 3% of gross market value, a fixed percentage for resources classified as other minerals for example sand and gravel mining.

2.4 Effects of Sand Mining

The effects of sand mining on livelihoods could either be positive, negative or a combination of both (Akabzaa, 2009). The consequences of sand mining activities are considered positive when desired or profitable outcomes emerge from it. It may be viewed as negative when unintended or destructive outcomes are experienced. The effects of sand mining activities are addressed in the following sub-sections.

Notwithstanding the numerous challenges associated with the activities of sand mining, it is also believed to have significant contributions to livelihood enhancement and economic development of many nations. For example, the total amount of money earned from the exportation of sand globally by countries such as Germany, Turkey, India, Italy, Belgium and others in the year 2010 amounted to over $31 billion (United Nations Commodity Trade Statistics, 2010). Sand mining is also a major source of employment for many people around the globe (Asha, 2011). A survey conducted by the Sand Times in 2010 discovered that, the activities of sand mining employed the majority of the people in the North Stradbroke Island (Sand Times, 8th September, 2010). The significance of sand to the construction sector cannot be ignored. The activities of sand mining produce aggregate materials such as gravel and sand that are used in the building of houses for shelter, landscaping and infrastructure development activities such as roads, railway lines and other general construction uses. For example, very large quantities of sand are required for building houses, motorways and railway lines (Velegrakis, Ballay, Poulos, Radzevicius, Bellec, Manso, 2010). These huge volumes of sand needed to produce various products are obtained through sand mining. It can therefore be argued that without sand mining, many development projects could not be implemented.

The contribution of the construction industries to Ghana's industrial production appreciated from 17.4 percent in 1986 to 20.8 percent in 1993 (Institute of Statistical, Social and Economic Research [ISSER], 1994). Consequently, many Ghanaians are beneficiaries of employments generated through the activities of sand mining. Among those who earn their livelihoods from the activities of sand mining in Ghana include drivers who operate heavy-duty trucks that convey the sand to their customers and

labourers who dig and load the sand into the trucks (Peprah, 2013). The activities of sand mining are also associated with high and lucrative profits which could be used for the betterment of people's livelihoods (Stewart, 2013). For instance, the minimum daily wage rate in Ghana in 1993 was US$1.22.

However, during the same period, sand contractors earned a minimum net profit of US$55.47 per day. In the same vein, sand carriers and loaders made a daily net income of US$1.54 and US$2.16 respectively (Mensah 1997). The huge income obtained through the activities of sand mining helps to secure the livelihoods of the beneficiaries. Sand and stone mining further leads to increasing sales of goods and services such as selling of water, foodstuffs and high patronage of taxi cabs in areas where these activities occur (Asante, Kabila, Afriyie, 2014). Sand mining is also noted to be a major source of funding many community projects such as schools and hospitals which provide livelihood security for many people (Mensah, 1997). This comes in the form of tolls and levies charged by chiefs and community leaders on sand mining activities that occur within their traditional areas. Sand mining can therefore be considered as one of the avenues in protecting and providing livelihood security to many people residing in various communities.

2.4.1 Negative Effects of Sand Mining

Sand mining is viewed by many scholars as an activity that destroys livelihoods of people. The extraction of sand and gravel resources has adverse environmental impacts which eventually pose livelihood risk to people (Kondolf, 1994). For example, sand mining causes turbidity which reduces water quality and hinders the growth of fishes and

other aquatic lives. Eventually, people who depend on fishing as a means of sustenance in these places are negatively affected (Supriharyono, 2004). In Alappuzha Coast of Kerala (India), sand mining has destroyed the livelihoods of thousands of fishermen and others who depend on fish for their jobs such as fish distribution, curing and peeling. In the same area, sand mining has further led to the loss of employment for the hundreds of people who depend on the land for rice cultivation and the coastal coconut trees for their survival (Sekhar and Jayadev, 2003). Also, sand mining activities in the Selangor State of Malaysia have caused extreme damage to the environment and livelihoods of many local communities such as Hulu, Kuala, Langat and others which engage in fishing and crop production (Ashraf *et al.,* 2011).

In Ghana, sand mining activities have also led to the reduction of farmlands; consequently, many people are facing livelihood security problems (Peprah, 2013; Musah, 2009). Reduced farmlands bring about economic hardships mostly because the affected people are usually given inadequate compensations (Abuodha and Hayombe, 2006). The activities of sand mining also lead to the destruction of public properties such as roads, electricity poles, telephone masts, underground pipes and other social amenities which supports people's livelihoods (Saviour, 2012; Viswanathan, 2002). Sand mining activities further weaken the livelihood foundation of people because it brings about land use conflicts due to its numerous negative externalities (Turner *et al.*, 2007). The section that follows provides a detailed discussion of the negative effects of sand mining on the environment.

2.5 Effects of Sand Mining on Environment

Sand mining and the exploitation of natural resources across the globe, have significant adverse effects on the environment (Akabzaa, 2000). The negative impacts of sand mining on the environment can be categorised as follows: damage to riparian and non-riparian habitat and organisms, destruction of water bodies; and damage to public and private properties.

The activities of sand mining lead to the destruction of vegetation, agricultural and non-agricultural lands (Aromolaran, 2012). Sand mining along streams has led to the destruction of several hectares of fertile streamside lands annually. Also, a lot of valuable timber resources and wildlife habitats have been lost to the activities of sand mining. Sand miners have created gullies on agricultural lands and forest reserves in several places (Tariro, 2013). The scooping of sand from the ground destroys the vegetation cover and the soils which serve as the habitat for wildlife. This situation destabilizes the ecosystem of living organisms thereby imperiling their lives (Lawal, 2011). Sand mining is a direct cause of destruction to the riparian and non-riparian habitat, flora and fauna (Peck et al., 2010). The extraction of sand from river beds creates gullies on the floors of the rivers. These deep pits on the river beds degrade or lower the groundwater table; consequently, wells in such places become dry. Also, the lowering or dropping of water table from the activities of alluvial sand mining affects the smooth flow of streams thereby negatively impacting on riparian wetlands. Sand mining diminishes water clarity and quality due to high turbidity levels, reduction of dissolved oxygen and high temperatures in such water bodies (Reid, 2006). This leads to bio-security and pest risks

which decreases the efficacy of crop production and also contributing to food insecurity (Rinaldi, Wyzga, Surian, 2005).

Sand mining is directly responsible for causing damages to public and private properties. The activities of the sand miners weaken the structure of the land; leading to the destructions of bridges, roads and pipe lines (Mensah, 1997). In spite of the numerous adverse effects of sand mining on the environment; Ghana's Environmental Protection Agency (EPA) has not been able to properly manage the operations of the sand miners due to financial and logistical challenges (Armstrong, 2008).

