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SAND MINING AND LOCAL LIVELIHOODS IN THE GA SOUTH MUNICIPALITY AND GOMOA EAST DISTRICT, GHANA

KOFI YEBOAH ASARE

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BY

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Thesis submitted to the Department of Integrated Development Studies of the School for Development Studies, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Doctor of Philosophy degree in Development Studies

MAY 2023

DECLARATION

Candidates' Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidates' Signature ……………………… Date: …………………………

Name:……………………………………………………………………

Supervisors' Declaration

We hereby declare that the preparation and presentation of this thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisors' Signature ……………………… Date …………………

Name: ....

Co-Supervisors' Signature..Date ....

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ABSTRACT

Globally, investment in housing and urban infrastructure to match the pace of urbanisation has led to high volumes of unsustainable sand extraction. In Ghana, farming and other land-based livelihoods account for the majority of the jobs held by locals in the sand mining regions. The main objective of the study was to assess how terrestrial sand mining in the Ga South Municipality and Gomoa East District affects local household livelihoods. A mixed-methods approach was used to gather quantitative data from 278 household heads and qualitative data from 32 key informants, including landowners, truck drivers, sand contractors, local government authorities, the Environmental Protection Agency, the Minerals Commission, and Focus Group Discussions with women and youth groups. Descriptive statistics, the chi-square test of independence, Kruskal-Wallis and the Median test were employed to analyse the quantitative data, while the qualitative data were transcribed and analysed thematically. The study revealed the following findings: first, sand mining was widespread and largely illegally undertaken by mainly non-natives of the mining communities, with the most common interest among the actors being monetary. Second, the negative impact of terrestrial sand mining on local livelihoods was more experienced by most of the local residents than its positive effects. Third, the rules governing sand mining were inadequately applied by the regulatory agencies. It is recommended for policymakers to resource the regulatory agencies to perform their mandate, while strict sanctions should be applied to illegal sand miners. The Land Use and Spatial Planning Authority, local government authorities, and landowners should work together to zone the study communities to ensure that land is reserved for traditional livelihoods.

KEY WORDS

Farmland

Housing and Urban Infrastructure

Institutions Governing Sand Mining

Land-based Livelihoods

Population Growth and Urbanisation

Sand Mining

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DEDICATION

To my mother, Madam Abena Doe; and wife, Josephine Ashia

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LIST OF ABBREVIATIONS

ALPs	Alternative Livelihood Programmes
ASM	Artisanal Small-Scale Mining
CHPS	Community Health Planning and Services
DFAs	Discriminant Function Analysis
DFID	Department for International Development
ECA	Economic Commission for Africa
EPC	Environmental Protection Council
EPA	Environmental Protection Agency
ET	Entitlement Theory
FAO	Food and Agricultural Organisation of the United Nations
GEDA	Gomoa East District Assembly
GLSS	Ghana Living Standards Survey
GSMA	Ga South Municipal Assembly
GSS	Ghana Statistical Service
HLS	Household Livelihood Security
ICDD	International Centre for Development and Decent Work
IRB-UCC	Institutional Review Board-University of Cape Coast
LI	Legislative Instrument
LUSPA	Land Use and Spatial Planning Authority
MC	Minerals Commission
MMDAs	Metropolitan, Municipal and District Assemblies
NGOs	Non-Governmental Organisations

OPATS	Organic Plant Production and Agroecosystems Research in the Tropics and Subtropics
PNDCL	Provisional National Defence Council Law
SDGs	Sustainable Development Goals
SLA	Sustainable Livelihood Approach
SSA	Sub-Saharan Africa
SWOT	Strengths, Weaknesses, Opportunities and Threats
UCC	University of Cape Coast
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UPE	Urban Political Ecology
US	United States
WACA	West Africa Coastal Area Management Programme
WCED	World Commission on Environment and Development

CHAPTER ONE

INTRODUCTION

In developed and underdeveloped nations alike, sand is mined mainly for construction of infrastructural facilities (Padmalal & Maya, 2014; Gavriletea, 2017; Larson, 2018; Zhai, Ding, An & Wang, 2020). In Ghana, particularly, Ga South Municipality and Gomoa East District, there are high rates of terrestrial sand mining, also called sand winning at an unsustainable rate (United Nations Environment Programme [UNEP], 2014). This is as a result of the burgeoning building industry in Accra which is also the most urbanising area in the country. Such unsustainable sand mining, at the backdrop of the rising demand for sand to support infrastructural development, have adversely effected household livelihood entitlement, particularly land.

Accordingly, this study, through the lens of Urban Political Ecology (UPE) theory (Heynen, Kaika & Swyngedouw, 2006), entitlement theory and political settlement theory, assesses how mining for terrestrial sand impacts local residents' ability to secure sustainable livelihoods to support their families. The introductory chapter of the thesis provides the general overview for the study. It also presents the problem statement that serves as the foundation for the research questions. The significance of the study, delimitation and organisation of the thesis are also discussed in the introductory chapter.

Background to the study

Many nations, particularly those in Africa and South America, depend heavily on mining for their socio-economic development (Tuokuu, Kpinpuo & Hinson, 2019). It is estimated that the livelihood of nearly 30 million people worldwide depends on the use of informal mineral resources extraction (Seccatore, Veiga, Origliasso, Marin & De Tomi, 2014). This has been attributed to the little entry requirements for mining, and the rising difficulty of supporting oneself through agriculture (Okoh & Hilson, 2011). While many have acknowledged the positive impact of mining, its link to sustainable development remains controversial (Vintro, Sanmiquel & Freijo, 2014). Since the host communities are frequently adversely impacted by mining operations, the primary problem pertaining to mining has been the difficulty of promoting sustainable environmental, economic, and social development.

Sand, gravel, and laterite make up the majority of the world's mined solid resources, weighing between 40 and 50 billion tons a year, equivalent to about 85% of global mineral extraction due to their various uses for humans (Torres et al., 2021; UNEP, 2019). Mining of sand dates back to thousands of years of imperial Roman architecture. Today, sand has a wide range of uses such as for fracking technology, computer chips, glass, paints and beach nourishment but the vast reported usage is for the construction of infrastructural facilities such as houses, schools, roads, bridges, and factories because of the increasing rate of urbanisation (Koehnken & Rintoul, 2018; Pereira, 2020, Bendixen et al., 2021).

Over the years, global trends such as urbanisation, population growth, modernisation and neoliberalism have imposed an ever-increasing need for sand globally (Torres, Brandt, Lear & Liu, 2017; UNEP, 2019). By 2050, it is predicted that the global urban population will have increased by around 75%, necessitating the construction of more contemporary housing and urban infrastructure (Saghir & Santoro, 2018). Since sand supports every aspect of the built environment, the connection between urbanisation and sand mining cannot be disregarded (Heynen et al., 2006). For instance, concrete, the most used substance in the world after water, is estimated to require a ton of cement and six to seven tons of sand and gravel (Scrivener & Kirkpatrick, 2008; UNEP, 2014; Schrecker, Birn, & Aguilera, 2018). The thesis is grounded on the tenets of UPE theory which argues that the social, environmental and economic dynamics associated with urbanisation lead to unequal access to and control over environmental resources which are often extracted from rural areas to support urban areas' development (Heynen et al., 2006).