2.6 Strategies to minimise the effects of sand mining on sub-structure of buildings

Institutions are organisations with a mission to achieve or regularise practices which have been performed over time (Scoones., 2009). Institutions can also be described as policies, laws, rules and norms governing the behaviour of something (Bandaragoda, 2000; Coward, 1980). Institutions can be in the form of explicit rules such as written laws, procedures and constitutions, or they can be implicit rules such as social conventions, norms and traditions (Scoones, 2009). A lot of organizations provide services to rural communities, with the aim of securing their livelihoods. The organizations operate within a set of laws, formal and informal policies or processes.

Institutions are set up to bring stability in human activities and interactions (North, 1990). Over the period, the activities of institutions such as the United Nations Development Programme (UNDP) in protecting the livelihoods of people are well noted across the

globe. These organizations have influenced a lot of policies, laws and regulations in various parts of the world. Any analysis of rural livelihoods should therefore consider the wide range of institutions and organizations operating at different levels, from within the household through to the national and international level (O'Laughlin, 2004).

In the context of this study, sand mining which is associated with the destruction of large tracts of lands is regarded as a shock to the affected communities. Under the circumstances, the role of various institutions in providing livelihood security becomes paramount. For instance, the adoption of environmental policy in Ghana in the year 1991 was meant to ensure proper management of the natural resources, and also to prevent their over exploitation so as to protect the environment (Ebenezer, 1991). Following the adoption of the National Environmental Policy, it became mandatory in the year 1994 for mining companies to conduct environmental impact assessment for mining activities in Ghana (Minerals Commission and Environmental Protection Council, 1994). The policy provided a detailed plan with specific standards on how to engage in sand mining without compromising on the quality or the sustenance of the environment. All the necessary mechanisms are to be put in place to protect the environment in any mineral or natural resource exploitative venture (Minerals Commission and Environmental Protection Council, 1994). Ghana's Parliament through Act 490, established the Environmental Protection Agency (EPA) with the sole purpose of formulating policies, laws and regulations governing the environment. The EPA was also mandated by Act 490 to enforce their rules and regulations on the environment (Environmental Protection Agency Act, 1994). Since then, the EPA has become the lead institution responsible for ensuring that sound environmental management practices are carried out in Ghana.

Institutions that have a stake in the activities of sand mining in Ghana can be traced from the various levels of government and private sectors. These include the Lands Commission, Environmental Protection Agency (EPA), Local Government (District/Municipal Assembly), Forestry Commission, Non-Governmental Organizations (NGOs), and Traditional Authorities. These institutions engage in activities aimed at providing land security whilst protecting vulnerable people. These land security activities include afforestation programmes, introduction of new construction methods, and construction of feeder roads, reclamation of degraded lands, and enactment of laws or policies to protect those who are vulnerable. Notwithstanding these roles, there are contestations about the performance of these institutions when it comes to dealing with the impacts of sand mining on residents of sand mining fringe communities. It remains to be seen whether these institutions play their roles as expected.

2.7 Conceptual Framework

This section focuses on the conceptual framework that was used in discussing and analyzing the study. Sand mining is the removal of sand from their natural configuration. Sand is used for all kinds of projects like land reclamations, the construction of artificial islands and coastline stabilization. These projects have economic and social benefits, but sand mining can also have environmental problems. Environmental problems occur when the rate of extraction of sand, gravel and other materials exceeds the rate at which natural processes generate these materials. The morphologies of the mining areas have demonstrated the impact of mining with the prowess to destroy the cycle of ecosystems. Numerous publications have been written with respect to these effects, and the next step

is what to do to minimize, prevent or correct these environmental effects, the so called mitigating measures (Pielou, 1966).

Sand mining is of great importance to the economy. It should however, be recognized that the processes of prospecting, extracting, concentrating, refining and transporting minerals have great potential for disrupting the natural environment (Rabie et al., 1994). Many Selangor streams, rivers and their flood plains have abundant quantities of sand and gravel that are mined conveniently and economically for a variety of uses. Often the conditions imposed on the approval for sand mining activities are expressed in administrative terms, without technical consideration of their potential impact on the ecosystem. Physical impacts of sand mining include reduction of water quality and destabilization of the stream bed and banks. Mining can also disrupts sediment supply and channel form, which can result in a deepening of the channel (incision) as well as sedimentation of habitats downstream. Channel instability and sedimentation from in stream mining also can damage public infrastructure (bridges, pipelines, and utility lines). Impacts to the biological resources include removal of infauna, epifauna, and some benthic fishes and alteration of the available substrate. This process can also destroy reverie vegetation, cause erosion, pollute water sources and reduce the diversity of animals supported by these woodlands habitats (Byrnes and Hiland, 1995).

This study aims to investigate both the negative impacts of sand mining. Positive in terms of financial gain and negative in terms of environmental impacts associated with potential sand mining operations and to outlines the best management practices in order to

minimize the adverse impacts. The recommendations made in this paper are intended as guidance for decision makers who are specifically involved in the review of sand mining and gravel extraction operations to make more informed decisions.

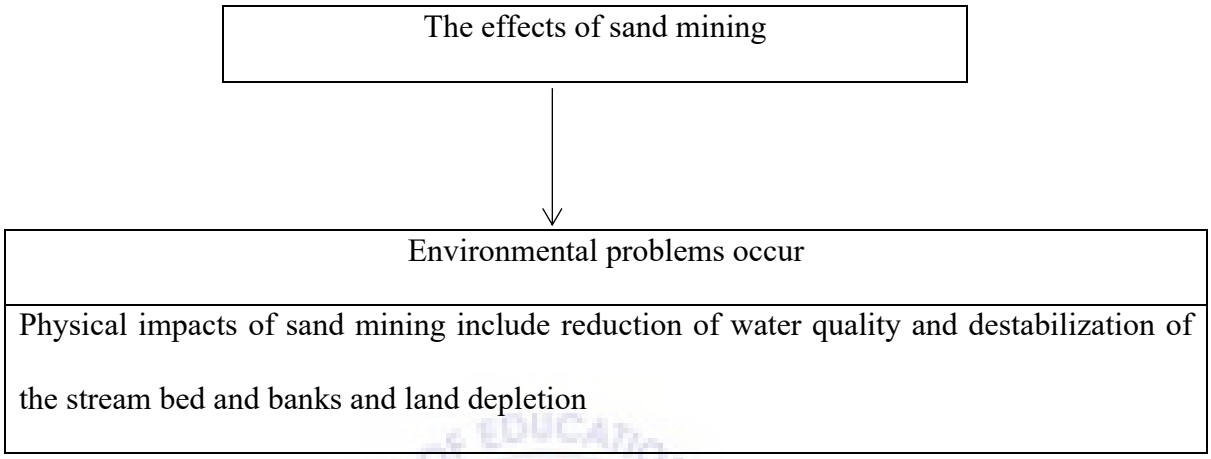

Figure 2.1: Conceptual model of the study

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the research methodology employed for the study. It involved research design, sources of data, population, sampling techniques and sampling size, data collection instruments and data analysis.

3.2 Study Area

The New Juaben Municipality falls within Eastern Region of Ghana. The New Juaben Municipality covers an estimated area of 110 square kilometers constituting 0.57% of the total land area of Eastern Region. A predominant natural feature in Koforidua is the 'Obuo Tabri' Mountain, which is considered sacred. Nearby is Akosombo Dam which holds Lake Volta, the world's largest man-made lake. Waterfalls in the area such as Akan Falls and Boti Falls and the Umbrella Rock attract tourists to New-Juaben Municipal and Eastern Region. New-Juaben Municipal has an annual rainfall ranging from 50 – 120 inches and 20 – 32 Celsius mean annual temperatures. The New-Juaben Municipality shares boundaries with East-Akim Municipality to the northeast, Akuapim North District to the east and south and Suhum Kraboa Coaltar District to the west.

MAP OF NEW JUABEN MUNICIPALITY

Table 3.1: Settlement within New Juaben Municipality

N/S	Settlement within the Municipality	Located Areas
1	Abotanso	Northern part
2	Adom Ponsu Boampong	Western part
3	Akwadum	Southern part
4	Effiduase	Southern part
5	Asikasu Asuogya	Eastern part
6	Asokore	Sothern part
7	Betom	Northern
8	Dansuogya	Western part
9	Dansu Dam Site	Western part
10	Jumapo	Eastern part
11	Kentekye	Northern part
12	Kofikrom	Northern part
13	Koforidua	Central part
14	Koforidua-Ada	Central part
15	Koforidua-Korle Nkwanta	Central part
16	Mpaem	Northern
17	Nyerede Opker	Western part
18	Nyerede Trom	Western part
19	Oyoko	Eastern part
20	Sorodae	Central part
21	Suhyen	Eastern part
22	Nkruakan	Eastern part

Source: New Juaben Municipal Assembly, 2017

3.3 Research Design

The research design used for this study was a case study. Gwimbi and Dirwai (2003), defined a case study as a strategy for doing research involving an empirical investigation

of a particular contemporary phenomenon within its real life context using multiple sources of evidence. This involves a study on its own right on a specific case with a conceptual framework. A case can be a school, village, river or any phenomenon of interest. Case studies are important in decision making and for policy makers.

3.4 Population for the Study

The targeted population for the study involved sand miners and chiefs of Koforidua constituted the population of the study.

3.5 Sampling Techniques and Sample Size

The purposive sampling technique was used to sample the key respondents in the municipality. Sample sizes of 200 respondents were selected for the study. This was made up of 176 household respondents, 7opinion leaders, 15 informants and 2chiefs were selected from a total of 5,095 households in the study areas. Additional 15 key informants were included in the study. These were made up of 7 opinion leaders/chiefs (one each from the seven communities), 3 coordinating directors (one each from the district/municipal assemblies), 3 district/municipal directors at the Ministry of Food and Agriculture and the regional directors of Environmental Protection Agency and Forestry Commission were included in the study. The projected number of households from the 2010 Population and Housing Census for New Juaben Municipality was 5,095. Out of this, 185 household respondents were selected for the study. Approximately thirty percent (30%) of the number of households selected was allocated to sand miners, whilst seventy percent (70%) was given to the non-sand miners or farmers.

3.6 Data Collection Instruments

Data collection instruments used includes questionnaire, interview and observation.

3.6.1 Questionnaires

There were questionnaires which were semi-structured; consisting of both open and closed-ended questions. The questionnaires were designed for the sand miners. The questionnaire had four sections. Section A required the respondents to give general information about him/ herself including the gender, age, marital status, and highest educational qualification. Section 2 examined the issues of sand mining on sub-structures of buildings in New Juaben Municipality. Section 3 identified the effects of sand mining on the people in the study area. Section 4 suggested strategies to minimize the effects of sand mining on sub-structure of buildings.

3.6.2 Interviews

The researcher interviewed 2 chiefs in the Koforidua community. Thus, by using semi-structured interviews the researcher can probe further in order to get more information from the interviewees, because neither the interviewer nor the respondents are confined to any specific questions and responses. The interview guide assessed the factors that influence people into sand mining. Moreover, the interview guide evaluated the effects of sand mining on Livelihoods of the indigence. To add more, an effect of sand mining on the environment was investigated and the role stakeholders play in ensuring livelihood security. These issues were highlighted in the interview.

3.6.3 Observation

The researcher visited three of the selected towns within the New Juaben Municipality to have actual information and observe the extent which effect of sand mining on sub structure of buildings and also examine the key effect to the destruction of substructure of building lands the study area.

This was done using two main protocol building condition inspectors. This include preliminary site surveyors or structural engineer and the specialist procedure was chosen because the researcher did not want to distract the attention of the residents who used the sub structure of buildings, since the effect on substructure of buildings are on use as the time the researcher visited the area and management had no plan to combat the sand mining activities at the earliest time.

In assessing the extent to which sand mining has affected the physical environment in New Juaben Municipality, the study examined the causes and the effects to which the selected communities have suffered from as observed by the researcher at the time of visit. One of the great limitations of an observation is that participants in sand mining may change their behavior from the natural, unobserved behavior while under observation. Nevertheless, efforts were made to minimize the influence of observation by using a known resident as an observer. The researcher visited Koforidua community and observed that sand miners have depleted the land.

3.7 Data Analysis

Data collected through the field survey were examined and edited to ensure consistency of responses. Both quantitative and qualitative techniques were used to analyse the data

for the study. With regard to the quantitative techniques, the primary data collected with questionnaires were coded and entered into the Statistical Product for Service Solutions (SPSS version 20) software. Subsequently, some tools of the SPSS software were used to analyze the inputted data. The outcomes of these analyses are presented in the form of frequency tables, percentages, bar charts, pie charts and cross tabulations to establish relationships amongst some of the key variables in the study. Data from the administration of interviews and field observations were analyzed qualitatively mainly through direct quotes from the respondents and the description of events as they happened in a written form.

3.8 Ethical Consideration

As this study requires the participation of human respondents, certain ethical issues were addressed. The consideration of these ethical issues is necessary for the purpose of ensuring the privacy as well as the safety of the participants; this is because in Ghana most information that comes to the public is different from what is actually happening on the ground. Among the significant ethical issues that were considered in the research process included consent and confidentiality. In order to secure the consent of the selected participants, the researcher relayed all-important details of the study, including its aim and purpose. By explaining these important details, the respondents were able to understand the importance of their role in the completion of the research. The confidentiality of the participants was ensure by not disclosing their names or personal information in the research. Only relevant details that helped in answering the research questions were included.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0 Introduction

The chapter present result and discussions obtained from questionnaires, interviewers and observations of the study.

4.1 Response rate

The researcher sent 198 questionnaires to collect research data from the sand miners. Out of 198 questionnaires sent out to collect primary data, 192 questionnaires were received while 6 questionnaires were not received. Therefore, the analysis of the study was based on 96% response rate as shown in Figure 4.1.