Due to its rapid urbanisation, Sub-Saharan Africa (henceforth, SSA) is predicted to see a similar increase in sand consumption as the rest of the world (Saghir & Santoro, 2018; Oxford Economics, 2021). By 2030, SSA's population is projected to increase from 1.1 billion to 1.4 billion people. As expected, the construction sector is predicted to develop at an average annual rate of 5.7% through 2030 (Oxford Economics, 2021). The urbanisation in SSA is attributable to low economic growth, poor infrastructure, limited financial capital, low technology and unemployment in rural areas relative to the major cities (Dick &

Schraven, 2021). The net effect of the rural-urban disparities is high influx of rural dwellers to the cities and subsequent sprawl to its urban fringes — notable for the city's food supply and affordable residential accommodation (Davis, 2006; Gough & Yankson, 2011; Akubia & Bruns, 2019). This has further led to widespread illegal sand mining in these areas (Torres et al., 2017; Akubia & Bruns, 2019; UNEP, 2019).

Most of Ghana's cities — Accra, Tamale, Kumasi and Sekondi-Takoradi — are experiencing high rates of urbanisation with huge urban infrastructure gaps, particularly private housing (Korah, Cobbinah, Nunbogu & Gyogluu, 2017; Gillespie, 2018; Ashiagbor, Amoako, Asabere & Quaye-Ballard, 2019). Accra is Ghana's fastest expanding city because of its location and status as an important economic center both locally and in the West African sub-region (Saghir & Santoro, 2018; Ghana Statistical Service (GSS, 2021a). Among the many problems as sociated with the rapid urbanisation of Accra are poor land use planning, flooding and inadequate infrastructural facilities. To illustrate this, GSS (2019) and Ehwi, Asante and Morrison (2020) explained that residential accommodations in Accra are mostly provided by private house owners with expensive rent advance required, yet they are limited. As a result, most middle-income city dwellers depend on the outlying communities around Accra for building land and sand to build their own homes in order to avoid the uncertainties involved in renting a property in Accra (Asante, Gavu, Quansah & Osei-Tutu 2018).

The Ga South municipality and Gomoa East district are noted for having a large terrestrial sand mining industry in Ghana as a result of their closeness to Accra and Kasoa (Dick-Sagoe & Tsra, 2016). Similar to other peri-urban fringe communities of Accra, these local government areas have become contested spaces for land with multiple land use actors resulting in dispossessions of weak actors (Darkwa & Attuquafio, 2012; Obeng-Odoom, 2014). Of much significance is the fact that the majority of the population in these local government areas works in subsistence farming or other land-based occupations, making them significant sources of agricultural produce for the city (GSS, 2019). Therefore, adequate access to arable land is crucial for the local population. The livelihood security of the vast majority of people living in the mining areas may be threatened by sand mining, which competes with other land-based livelihoods.

The externalities that sand mining offers to people and communities can be both beneficial and detrimental. On the positive side, aside from its significance for the building industry, the evidence suggests that sand mining provides a living for a significant portion of the population (Saviour, 2012; Asante, Abass & Afriyie, 2014; Schrecker et al., 2018). On the negative side, the majority of people believe that mining for sand is not only unsustainable because it depletes natural resources, but also because it has extremely negative and irreversible effects (Asabonga, Cecilia, Mpundu & Vincent, 2017; Lowe, 2018; Rathoure & Rathoure, 2020). Unsustainable sand mining has a negative impact on other economic actors, cultural heritage, as well as the health and safety of nearby communities (Mohapatra, Shaikh, Nayak & Navada, 2017).

The interconnectedness of the positive and negative effects surrounding sand mining suggests that it is a necessary evil because, even though land is controlled and manipulated to serve the interests of powerful individuals through unequal power relations, other social groups and locations elsewhere benefit from its extraction (Heynen et al., 2006; Kervankiran, Dziwornu & Temurçin, 2016). In other words, despite the environmental, social, and economic consequences of sand mining, its extraction is necessary for infrastructure development in order to meet the demands of urbanisation and population expansion. The positive and negative effects reported, point to the fact that there are multiple realities for different actors with respect to sand mining (Johnbull & Brown, 2017).

Under the prevailing conditions of widespread sand mining and competing claims over land, weaker actors who have their livelihoods tied to land are compelled to diversify their livelihoods, migrate or shift their farming activities far from their communities (Nin-Pratt & McBride, 2014; Cobbinah, Gaisie & Owusu-Amponsah, 2015). Though diversification is very important in sustaining rural livelihoods (Ellis & Freeman, 2004; Khatun & Roy, 2012); adequate access to and control over assets, which most of these people lack in the first place, have been recognised as an important determinant for successful livelihood diversification (Katega & Lifuliro, 2014; Mesele, 2016). Hence, economically weak actors in most cases, employ alternative livelihood strategies mainly as a survival approach.

The relevance of protecting land for sustainable livelihoods is well explained by the entitlement theory. According to Sen (1981), the low degree of access to environmental resources by weaker actors is what is meant by a resource's scarcity rather than the absence of resources. The central issue in the entitlement argument is that getting access to natural resources such as land is the most important ingredient for sustaining rural livelihoods and not the mere availability of resources (Leach & Mearns, 1991). Institutions are at the heart of the entitlement argument since the legitimacy with the acquisition and usage of environmental resources are established through institutions (Heynen, 2016). Therefore, in the absence of well-defined institutional arrangements and effective regulations, wealthy actors abuse power over local residents who have inadequate tenure security and engage in unsustainable exploitation of resources to satisfy their interests (Getzner & Islam, 2013).

Despite the fact that socio-economic issues including insufficient employment and a lack of environmental awareness have been identified as reasons why people participate in unsustainable sand extraction (Mensah, 1997), inadequate regulation and enforcement of environmental regulations are equally important (UNEP, 2019). The political settlement theory, which emphasizes the interdependency between institutions and the allocation of power, provide an explanation for the regulators' incapacity to successfully implement mining regulations (Khan, 2010). According to the political settlement theory, given that mining rules have varying costs and benefits for different actors, the successful enforcement of rules rests in great part on opposition or support from influential groups in society.

Sand mining has a clear link to the achievement of the Sustainable Development Goals (SDGs) as it is interconnected with economic, environmental and social development. Unsustainable sand mining could interfere with the achievement of SDGs 1, 2, 3, 8, 15 and 16, which aim to eliminate all forms of poverty; end hunger; ensure the health and well-being of all people; foster decent employment and economic growth; safeguard and ensure sustainable use of terrestrial ecosystems and forests; and advance peace and justice for all through strong institutions, respectfully. It is, therefore, not surprising that the parliament of Ghana constituted an ad hoc committee in 2017 to examine the impact of Ghana's sand mining industry as a strategy to position sand mining rightly to enhance the achievement of the SDGs.

It could be summarized that the need for sand in Ghana will keep rising as a result of the high pace of urbanisation in major cities. Amid the negative and positive outcomes occasioned by sand mining, there is a call towards sustainable livelihood and for that matter sustainable development. Clearly, the different interests and power relations of the actors involved in sand mining might create a condition where few wealthy actors would have access to and control over land, while the vulnerable ones, who are the majority, would suffer.

Statement of the Problem

The majority of the residents in the Ga South municipality and Gomoa East district of Ghana are farmers who depend on adequate access to farmland for their livelihoods and food needs (GSS, 2019). However, sand mining is widespread in these local government areas and is predominantly undertaken from farmland. Yet, globally, debates on mining and development are dominantly centered on the international trade of precious minerals such as gold, bauxite, and fossil flues, to the neglect of industrial minerals. This is because industrial minerals have less potential to generate foreign exchange and revenue compared to precious minerals (Dawson, 2020; Franks, 2020). Therefore, UNEP (2019) argued that sand mining is a hindrance to attaining sustainable development in the twenty-first century, but scientific research to support its responsible extraction and consumption is limited.