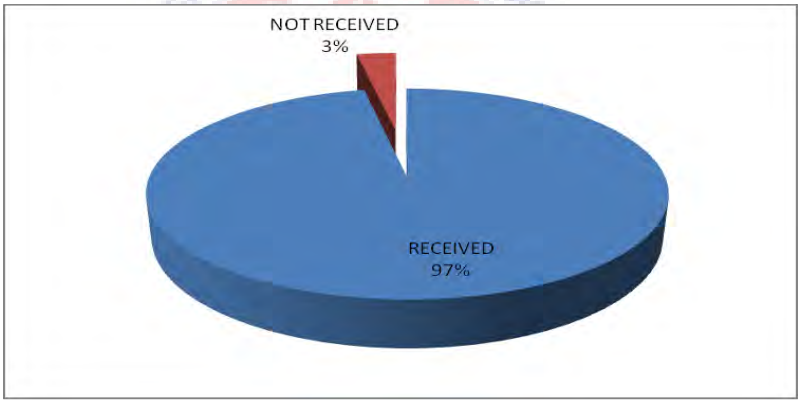

Figure 4.1: Response rate of the Sand miners questionnaires

n=192, Field survey, Kponyo (2018)

4.2 Results of the Questionnaire

This section analyzed the results of the questionnaire obtained from the Sand miners at the New Juaben Municipality.

4.2.1 Results of the Questionnaire from the Sand miners

Table 4.1 shows that 143 sand miners representing 74.5% were males while 49 sand miners representing 25.5% were females. Also, 127 sand miners representing 66.1% were married, 63 sand miners representing 32.8% were single, while 2 sand miners representing 1% were divorced. Furthermore, 90 sand miners representing 46.9% had no formal education, 60 sand miners representing 31.2% had Basic education/MSLC, 38 sand miners representing 19.8% had Secondary/Voc/Tech Education, while 4 sand miners representing 2.1% possess tertiary education certificates as their highest academic qualification.

Table 4.1: Socio-demographic characteristics of Sand miners

Gender	Frequency	Percent (%)
Male	143	74.5
Female	49	25.5
Total	192	100.0
Age range of the sand miners		
20-29 years	61	31.8
30-39 years	44	22.9
40-49 years	42	21.9
50-59 years	40	20.8
Above60 years	5	2.6
Total	192	100.0
Marital Status		
Married	63	32.8
Single	127	66.1
Divorced	2	1.0
Total	192	100.0
Level of education		
No formal education	90	46.9
Basic education/MSLC	60	31.2
Secondary/Voc/Tech Education	38	19.8
Tertiary Education	4	2.1
Total	192	100.0

n=192, Field survey, Kponyo (2018)

Moreover, 61 sand miners representing 31.8% were between the age ranges 20-29 years, 44 sand miners representing 22.9% were between the age ranges 30-39 years, 42 sand miners representing 21.9% were between the age category 40-49 years, while 5 sand miners representing 2.6% were above 60 years. This means that more youth were engaged in sand mining activities. These agrees with Addo, (2008), who indicated that sand mining is therefore unattractive to old people with reduced energy and weak muscles. Consequently, most of the youth in sand mining fringe communities prefer to be sand miners, whilst the majority of the old people opt for farming. The mass movement of the youth and the economically active population into sand mining could also be attributed to the comparative economic advantage of sand mining over farming. That is, sand miners have regular access to income than most farmers. This finding is consistent with the view that, age has an influence on the choice of livelihood strategies of people. The ability to consider a particular livelihood activity is greatly affected by age. This is because growth decreases the energy required for some physical livelihood activities. There is a strong decline in economic opportunity with age and the contribution of older people to social and economic development is in many cases undervalued because of the kind of work they do (Armando, 2002).

4.2 Issues of Sand Mining on Sub-structure

The study results show that 55 sand miners representing 28.6% indicated that the distance from the sand mining areas to their houses was between 1001-1500m, 52 sand miners representing 27.1% said that the distance from the sand mining areas to their house is between 501m-1000m, 47 sand miners representing 24.5% revealed that the distance from the sand mining areas to their house is between 0-500m, 31 sand miners representing 16.1% said that the distance from the sand mining areas to their house 1501m-2000m, while 7 sand miners representing 3.6% revealed that the distance from the sand mining areas to their house is above 2000m.

The study results revealed that 143 sand miners representing 74.4% affirmed that they often visit the sand mining area, 25 sand miners representing 13% indicated that they do not visit the sand mining area regularly, 18 sand miners representing 9.4% said that they sometimes visit the sand mining area, while 6 sand miners representing 3.1% revealed that they rarely visit the sand mining area.

Moreover, 101 sand miners representing 52.6% agreed that they visit the sand mining area to mine sand, 47 sand miners representing 24.5% indicated that they go to the sand mining area to get domestic water, 20 sand miners representing 10.4% revealed that they visit the sand mining area to farm/garden, 18 sand miners representing 9.4% also revealed that they fish at the sand mining area.

This means that, in spite of the capacity of sand mining to transform the economic lives of certain people, it also brings income loses to another group of people, especially farmers whose lands are used for the sand mining (Musah, 2009). The existence of good sand reserves in the communities therefore turned out to be curses rather than blessings to

the affected farmers. That is, the sand miners siphon away their sources of wealth leaving them poorer. It can be concluded that, many more farmers would be made poorer as long as the rate and manner in which sand mining is done in the communities continue.

That is, as more farmlands are converted into sand mining sites, many more farmers get reduced income and consequently their vulnerability levels increase. The diminished income of the affected farmers has the potential of increasing their poverty levels and therefore compelling them to abandon farming or influencing them to become sand miners if they are capable and interested. Such a scenario could threaten food security which would not only affect the sand mining fringe communities but the entire region. There is therefore the need for some form of interventions to check the increasing activities of the sand miners, especially on farmlands.

Table 4.2: The issues of sand mining on sub-structures of buildings in New Juabeng Municipality

How far do you live from sand mining areas approximately?	Frequency	Percent (%)
0-500m	47	24.5
501m-1000m	52	27.1
1001m-1500m	55	28.6
1501m-2000m	31	16.1
above 2000m	7	3.6
Total	192	100.0
Do you often visit the sand mining area?		
Yes	143	74.4
No	25	13.0
Sometimes	18	9.4
Rarely	6	3.1
Total	192	100.0
Activities you normally do at the sand mining areas.		
Get domestic water	47	24.5
Sand mining	101	52.6
Fishing	18	9.4
Gardening	20	10.4
Farming	4	2.1
Herding livestock	2	1.0
Total	192	100.0

n=192, Field survey, Kponyo (2018)

4.3 The effects of sand mining on the people

The study results held that 137 sand miners representing 71.4% agreed that sand mining contributes to the depleting of the sub-structures of buildings, 50 sand miners representing 26% strongly agreed, while 5 sand miners representing 2.6% were neutral.