According to the theoretical tenets of UPE, understanding of environmental issues in the context of entitlements and livelihoods are enhanced when the interests of the different actors involved in the resource extraction and their bundles of power are examined (Zimmer, 2010). Some earlier empirical studies outlined the different stakeholders involved in sand mining, namely: sand contractors, landowners, traditional leaders, truck drivers, local government agencies and regulatory agencies (Mensah 1997; Dick-Sagoe & Tsra, 2016; Dawson, 2020; Essaw et al., 2023). These studies, however, did not analyze the interests and power position of the identified actors. Therefore, it is appropriate to understand the power dynamics and vested interests influencing the access to and usage of land for sand mining at the rural and peri-urban margins of Accra. Additionally, the earlier studies did not examine the scope and procedures of sand mining in the respective study areas.

The interaction between human and nature also creates social, environmental and economic ramifications with benefits and losses to different actors (Heynen, 2006). However, the majority of the literature on sand mining (Mensah, 1997; Lawal, 2011; Saviour, 2012) focuses on its environmental effects, ignoring the economic and social pillars of sustainability (Loorbach & Shiroyama, 2016). It is necessary to adopt a more comprehensive approach to sustainability that takes into account the environmental, economic and social impacts of sand mining on local household livelihoods.

Concerns about alternative livelihood strategies in Artisanal Small-Scale Mining (ASM) host areas, are largely based on informal gold mining (Hilson & Banchirigah, 2009; Banchirigah & Hilson, 2010), which has gained much of the public and research attention. There is limited information in the literature, particularly in Ghana, on Alternative Livelihood Programmes (ALPs) in sand mining communities (Lamb, Marschke & Rigg, 2019). While some findings with small-scale gold mining might be similar to that of sand mining, it is apt to investigate the alternative livelihood strategies residents in sand mining communities pursue. This is because small-scale gold mining and sand mining have different methods with respect to how they are mined, managed and regulated. Apart from that, the value placed on the two resources differs; therefore, it is problematic to assume that all the issues are transferable.

The extraction of sand is mostly unregulated and does not meet health and safety standards as well as environmental rehabilitation requirements (Mensah, 1997; Rege, 2016). UNEP (2019) observed that in many nations, sand mining is neither governed nor regulated. There is currently insufficient study on the institutions governing the sand mining industry in Ghana; a situation Koehnken and Rintoul (2018) argued as a global challenge. Theoretically, the UPE argues strongly that environmental practices gain legitimacy through institutions. The study aims to fill this knowledge gap based on these justifications by exploring the institutions and practices in relation to sand mining to understand how they are applied in the study communities.

Theoretically, UPE has been used to study issues such as environmental entitlement, biodiversity, climate change, land reforms, access to water among other. However, prior research focused on urban areas in industrialized nations and ignored peri-urban and rural areas, particularly in SSA; a situation its critics termed 'methodological cityism' (Angelo & Wachsmuth, 2015). This research, therefore, seeks to overcome this theoretical gap by using the UPE theory beyond the urban core to study the impacts of sand mining on local household livelihoods in the Ga South and Gomoa East local government areas of Ghana.

Objectives of the study

The main objective of the study was to assess the implications of terrestrial sand mining on local livelihoods in the Ga South Municipality and Gomoa East District of Ghana.

Specifically, the study seeks to:

1. Examine the organisation of terrestrial sand mining in the Ga South Municipality and Gomoa East District.

2. Investigate the effects of terrestrial sand mining on the local residents' livelihoods.
3. Explore the alternative livelihood strategies used by the local residents in the study areas.
4. Explore the application of the institutional framework governing sand mining in the study communities.

Research questions

The following research questions will be answered by the study:

1. How is terrestrial sand mining organised in the Ga South Municipality and Gomoa East District?
2. How does terrestrial sand mining affect the local residents' livelihoods?
3. What alternative livelihood strategies do the local residents use due to the effects of sand mining?
4. How is the institutional framework governing sand mining applied in the study areas?

Significance of the study

First, the results of this study will help policymakers to formulate policies for rural agriculture development, especially on issues relating to access to and control over farmland. It is hoped that the findings will eventually encourage stronger pro-poor policies, which would have a greater influence on the livelihoods of rural and peri-urban residents in areas with active sand mining. Second, the study would contribute to the knowledge of the interests and power positions of the different actors involved in sand mining, which is key for effective sand governance. Thirdly, the study will aid policymakers in determining how well the institutional framework governing sand mining controls the sector. The findings would assist decision-makers in developing practical measures to guarantee that sand mining is done in a sustainable way, along with other traditional livelihoods, including farming.

Fourth, agencies involved in spatial planning including Local Government Authorities and the Land Use and Spatial Planning Authority (LUSPA) would be informed to develop appropriate zoning to determine where urban growth should be placed and reserve land for agriculture as well as other land-based livelihoods. Fifth, the study would contribute to the UPE theory by applying it to peri-urban and rural areas in Ghana since earlier application of the theory focused mainly on urban areas in industrialized countries.

Delimitations

Thematically, the focus of this thesis is on how sand mining affects local household livelihoods. Specifically, it captures the organisation of terrestrial sand mining in the study areas, focusing on the interests and power positions of the actors, processes involved in the mining of terrestrial sand and the magnitude of sand mined in the study communities. The rest of the thematic issues encompass effects of terrestrial sand mining on the local residents' livelihoods, the alternative livelihood strategies used by the residents due to the externalities of sand mining and the application of the institutional framework for sand mining.

Geographically, the rural and peri-urban areas of the Ga South municipality and Gomoa East District served as the study's locations. It focuses exclusively on these two local government areas which are prone to sand mining activities as a result of their proximity to Accra. For the target population, it captures household heads, sand contractors, truck drivers, chiefs/landowners, community development committee, youth and women groups in the communities. It further covers the officials of the selected local government authorities, Minerals Commission and EPA.

Organisation of the thesis

There are eight chapters in the thesis. The first Chapter, which is the introduction, covers the background of the study, the problem statement, the research objectives, the research questions, significance of the study, the delimitations, and the thesis organization. Chapter Two centers on the conceptual review, while the theoretical, empirical, conceptual framework and lessons learnt constitutes Chapter Three. Chapter Four covers the methodology which comprises the research design, profile of the study areas, study population, sampling procedures, instrument design, pre-test, actual field work, ethical considerations as well as data processing and analysis.

The fifth Chapter concentrates on the organisation of sand mining in the study area with particular focus on the scope and the magnitude of sand mined from the areas, the processes involved in sand mining, the interests and power positions of the actors. Chapter Six focuses on the effects of terrestrial sand mining on local household livelihoods, with specific attention on all the pillars of sustainability. The alternative livelihood strategies used by the household heads are also captured in Chapter Six. The Seventh Chapter covers the application of the institutional framework governing sand mining in the study communities, while the summary, findings, and recommendations are covered in Chapter Eight, which is the last chapter.

Summary of the Chapter

The chapter began with an introduction that described the problem being looked into, the importance of the study, and the study's theoretical foundation. There was a presentation of the background to the study, which provided information about the study's broad context and its applicability to the study areas. The statement of the problem and gaps in the existing literature came after that. Afterward, the overarching objective of the study was stated, and four specific objectives were offered to guide the direction of the study. The significance of the research, delimitation and the organisation of the study were also presented.