Moreover, 153 sand miners representing 79.7% agreed that loss of vegetation was amongst the other impacts of sand mining, 33sand miners representing 17.2% strongly agreed, 6 sand miners representing 3.1% were neutral. Also, 161 sand miners representing 83.9% agreed that sand mining creates open pits that destroy the substructures of buildings, 27 sand miners representing 14.1% strongly agreed, while 4 sand miners representing 2.1% were neutral. Furthermore, 165 sand miners representing 85.9% agreed that sand mining induces soil erosion and destroying the substructure of buildings, 21 sand miners representing 10.9% strongly agreed, 6 sand miners representing 3.1% were neutral.

Moreover, 158 sand miners representing 82.3% agreed that sand mining contributes to environmental degradation such as land sliding, compaction, low organic matter, loss of soil structure, 30 sand miners representing 15.6% strongly agreed, 4 sand miners representing 2.1% were neutral. Also, 176 sand miners representing 91.7% agreed that sand mining creates open pits that destroy the substructures of buildings, 13 sand miners representing 6.8% strongly agreed, while 3 sand miners representing 1.6% were neutral.

On many occasions, the affected farmers go to their farms only to witness the destruction of their farms by the sand miners. This supports the position of Imoru (2010) that, chiefs and land owners give out lands to sand miners caring little about its effects on the environment and people's livelihoods. The view that sand mining leads to the reduction of farmlands is consistent with the findings of Peprah (2013) and Musah (2009), whose studies into the effects of sand mining in Wa in the Upper West region and East Gonja in the Northern region respectively, found the activities of sand mining to be associated with the reduction or loss of farmlands. The cumulative effects of all these negative practices

are that, farmlands are lost leading to the destruction of food crops, thereby making the affected farmers desperate and poorer.

The livelihood sources of these farmers are shaken leading to the deterioration in their living standards. The plights of the affected farmers are worsened by the fact that, on many occasions, inadequate or no compensations are paid to them for the destruction caused to their food crops. This situation leads to conflicts between the chiefs, the sand miners, land owners and farmers in the communities. This position confirms the findings of Willis and Garrod (1999) that, mining of sand frequently generates land use conflicts due to its negative externalities. The loss of farmlands to sand mining activities has the tendency of causing unemployment among farmers which could lead to increased poverty in the communities involved. Also, the issue of land grabbing for sand mining has the potential of degenerating into full scale conflict between the farmers, sand miners and their associates.

More so, farmers whose farmlands are destroyed could be discouraged from engaging in farming. Some of these farmers could be influenced to commit crimes such as stealing or robbery for their survival. Another negative effect of sand mining on livelihoods and the environment is the damages caused to streams and rivers by sand mining. The activities of sand mining are directly responsible for the destruction of water bodies, especially when they are done in river valleys. All the farmers and majority of the sand miners (78% & 89% respectively) sampled for the study supported the idea that, sand mining leads to the destruction of water bodies. Not only do the sand miners dig very close to streams for sand, but sometimes they also take their sand directly from the floors of water bodies. All

these harmful activities lead to the drying up of water bodies or make them unsafe for human consumption.

Table 4.3: The effects of sand mining on the people in the study area

The effects of sand mining	SA n(%)	A n(%)	N n(%)	D	SD	Total n(%)
Sand mining contributes to the depleting of the sub structures of buildings	50 (26)	137 (71.4)	5 (2.6)	0	0	192 (100)
Loss of vegetation was amongst the other impacts of sand mining	33 (17.2)	153 (79.7)	6 (3.1)	0	0	192 (100)
Sand mining creates open pits that destroys the substructures of buildings	27 (14.1)	161 (83.9)	4 (2.1)	0	0	192 (100)
Sand mining induces soil erosion and destroying the substructure of buildings.	21 (10.9)	165 (85.9)	6 (3.1)	0	0	192 (100)
Sand mining contributes to environmental degradation such as land sliding, compaction, low organic matter, loss of soil structure.	30 (15.6)	158 (82.3)	4 (2.1)	0	0	192 (100)
Sand mining creates open pits that destroys the substructures of buildings	13 (6.8)	176 (91.7)	3 (1.6)	0	0	192 (100)

n=192, Field survey, Kponyo (2018)

Key: SD-Strongly disagree, D-Disagree, N-Neutral, A-Agree, SA-Strongly agree

4.4 Strategies to minimize the effects of sand mining

Table 4.5 indicates that 135 sand miners representing 70.3% agreed that the Environmental Protection Agency should intensify operations to combat illegal mining activities, 49 sand miners representing 25.5% strongly agreed, while 8 sand miners representing 4.2% were neutral. Moreover, 139 sand miners representing 72.4% agreed that stream should not be diverted to form inactive channel, 49 sand miners representing 25.5% strongly agreed, while 4 sand miners representing 2.1% were neutral.

Furthermore, 140 sand miners representing 72.9% agreed that sand mining at the concave side of the river channel should be avoided to prevent river bank erosion, 47 sand miners representing 24.5% strongly agreed, while 5 sand miners representing 2.6% were neutral. The study results indicate that 123 sand miners representing 64.1% strongly agreed that mining of gravelly sand from the riverbed should be restricted to a maximum depth of 3m from the surface, 63 sand miners representing 32.8% agreed, while 6 sand miners representing 3.1% were neutral.

Furthermore, 141 sand miners representing 73.4% agreed that the Minerals Commission and Environmental Protection Council should put in place all the necessary mechanisms to protect the environment in any mineral or natural resource exploitative venture, 47 sand miners representing 24.5% strongly agreed, while 4 sand miners representing 2.1% were neutral. Moreover, 134 sand miners representing 69.8% agreed that the EPA should do well to enforce their rules and regulations on the environment, 56 sand miners representing 29.2% strongly agreed, while 2 sand miners representing 1% were neutral.

These results are in disagreement with Collins and Dunn. *(*1990), they revealed that sand mining is directly responsible for causing damages to public and private properties. Te activities of the sand miners weaken the structure of the land; leading to the destructions of bridges, roads and pipe lines. In spite of the numerous adverse effects of sand mining on the environment; Ghana's Environmental Protection Agency (EPA) has not been able to properly manage the operations of the sand miners due to financial and logistical challenges (Armstrong, 2008).

Institutions are organizations with a mission to achieve or regularize practices which have been performed over time (Leach, Mearns., Scoones., 1999). Institutions can also be

described as policies, laws, rules and norms governing the behaviour of something (Bandaragoda, 2000; Coward, 1980). Institutions can be in the form of explicit rules such as written laws, procedures and constitutions, or they can be implicit rules such as social conventions, norms and traditions (Scoones, 2009; Jepperson, 1991). A lot of organizations provide services to rural communities, with the aim of securing their livelihoods. The organizations operate within a set of laws, formal and informal policies or processes.