CHAPTER TWO

CONCEPTUAL OVERVIEW FOR SAND MINING AND HOUSEHOLD LIVELIHOODS

Introduction

The second chapter focuses on the concepts that are pertinent to the research. A conceptual review facilitates the identification of essential variables, broadens understanding of the research field, and clarifies the problem statement (Sekaran, 2003; Griffee, 2012; Walliman, 2011). Urbanisation in Ghana, sand, sustainable livelihoods, sustainable development, Ghana's system of land tenure, institutions, and the roles of traditional and modern institutions involved in mining are among the key concepts examined.

Urbanisation in Ghana

In the past thirty years, Ghana's rate of urbanisation has increased, changing the ratio of the population living in urban and rural areas (GSS, 2021a). For the first time since its post-independence population census in 1960, Ghana's demography changed in 2010, with an increase in the urban population relative to the rural population. The percentage of people living in urban areas rose from 23.1% in 1960 to 50.9% in 2010 and is now 56.7% as of 2020 (GSS, 2021a). About half (47.8%) of the growth in urban population in 2020 was accounted for by Accra and Kumasi alone. As a result, these cities experienced a significant increase in demand for residential, commercial, and other urban infrastructure (GSS, 2021a).

Currently, the biggest and fastest-growing city in Ghana is Accra. Between 1960 and 2021, Accra's population increased significantly, from just over 388 thousand to 2.55 million (GSS, 2021a). The Greater Accra Region, including the metropolitan area, was primarily rural before Ghana's capital city was established there in 1877, with farming and fishing serving as the main sources of income for residents. Accra began to develop as an urban center in 1891, and in 1960 it was given city status (Parker, 2000; Twum-Baah, 2000). Since 1960, the city has continued to grow, with the majority of the growth taking place in the urban periphery areas, which are a significant source of agricultural produce and ecosystem services (Kleemann, Inkoom, Thiel, Shankar, Lautenbach & Fürst, 2017; Owusu & Yankson, 2017). For example, from 12.40 km^2 in 1985 to 161.52 km^2 in 2015, built-up areas in Ga West Municipality developed substantially at the expense of agricultural and forestry land (Ashiagbor, Amoako, Asabere & Quaye-Ballard, 2019).

The effects of rapid urbanisation in Accra include instability in the land market and land tenure arrangements, changes in land value, land disputes, the development of the rural-urban interface, changes in land cover and use, sand mining, and a decline in agricultural activities without any viable replacements for alternative sources of income (Cobbinah & Amoako, 2012; Ashiagbor et al., 2019). Beyond the alteration in land use, Accra's growing urbanisation is also correlated with poor sanitation, limited transport services, flooding, low-quality roads, and unemployment (Møller-Jensen, Allotey, Kofie & Yankson, 2020).

Sand

Sand is a naturally occurring aggregate made of quartz, primarily silica, with other ingredients that vary depending on the region, and it is generated by erosion from flowing water, rocks, or wind over thousands of years (Morgan & Kench, 2016). Different scholars classify sand based on its formation method, size distribution, and composition. For instance, sand is defined by geologists according to its grain size, which ranges from 0.0625mm to 2mm. A sand sample can also be described by colour, grain size, composition, morphology, and surface texture (Gavriletea, 2017). Though sand is an abundant resource, not all types of sand are good for industrial purposes. For example, the Desert constitutes an abundant source of sand — about 20% of the earth's total land area — but it does not meet the world's industrial standards, nor can it be used for construction (Harris, 2003). This is a result of the small, evenly dispersed grain size and lack of contaminants like silica and clay particles.

Despite having other significant uses, sand is mostly used in the building industry (aggregate) (Beiser, 2018; Koehnken & Rintoul, 2018). Appropriate sand resources for industrial activities are therefore limited and mostly obtained from terrestrial and marine deposits (Beiser, 2018). While marine sand comes from shore and offshore deposits, terrestrial sand comes from river channel deposits, such as floodplain deposits and residual soil deposits (Figure 1).

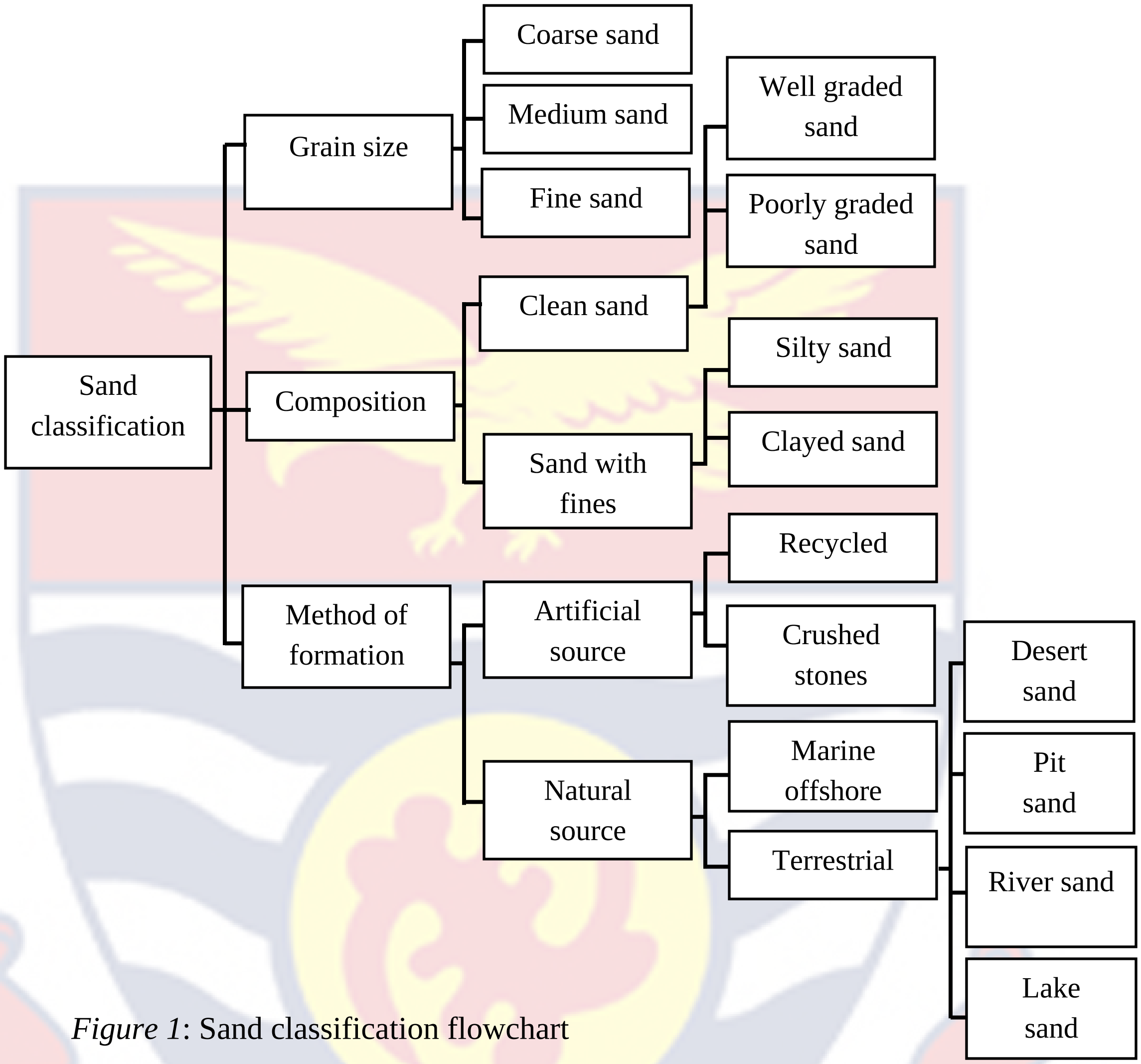

Figure 1: Sand classification flowchart

Source: Adopted from Gavriletea (2017)

The methods of sand mining include dredging, the use of bulldozers, and manually with tools such as spade. Recently, marine sand mining has increased significantly over the previously dominant river bed mining due to the overexploitation of the later, causing the ban of the practice in many countries (Gavriletea, 2017). Pereira (2020) explains that offshore sand dredging is the most common sand mining method used in advanced countries. However, in emerging countries such as India, Malaysia, Sri Lanka, Nepal, Botswana, Morocco, and Bangladesh, where illegal sand mining was very prevalent, sand was usually extracted from rivers and land quarries (Bagchi, 2010; Piyadasa, 2011; Khan & Sugie, 2015; UNEP, 2019).