Table 4.4 Strategies to minimize the effects of sand mining on sub-structure of buildings

Strategies	SA n(%)	A n(%)	N n(%)	D	SD	Total n(%)
The Environmental Protection Agency should intensify operations to combat illegal mining activities.	49 (25.5)	135 (70.3)	8 (4.2)	0	0	192 (100)
Stream should not be diverted to form inactive channel	49 (25.5	139 (72.4)	4 (2.1)	0	0	192 (100)
Mining at the concave side of the river channel should be avoided to prevent bank erosion.	47 (24.5)	140 (72.9)	5 (2.6)	0	0	192 (100)
Mining of gravelly sand from the riverbed should be restricted to a maximum depth of 3m from the surface.	123 (64.1)	63 (32.8)	6 (3.1)	0	0	192 (100)
The Minerals Commission and Environmental Protection Council should put in place all the necessary mechanisms are to protect the environment in any mineral or natural resource exploitative venture.	47 (24.5)	141 (73.4)	4 (2.1)	0	0	192 (100)
The EPA should do well to enforce their rules and regulations on the environment.	56 (29.2)	134 (69.8)	2 (1)	0	0	192 (100)

n=192, Field survey, Kponyo (2018)

Key: SD-Strongly disagree, D-Disagree, N-Neutral, A-Agree, SA-Strongly agree

4.5 Sand mining activities and cracks

Table 4.3 reveals that, 88 sand miners representing 45.8% said that 16-20 trucks pass through their village in a day, 38 sand miners representing 19.8% indicated that 0-5 trucks pass through their village daily, 35 sand miners representing 18.2% said that more than 20 trucks pass through their village daily, 21 sand miners representing 10.9% said that 11-15 trucks pass through the village daily, while 10 sand miners representing 5.2% agreed that 6-10 trucks pass through their village in a day.

To add more, 169 sand miners representing 88% affirmed that they have cracks on the sub-structures of their buildings, while 23 sand miners representing 12% said that they do not have cracks on the sub-structures of their buildings.

The study results revealed that 172 sand miners representing 89.6% said that the crack on the sub-structures of their buildings were severe, 16 sand miners representing 8.3% said that the cracks were not severe, while 4 sand miners representing 2.1% said that they do not know.

This situation has negative implications for the communities in the sense that, not all the people in the sand mining fringe communities enjoy the financial benefits of sand mining; however, its negative effects in terms of the degradation of the environment affect all the members in the communities. It also implies that, by the time all the sand resources are exhausted, the communities would have nothing to boast of from the activities of sand mining. Meanwhile the sand miners would have siphoned away all the wealth of the people in the form of sand resource leaving them poorer. This finding is however not consistent with that of Musah (2009), who in his assessment of the impacts of sand mining in East Gonja District (Ghana) and Gunnarsholt (Iceland) discovered that,

sand mining enhances communication and infrastructure developments such as roads and housing in the communities concerned.

It also contradicts the findings of Mensah (1997), that sand mining activities provide the avenues for financing local community projects. The possible reason that could be given for the differences between this research and the other studies on the issue of development projects is that, most of the communities involved in this study had chieftaincy disputes. This has the potential of making it difficult for them to unite towards the use of the proceeds from the sand mining activities.

Table 4.5 Sand mining activities and cracks on the sub-structures of buildings

How many trucks pass through your village in a day	Frequency	Percent
0-5	38	19.8
6-10	10	5.2
11-15	21	10.9
16-20	88	45.8
Above20	35	18.2
Total	192	100.0
Do you have cracks on the sub-structures of your buildings?		
Yes	169	88.0
No	23	12.0
Total	192	100.0
How severe is the crack on the sub-structures of your buildings?		
Severe	77	40.1
Very severe	95	49.5
Not severe	16	8.3
I do not know	4	2.1
Total	192	100.0

n=192, Field survey, Kponyo (2018)

4.6 Results of Interview

This section analysed the interview guide for the chiefs in Koforidua (New Juaben Municipality)

4.6.1 Results of Interview from the chiefs in Koforidua

The chiefs of Koforidua were interviewed and they expressed their dissatisfaction about the youthful composition of the sand mining labour force as follows:

'We are living in difficult times. Most of the youth here have abandoned agriculture for sand mining. Farming is no longer attractive to the youth and this may affect our food security in the near future. This is because food crop production has been left in the hands of old people. Meanwhile these elderly people are mostly weak due to sickness and ageing. Most of these old people cannot even provide enough food for themselves let alone providing for the rising population in our communities'.

This expression confirms the views of Gorman *et al.,* (2003), that old age is associated with high incidence of poverty, vulnerability and declining living standards due to a combination of inter-related factors, including deteriorating health status and declining livelihood opportunities. The above scenario calls for an immediate intervention by the local authorities, to educate and change the negative mindset of the youth towards farming. Such a move could prevent future food security crisis in the communities.

In most cases, the matured agricultural produce such as maize and groundnuts are required to be dried and stored for some time before they can attract good prices. All these processes delay income associated with farming. This means that, some people became sand miners because; they saw the quick access to income as an opportunity to

enhance their lives. Also, investments made in farming does not provide immediate monetary returns, hence movements of many people into sand mining.

"Moreover, the chiefs revealed that sand mining activities pose severe threat to agriculture. Farming is no longer attractive to the youth because, most of its benefits are enjoyed in the long term. Sand mining has become the preferred choice to many people here because; it guarantees them regular and quick income".

This result confirms the view of Robert (2014) that many of Kenya's poor youngsters were turning to sand mining as a quick way to earn money. It should however be noted that, even though sand mining brings quick income, it could be detrimental to the communities in the long run. This is because; it may influence people to sacrifice the arable lands at their disposal regardless of its intra-generational and inter-generational consequences. An observation at the events in the communities showed that, the quickest means of getting money was to become a sand miner. In this context, many land owners in the communities leased most of their lands to the sand miners at the expense of agricultural production and food security. The implication of this finding is that, without any intervention, sand mining activities will continue to flourish and overshadow other livelihood activities in the communities. Such a situation could lead to the dwindling or exhaustion of all the sand resources.

4.6.2 Results of Interview from Environmentalists (E.P.A)

The views here further support the conceptual framework for the study that, people join sand mining either to enjoy some of its benefits or because of climatic and physical

vulnerabilities which affect the sub-structure of buildings and agriculture. An official from the Environmental Protection Agency (EPA) in an interview said:

"Sand mining activities pose severe threat to sub-structure of buildings. construction is no longer attractive to the youth because, most of its benefits are enjoyed in the long term. Sand mining has become the preferred choice to many people here because; it guarantees them regular and quick income".

This result confirms the view of Robert (2014) that many of Kenya's poor youngsters were turning to sand mining as a quick way to earn money. It should however be noted that, even though sand mining brings quick income, it could be detrimental to the communities in the long run. This is because; it may influence people to sacrifice the arable lands at their disposal regardless of its intra-generational and inter-generational consequences. An observation at the events in the communities showed that, the quickest means of getting money was to become a sand miner. In this context, many land owners in the communities leased most of their lands to the sand miners at the expense of agricultural production and food security. The implication of this finding is that, without any intervention, sand mining activities will continue to flourish and overshadow other livelihood activities in the communities. Such a situation could lead to the dwindling or exhaustion of all the sand resources.