Sustainable Livelihood

In 1987, the World Commission on Environment and Development (WCED) propounded sustainable livelihood as a strategy to connect socio-economic and ecological issues in a policy-relevant structure to improve the living conditions of poor people (Krantz, 2001). Subsequently, the concept of sustainable livelihoods was accepted as a broad goal for poverty eradication at the 1992 United Nations Conference on Environment and Development. Chambers and Conway (1992) explained that households can achieve sustainable livelihoods through adequate access to land, right to fishing, hunting, and grazing as well as adequate remuneration from stable employment. Therefore, issues such as vulnerability, environmental degradation, and social exclusion should be minimised in the attempt to alleviate poverty.

Chambers (1983) argued that rural development was ineffective because of the split between what poverty really was and how it was perceived by development practitioners. Therefore, Chambers and Conway (1992) offered a new approach to development called Sustainable Rural Livelihoods in their work titled 'Rural Development: Putting the Last First'. The approach was propounded because Chambers and Conway (1992) observed that past development approaches, such as the modernization theory, failed to effectively address poverty and rural development, particularly in developing countries. They noted that:

‘A livelihood comprises the capabilities, assets (stores, resources, claims, and access), and activities required for a means of living: a livelihood is sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term’ (Chambers & Conway, 1992, p. 6).

The approach evolves around poverty reduction, how poor people live their lives, how they access and harness the opportunities economic growth offers and the relevance of structure and institutions to their livelihoods (Krantz, 2001; Yaro, 2004; Ashley & Carney, 1999). The SLA provides solutions to the various factors and processes that adversely affect the ability of poor people to earn a living in a socially, economically, and ecologically sustainable manner.

Sustainable Livelihood Framework

The Sustainable Livelihood Framework is a key tool that was developed from the SLA for the practical application of the SLA. Since the 1990’s, many development agencies, including the United Nations Development Programme (UNDP), CARE International, the Department for International Development, UK (DFID), and OXFAM have developed frameworks for their project planning and analysis based on the SLA. This study, however, dwells on the DFID framework, which is perhaps the most representative of all the frameworks.

The DFID's sustainable livelihood framework

The DFID Sustainable Livelihoods Framework was developed with the goal of eradicating poverty in developing nations, building on previous work by the Institute for Development Studies, University of Sussex (Krantz, 2001). The goal of DFID's sustainable livelihood framework is to focus the organisation's attention more on supporting initiatives that directly improve the livelihoods of the disadvantaged. According to Ashley and Carney (1999), there are six guiding principles for the DFID framework for poverty-focused development: First, people-centred, which means that poverty interventions should emphasise what is important for poor people and also acknowledge differences among groups. Second, in determining and addressing livelihood priorities, the poor themselves must play a crucial role. Third, interventions should be implemented at both macro- and micro-levels. Fouth, partnership between public and private sectors are required. Fifth, a balance should be maintained between all the pillars of sustainability. Sixth, external assistance should be flexible to account for shifts in people's circumstances.

According to the DFID framework shown in Figure 2, the outcomes of a household's livelihood portfolio are influenced by three key variables (DFID, 2000). First, the sets of assets a household has for its livelihood activities. In order to guarantee sustainable livelihoods, it is crucial to have access to these assets, which include natural, physical, human, financial, and social capital. Human capital refers to the knowledge, skills, and good health that are necessary for pursuing various livelihood strategies, whereas financial capital refers to the financial resources, such as cash, access to credit, and savings, that allow people to pursue various livelihood options (Carney, 1998).

Social resources such as networks, social claims, affiliations, relationships of trust, reciprocity, and exchange that provide access to larger institutions of society for livelihood empowerment constitute social capital. Natural capital refers to the natural resources that can be used to support a livelihood, such as soil, wood, land, air quality, water, biodiversity, wildlife, and other environmental resources (Chambers, 1995). Last but not least, physical capital refers to the fundamental infrastructure and resources that allow individuals to pursue their livelihoods.

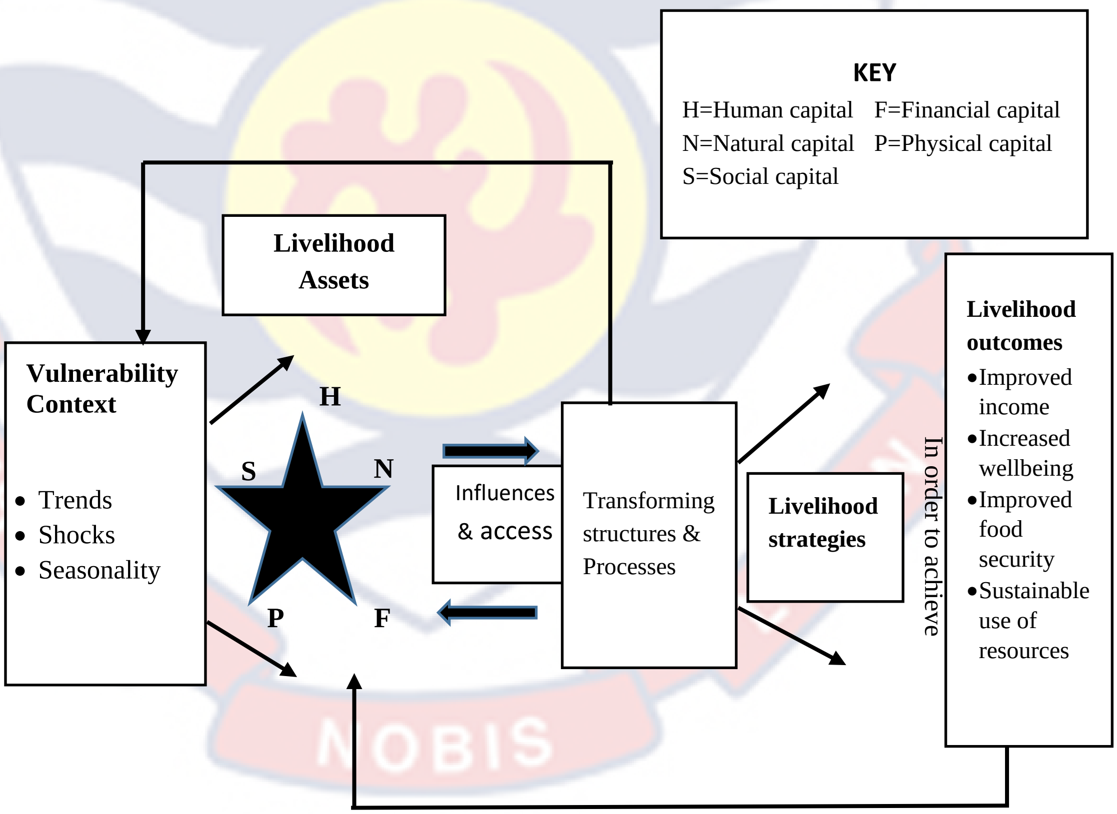

Figure 2: DFID's sustainable livelihood framework

Source: DFID (2000)

The household's choice of livelihood activities based on its capital stock endowment is the second factor that affects the outcome of rural livelihood. The rural economy in developing nations encompasses all types of economic activities, not only agriculture (Csaki & Tuck, 2000; Asare, Agyenim & Koomson, 2021). According to Scoones (1998), households in rural and peri-urban areas primarily follow the three livelihood strategies of migration, diversification of sources of income, and intensification of agriculture.