4.7 Results of Observations

The researcher observed the sand miners at the Koforidua (New Juaben Municipality) as they mine sand causing the destruction of the sub-structures of buildings in the Municipality.

4.7.1 Results of Observation at Dansu Dam Site

The Researcher observed sand miners at the Dansu Dam site (New Juaben Municipality) as they mine sand and destroy the land for construction building. Structures have come under serious threat as a result of sand mining. Most structures have experienced some deformities and are near collapsing.

4.7.2 Results of Observation at Kentekye

Figure 4.3 portrays a dangerous landslide in the study area as a result of over mining of sand at Kentekye. This agrees with Tariro, (2013), sand miners have created gullies on agricultural lands and forest reserves in several places. The scooping of sand from the ground destroys the vegetation cover and the soils which serve as the habitat for wildlife. This situation destabilises the ecosystem of living organisms thereby imperiling their lives (Lawal, 2011; Ambak and Zakaria, 2010; Phua et al., 2004).

Figure 4.3: Dangerous landslide at Kentekye

Source: Field survey, Kponyo (2018)

4.7.3 Results of Observation at Akwadum

Figure 4.4 reveals a destroyed sub-structure of the land as a result of too much mining of sand at Akwadum, where the deep roots of a tree and grasses are all destroyed. Sand mining is a direct cause of destruction to the riparian and non-riparian habitat, flora and fauna (Peck et al., 2010; Kelley *et al.,* 2004). The extraction of sand from river beds creates gullies on the floors of the rivers. These deep pits on the river beds degrade or lower the groundwater table; consequently, wells in such places become dry (Peckenham, Thornton, Whalen, 2009; Selvakumar, Venkataraman., Sundaravaradarajan., 2008; Hemalatha, Chandrakanth, Nagaraj, 2005).

Figure 4.4 Exposed roots of a tree due to excessive sand mining at Akwadum

Source: Field survey, 2018

4.7.4 Results of Observation at Oyoko

The researcher observed that, substructures of building land have come under serious threat at Oyoko in the New Juaben Municipality as a result of sand mining in Municipality where construction of the substructure of buildings could be done on such land have come under serious threat as a result of sand mining which made the land prone to waterlog when it rains heavily. Most substructures of building lands in the area have experienced some erosion for that reasons, residence in that area could not have access to firm base lands to put up of substructure of buildings.

Figure 4.5 show the destruction of building due to made up ground at Oyoko

Source: Field survey, Kponyo (2018)

4.7.5 Results of Observation Asikasu Asuogya

Figure 4.6 indicates water accumulation in an open pit created sand mining in the study area.

The activities of sand mining lead to the destruction of vegetation, agricultural and non-agricultural lands (Aromolaran, 2012; Hedge, 2011). Sand mining along streams has led to the destruction of several hectares of fertile streamside lands annually. Also, a lot of valuable timber resources and wildlife habitats have been lost to the activities of sand mining. Also, the lowering or dropping of water table from the activities of alluvial sand mining affects the smooth flow of streams thereby negatively impacting on riparian wetlands.

Figure 4.6: A river at Asikasu Asuogya drying up through sand mining

Source: Field survey, Kponyo (2018)

4.7.6 Results of Observation at Jumapo

Figure 4.7 shows sstagnant water and growth of grass conducive to mosquito breeding due to sand mining at Jumapo. The view that sand mining leads to the destruction of water bodies confirms the findings of Saviour (2012), whose study into the causes, consequences and management of sand mining in India revealed that, reduction of water quality and poisoning of aquatic lives are some of the negative effects of sand mining on water resources. Other studies have also implicated sand mining for the destruction of water bodies through siltation, ground water depletion and pollution of water sources (Ambak and Zakaria, 2010; Byrnes and Hiland, 1995). The pollution of these water bodies have led to water scarcity in the communities, especially during the dry seasons. The destruction of these water bodies could have other serious negative effects on the livelihoods of people in the sand mining fringe communities; if measures are not put in place to avert their continuous destruction.

Figure 4.7: A stagnant water at Jumapo due to excessive sand mining

Source: Field survey, Kponyo (2018)

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of findings, conclusions and the recommendations for the study.

5.2 Summary of Findings

- The study indicated that most respondents affirmed that the cracks on the sub-structures of their buildings are very severe because of the intensity of sand mining.
- The study revealed that sand mining has contributed to the depletion of sand around the sub structures and thus destroying the sub-structures of buildings.
- Moreover, the loss of vegetation was amongst the other impacts of sand mining. The loss of vegetation affected farming and gardening in the area. Furthermore, sand mining creates open pits that weaken the substructures of buildings.
- The study revealed that sand mining induces soil erosion and destruction of the sub-structure of the buildings. Moreover, sand mining has contributed to environmental degradation such as land sliding, compaction, low organic matter, loss of soil structure.

5.3 Conclusions

Sand mining communities are associated with destructions to the sub-structures of buildings, vegetation cover, creation of gullies on farmlands and other damages to the physical environment. Unfortunately, these degraded sites become unproductive because no measures are put in place to reclaim the lost lands. Consequently, several acres of

lands are lost annually to the activities of sand mining in various parts of the region. All efforts must therefore be put in place by the district assemblies, in collaborations with the Environmental Protection Agency and the Ministry of Food and Agriculture; to restore the lands that are destroyed in the wake of sand mining activities. These reclaimed lands could be reused by the farmers or be used for afforestation projects. The study has again provided a framework for future researches into the roles and challenges of local authorities in the sand mining industry.

5.4 Recommendations

1) The Environmental Protection Agency should intensify operations to combat illegal mining activities in the New Juaben Municipality, thereby protecting the substructure of the building.
2) The Minerals Commission and Environmental Protection Council should put in place all the necessary mechanisms to protect the environment in any mineral or natural resource exploitative venture.
3) The EPA should do well to enforce their rules and regulations on the environment, thus to implement municipality regulation that have to be deemed necessary in the protection of human and environmental health.
4) The factors that influence people into sand mining can be minimised when members of the sand mining-fringe communities are introduced to other livelihood activities. This is because; unemployment and other vulnerabilities in farming compelled many people to become sand miners.

5) The district/municipal assemblies in collaboration with the Ministry of Food and Agriculture should therefore introduce more profitable alternative livelihood activities to the youth who are mostly into sand mining.

6. The EPA have to set municipal standard that can use as a guidelines for the entire community to develop and enforce their own regulation to protect the environment.

5.5 Suggestions for further Research

According to the recommendations of the study, the researcher suggested that a similar study should be conducted to investigate the impact of job creation on rural folk's live hoods in Ghana.