The external environment, influenced by the transforming structure and processes, exposure to shocks, economic trends, and social context, constitutes the third feature of the DFID framework. The institutions, laws, and policies that influence livelihoods are transforming structures and processes. The transforming structures and processes support the following decisions: access to the five different asset types; the terms of exchange for the various asset types; and the financial benefits of the various livelihood options (DFID, 2000). While transforming processes include policies, legislation, and power relations that establish the structures and how people operate or interact, transforming structures are the organisations that set and implement policies and laws, provide services, conduct trade, and perform other duties that influence livelihoods.

Although the DFID framework is not an exact representation of reality, it offers an analytical framework that makes it easier to have a thorough knowledge of the many elements that either limit or improve livelihood chances. The framework's strength is that it encourages users to take a comprehensive and organised view of the elements that contribute to poverty. These could be shocks and unfavourable trends, institutions and policies that do not work well, or a simple lack of resources. It attempts to balance the contributions made by all the sectors through the accumulation of the stocks of assets from which individuals draw to support their livelihoods rather than taking a sectoral perspective on poverty (DFID, 1999). The framework is oriented toward the needs of people and entails a deeper comprehension of the procedures, including the governance of natural resources and regional as well as local customs, including land access, distribution, and forest management.

Although the transforming structures and processes are captured, the framework's flaw is that it does not thoroughly explore how institutions operate. The DFID framework does not adequately account for institutional arrangements that are supported by power relations and are crucial in determining who has access to and control over resources for sustainable livelihoods (Forsyth, Leach, & Scoones, 1998). De Haan and Zoomers (2005) further assert that because power relations are not adequately included within transforming structures and processes, the many layers of power and how they shape access to resources for livelihood are not addressed. That notwithstanding, the framework offers an important analytical approach to complement the theoretical underpinnings of the study in order to adequately answer the research questions.

Sustainable Development and Sand Mining

For more than three decades, the sustainable development concept has been the focus of several discussions and disagreements in the development literature (Tuokuu et al., 2019). Some authors have advanced the idea that sustainable development is a strategy used by some companies to lessen criticisms of the adverse impact of their operations (Benson & Kirsch, 2010). According to Mensah and Enu-Kwesi (2019), the strategy for the successful implementation of sustainable development runs the risk of becoming a rhetorical trend.

Different people define the concept differently based on their background and discipline (Essah & Andrews, 2016; Onn & Woodley, 2014; Sørensen & Grindsted, 2021). Sustainable development, according to Chambers and Conway (1992), is the term used to describe practices that have a minimal impact on the environment, such as organic farming, institutions that can generate their own income, and procedures that are self-supporting without government support. Sachs (2015) argues that sustainable development refers to economic development that reflects both social and environmental responsibility. Another definition of sustainable development is maintaining and enhancing a sound economic, ecological, and social system for the advancement of humanity (Thomas, 2015; Mensah & Enu-Kwesi, 2019). The last definition is complete and best for this study since it recognises the social, environmental, and economic effects of sand mining on host communities and encompasses all the principles of sustainable development.

According to Munyanduki (2017), sustainable development in the mining industry occurs when investments are economically feasible, technically and environmentally sound, and socially responsible. Other scholars argue that sustainable development cannot be assured in the mining industry, and therefore, the concept should not even be discussed when dealing with non-renewable resources (Sørensen & Grindsted, 2021; Onn & Woodley, 2014). The concept is controversial since it is unclear what should be sustained, by whom, for whom, and what are the best ways of achieving the goals (Mensah, 2019; Shahzalal & Hassan, 2019). However, this study agrees with Bebbington and Humphreys-Bebbington (2018) that the argument about what is likely to be sustained and how host communities negotiate for compensation for the adverse impacts of mining should be at the center of all conversations on mining and sustainable development.

Therefore, in order to ensure that economic activity is carried out in a way that benefits both present and future generations, sustainable development is a necessity that calls for collaborative action (Sachs & Reid, 2006). The global community endorsed "Transforming Our World: The 2030 Agenda for Sustainable Development" in September 2015, which includes 17 Sustainable Development Goals (SDGs) to advance human welfare and safeguard the planet for both current and future generations, as seen in Figure 3.

Figure 3: UN Sustainable Development Goals

Source: Adopted from United Nations (2019)

According to the World Economic Forum (2016), mining causes issues including inequality, conflicts, environmental degradation, corruption, and gender-based violence that the SDGs aspire to solve. In order to protect the interests of both present and future generations, it is imperative to link sustainable development to sand mining. Therefore, in the places where sand mining occurs, rules must be put in place to achieve a balance between economic development, environmental protection, and social well-being.

Interconnected pillars of sustainability

As depicted in Figure 4, sustainability is concerned with three interrelated pillars that represent the connections between the environmental, social, and economic facets of life (Wanamaker, 2018). The actions of humans have implications for the economy, environment, and society, thereby affecting the total wellbeing of the human race (Mensah, 2019). Major development endeavours such as land use, surface water management, agriculture, construction, energy management, resource extraction, and law enforcement should give recognition to the interrelationships among the pillars of sustainable development (Wanamaker, 2018).

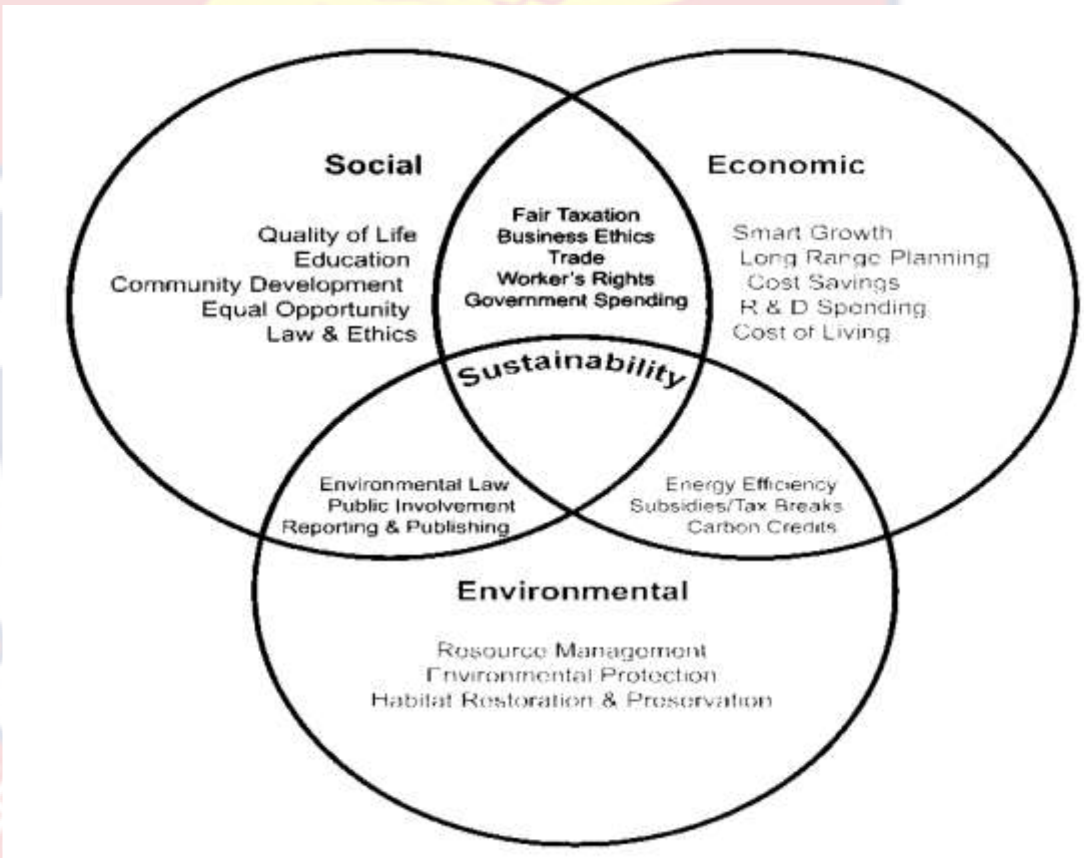

Figure 4: Interconnectedness among the pillars of sustainable development

Source: Adopted from Wanamaker (2018)

Environmental sustainability

Environmental sustainability refers to issues including global warming, forest loss, excessive exploitation of non-renewable resources, pollution, and other negative conditions that affect the entire world (Chambers & Conway, 1992). The concept is concerned with the natural environment and how it would continue to be useful for supporting human life (Mensah, 2019). Sand, for example, should not be used more quickly than it can be replenished in order to maintain environmental sustainability. Likewise, garbage should not be released into the environment more quickly than it can be absorbed (Diesendorf, 2000; Evers, 2018). Therefore, environmental impact assessment must be fused into all programmes that have the potential to harm the environment.

It is important to consider whether livelihood activities such as sand mining enhance, maintain, or degrade the local environment. When livelihood practices have a negative impact on others' access to and claims upon resources, they are not environmentally sustainable. Ineffective application of the law, coercion, or administrative hurdles are only a few examples of how access to and claims on resources might be undermined (Chambers & Conway, 1992). An important question that needs consideration is whether, environmentally, sand mining contributes negatively or positively to the sustainability of other livelihoods and the ecosystem.

Economic sustainability

Economic sustainability is built on a production system that meets present-generations consumption needs without negatively affecting those of future generations (Chehabeddine, Grabowska & Adekola, 2022). It entails generating financial value from whatever undertaking or choice is being made. Mensah (2019) argues that due to population increase and urbanisation, humans appear to be more focused on economic growth than other significant cost factors, such as the impact of depletion, for example. Markets are still being driven by the rising demand for products and services, which is having negative repercussions on society and the environment. Therefore, economic sustainability focuses on making decisions that are as fair and financially responsible as possible while taking other sustainability factors into account (Wanamaker, 2018; Zhai & Chang, 2018).

Social sustainability

Social sustainability is defined by Littig and Griessler (2005) as a method of social organisation that reduces poverty. However, poverty alleviation should not result in environmental degradation or economic instability. According to Saith (2006), social sustainability involves the growth of individuals, groups, and cultures in order to support the achievement of meaningful living. This development draws on appropriate access to healthcare, education, gender equality, peace, and stability on a global scale. The idea behind social sustainability is that a choice or activity should advance societal improvement. It also involves issues such as environmental law, local participation and involvement, and human rights protection. Social sustainability is equally concerned with how a household can gain and maintain an adequate and decent livelihood (Chambers & Conway, 1992).

Institutions Defined

Institutions are “the humanly devised constraints that shape human action” (North, 1990, p. 3). Institutions are referred to by Ankarloo (2002) as the rules of the-game in the economy, whereby organisations (the players) emerge in reaction to the institutional structure. The DFID (2003) distinguishes between institutions and organisations by defining institutions as the rules of the game and organisations as how we structure ourselves to play. However, Chambers (1983) uses the term "institutions" to refer to both organisations and the rules, processes, and norms that are represented in regular interactions and behaviours inside an organisation.

There are formal and informal institutions (North, 1990). Formal institutions are those where rules are explicitly stated in public laws that call for external enforcement by a third-party organisation, such as the police, prisons, legal system, and prosecutors, to ensure their observance. On one hand, formal institutions are impersonal as the rules apply to all persons or organisations (Khan, 2010). On the other hand, informal institutions are laws that are not technically written down but are nonetheless upheld by a third party that relies on the mobilization of informal power. The sanctions in the informal institution are enforced by either an unorganised actor or organisations such as churches and associations (Voigt & Kiwit, 1998).

The management of rural and peri-urban areas involves both formal and informal institutions, and these relationships are crucial (Ubink & Quan, 2008). The application of formal rules to a large degree depends on informal rules, and the interrelationship can be used to lower the cost of enforcing formal rules (North, 1990). Formal institutions fall short in situations involving the management of resources that are characterised by intricate, contradictory, and ambiguous local relationships and behaviours (Leach, Mearns, & Scoones, 1999). The reverse is also true, as in the absence of formal enforcement and policing, informal rules may change quickly and new institutions that do not serve the interests of the majority may develop.

Institutional arrangements impact the processes of endowment, entitlement mapping, and livelihood outcomes; hence, institutions are crucial to the study. According to Leach et al. (1999), a variety of formal and informal institutions play a significant role in managing access to and control over Marantaceae (Marantochloa purpurea) leaves, which provide a source of income for some rural communities in southern Ghana. The issue with entitlement mapping, or access to and control over farmland, is influenced by complex relationships between both formal and informal institutions.

Formal Institutional frameworks for Mining in Ghana

Within the context of sand mining, institutions are very important in providing livelihood security for local residents. The 1992 Constitution of the Republic of Ghana and the Mineral and Mining Act, 2006 (Act 703), as amended by the Minerals and Mining (Amendment) Act, 2015 (Act 900), and the Minerals and Mining (Amendment) Act, 2019 (Act 995), serve as the main legal foundations for the modern institutional framework for managing Ghana's mining sector. All legislation and Legislative Instruments (L.I.) related to mining are passed by the Ghanaian parliament. The Metropolitan, Municipal, and District Assemblies (MMDAs) are permitted by law to enact by-laws to regulate mining activities within their areas of jurisdiction.

Legal enactments, including the Minerals Commission Law, 1993 (Act 450), Mineral and Mining Act, 2006 (Act 703), Environmental Protection Agency Act, 1994 (Act 490), Local Governance Act, 2016 (Act 936), and the Land Use and Spatial Planning Act, 2016 (Act 925), are among the formal institutions formulated to regulate all mining activities in Ghana. The three sub-sections that follow discuss the mandate of some public organisations mandated to implement the aforementioned laws in relation to mining in Ghana.