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APPENDIX A

QUESTIONNAIRE

This questionnaire is aimed at collecting data for the study **"effect of sand mining on the Substructures of buildings in the New Juaben Municipality".** This data is purely for academic reasons and would be conducted in a confidential manner. The researcher therefore assures you that no part of this information given would be used for any other purpose.

Please make a tick [] in the box against your response. Thanks for your cooperation.

Section A: Socio-demographic characteristics of respondents.

1. What is your gender?

   a) Male [ ]

   b) Female [ ]

2. In which of the following age range do you belong?

   a) 20-29 years [ ]

   b) 30-39 years [ ]

   c) 40-49 years [ ]

   d) 50-59 [ ]

   e) 60 years and above [ ]

3. Marital Status:

   a) Married [ ]

   b) Single [ ]

   c) Divorced [ ]

4. Level of education……

a) No formal education [ ]

b) Basic education/MSLC [ ]

c) Secondary/Voc/Tech Education [ ]

d) Tertiary Education [ ]

Section B: The issues of sand mining on sub-structures of buildings in New Juaben Municipality

For the questions below please, tick the appropriate answer.

5.How far do you live from sand mining areas approximately? 0-500m 501-1000m 1001-1500m 1501-2000m above 2000m

6.Do you often visit the sand mining area? YES [ ] NO [ ] SOMETIMES [ ] RARELY [ ]

7.If yes, choose and tick activities you normally do at the sand mining areas.

Get domestic water [ ] sand mining [ ] fishing [ ] gardening [ ] farming [ ] herding livestock [ ] others, specify……

8. Approximately, how many trucks pass through your village in a day? 0-5 [ ] 6-10 [ ] 11-15 [ ] 16-20 [ ] 20 and above [ ]

9. Do you have cracks on the sub-structures of your buildings? Yes [ ] No [ ]

10. How severe is the crack on the sub-structures of your buildings?

Severe [ ] Very severe [ ] Not severe [ ] I do not know [ ]

Section C: The effects of sand mining on the people in the study area

The effects of sand mining	**SD**	**D**	**N**	**A**	**SA**
11. Sand mining contributes to the depleting of the sub structures of buildings					
12. Loss of vegetation was amongst the other impacts of sand mining					
13. Sand mining creates open pits that destroys the substructures of buildings					
14. Sand mining induces soil erosion and destroying the substructure of buildings.					
15. Sand mining contributes to environmental degradation such ass land sliding, compaction, low organic matter, loss of soil structure.					
16. Sand mining creates open pits that destroys the substructures of buildings					

Section D: Strategies to minimise the effects of sand mining on sub-structure of buildings

The effects of sand mining	**SD**	**D**	**N**	**A**	**SA**
17. The Environmental Protection Agency should intensify operations to combat illegal mining activities.					

18. Stream should not be diverted to form inactive channel					
19. Mining at the concave side of the river channel should be avoided to prevent bank erosion.					
20. Mining of gravelly sand from the riverbed should be restricted to a maximum depth of 3m from the surface.					
21.The Minerals Commission and Environmental Protection Council should put in place all the necessary mechanisms are to protect the environment in any mineral or natural resource exploitative venture.					
22.The EPA should do well to enforce their rules and regulations on the environment.					

APPENDIX B

INDEPTH INTERVIEW GUIDE FOR CHIEFS/ ASSEMBLY MEMBERS IN SELECTED COMMUNITIES

Date of interview: .....

Place of interview: .....

Interviewer's name: .....

Position/Status: .....

The main objective of the study is to assess the effects of sand mining on the environment and people's livelihoods. The effects on the environment will be measured based on the extent to which the environment in the affected areas have been degraded using indicators such as deforestation, destruction of water bodies, and the loss or reduction of wildlife. Also the effects of sand mining on livelihoods will be measured by some factors such as the reduction/increase in people's income, reduction/increase in job avenues, and the reduction/increase in crop yields. This questionnaire is designed to elicit information regarding this research work. There are no correct or wrong answers. Information given will solely be used for this research. You are also assured of full confidentiality, privacy and anonymity of any information that you provide. You are kindly requested to answer the questions as frankly and openly as you can.

Section A: Socio-demographic characteristics of respondents.

1. Sex:

   Male [] Female []

2. In which of the following age range do you belong?

   20-29 years [] 30-39 years [] (c) 40-49 years [] (d) 50-59 [] (e) 60 years and above []

3. Marital Status:

   Married [] Single [] (c) Divorced [] Separated [] (e) Co-habiting [] Widowed []

4. Level of education.....

   No formal education [] Basic education/MSLC [] (c) Secondary/voc/tech education [] Tertiary education [] others, specify.....

5. Occupation.....

6. How long have you been living in this community?

   0-4 [] (b) 5-9 [] (c) 10-14 [] 15-19 [] 20 and above []

Section B: Factors that push people into sand mining

1. What reason(s) would you give to explain why some people in your community engage in the activities of sand mining? .....
2. How do the sand miners acquire lands for the sand mining activities?.....
3. Do the sand miners pay royalties to the community?

   Yes [] (b) No []

4. If "Yes", are you satisfied with the amount given? .....

Section C: Effects of sand mining on Livelihoods

5. What are the positive effects of sand mining on livelihoods that you are aware of?

   .....

6. What are the negative effects of sand mining on livelihoods that you are aware of?

   .....

Section D: Effects of sand mining on the environment

1. Mention and explain any adverse effects of sand mining activities on the environment in your community: .....
2. What suggestion(s) would you give to combat the negative/adverse effects of sand mining on the environment? .....

Section E: Role of stakeholders in ensuring livelihood security

1. Who are the usual owners of the sand mining sites in this community? (Tick as many as possible) Individuals [] Governments [] Companies [] Others, specify…….
2. What institution regulates the activities of sand mining in this area? ....
3. Is proper monitoring and enforcement often done to ensure compliance?
   Yes [] No []
4. If No, why in your opinion is it so?.....
5. What kind of help have you received from any level of government to mitigate the adverse effects of the sand mining in your community: .....?
6. Indicate level of government that provided the assistance
   District Assembly [] Regional Administration [] Central Government []
   others, specify.....
7. Have you received support from any NGO? Yes [] (b) No []
8. If yes, indicate name of NGO .....…

APPENDIX C

OBSERVATION SCHEDULE

This observation schedule was made up of documentaries on the following sub-themes in the study communities.

9. Livelihood assets of the people.
10. Livelihood activities in the communities.
11. Land degradation as a result of the activities of sand mining.
12. Destruction of vegetation due to sand mining.
13. Destruction of water bodies due to sand mining
14. Destruction of farmlands with crops that have not been harvested by the farmers.
15. Social life of the people in the community.
16. Development projects and infrastructure undertaken and provided by the sand miners for the communities
17. Health conditions of the people in the community and identify its linkage to the sand mining operations in the community.
18. Reclamation sites (if any) and how those lands are being used.
19. Environmental management practices employed by the communities and the sand mining operators.
20. The presence of officials from governmental agencies and other stakeholders