Minerals Commission

In Ghana, the right to extract any mineral resources is vested in the President of the Republic. However, the Minister in charge of the Ministry of Lands and Natural Resources instead exercises this authority by issuing licenses to applicants who meet the requirement to engage in mining in Ghana. The Ministry operates in three main sectors: land, forestry, and mining, all of which are administered by a commissioner. The Minerals Commission, which was created under the Minerals Commission Law (PNDCL 153) of 1986 and later amended by the Minerals Commission Act, 1993 (Act 450), is the organisation that represents the mining industry in Ghana (Hilson, 2002). There are five departments under the Minerals Commission, including finance and administration, monitoring and evaluation, small-scale mining, legal and planning, and policy analysis, as well as one division, the inspectorate division.

Potential applicants notify a nearby office of the Minerals Commission of their desire to mine, and this starts the process of getting a mining license. When appropriate, the area is delineated, and site plans are prepared after an official of the Commission assesses the suitability of the selected site. In the case of sand mining, a notice of intention to allot the area for mining is published for 21 days. If there are no objections after the 21-day notice, the applicant completes the required paperwork and submits it to the Minerals Commission in Accra for a mining lease or license (Minerals & Mining Act 2006, Act 703).

Establishing and enforcing environmental, health, and safety requirements in mines is the responsibility of the Minerals Commission's Inspectorate Division (Tenkorang, 2016). Additionally, the Inspectorate Division ensures that all mining-related operations and firms adhere to Ghanaian legal and regulatory requirements. For the preservation of natural resources, community health and safety, and the environment both before and after mining, the Minerals Commission works in conjunction with the Forestry Commission established by the Forestry Commission Act, 1999 (Act 571) and the EPA.

Environmental Protection Agency

Environmental laws in Ghana date back to colonial days, though most of the laws were related to disease prevention and control (Adjarko, Gemadzie & Agyekum, 2016). Following the Stockholm Convention of 1972, the Environmental Protection Council (EPC) was created. All environmental issues in Ghana were to be coordinated by the EPC. The Environmental Protection Council (Amendment) Decree, 1976 (SMCD 58), replaced the Environmental Protection Council Decree, 1974 (NRCD 239). The 1992 Rio de Janeiro Earth Summit sparked a global commitment to the environment and paved the way for the passage of the EPA Act of 1994 (Act 490) (Mensah, Justice, Osei, & Henrietta, 2020).

The Environmental Protection Agency (EPA) was founded by the Ghanaian Parliament under the EPA Act, 1994 (Act 490), which charged it with the responsibility of implementing environmental policies, rules, and regulations. Since its founding, Ghana's EPA has emerged as the main agency in charge of good environmental management practices. The agency undertakes routine inspections of mining activities in Ghana to ensure that environmental standards are maintained. The EPA also investigates grievances from the general public in connection with poor environmental quality.

Since the Environmental Assessment Regulation, 1999 (L. I. 1652), was enacted, mining companies in Ghana are required to complete environmental impact assessments. The environmental permit procedure involves a thorough assessment of the goals of the proposed mining operation and its anticipated environmental effects. According to Legislative Instrument, 1999 (LI 1652), the EPA must receive a complete environmental impact statement before a mining license application may be approved. LI 1652 offers a comprehensive strategy with precise guidelines on how to conduct mining activities without having a negative influence on the environment's quality or the public's health. The screening of applications for environmental permits by the EPA covers issues as detailed below:

> ‘The location, size, and likely output of the undertaking; the technology intended to be used; the concern of the general public, if any, and in particular the concerns of immediate residents, if any; land use; and any

other factor of relevance to the particular undertaking to which the applicant relates' (Section 5(1) of LI 1652).

When a request for an environmental permit is approved, the permit is good for 18 months, starting on the day it is issued. According to Sections 21(1) and (2) of LI 1652, the permit becomes void if the project is not operational within 18 months. After the mining operation starts, the EPA must receive an annual environmental report 12 months after the start of the mining operation and every succeeding 12 months. The Minerals Commission recommends to the sector minister to grant the mining lease to the applicant after the prospective miner has met all preliminary requirements, as seen in Figure 5.

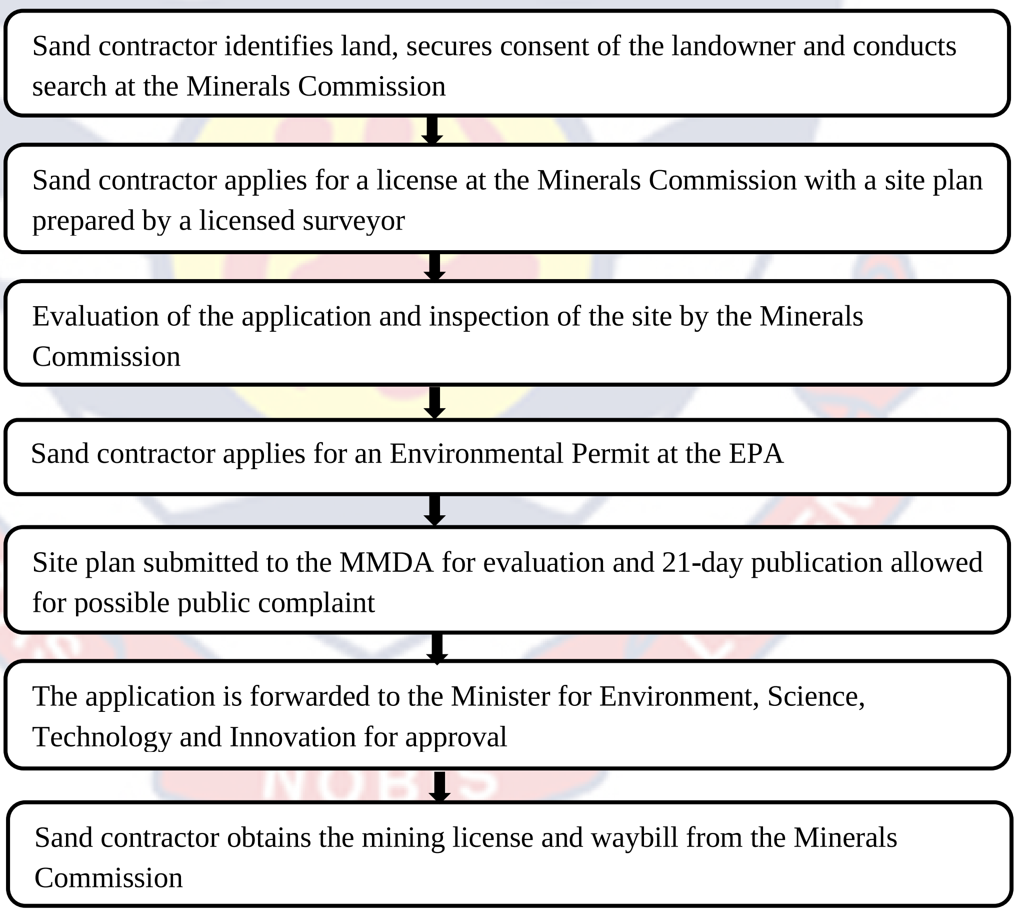

Figure 5: Licensing process for sand mining
Source: Author's compilation based on available literature

Metropolitan, Municipal and District Assemblies

According to Section 12(1) of the Local Governance Act of 2016 (Act 936), the MMDAs are the highest political and administrative authorities in their respective areas of jurisdiction. Therefore, MMDAs are responsible for the development, improvement, and management of human settlements and the environment in their local government areas. As such, MMDAs are key stakeholders in the management of mining undertakings. Act 936 empowers MMDAs to take necessary action through the promulgation of by-laws to ensure that all mining activities conform to sustainable environmental standards. The MMDAs' Spatial Planning Committee is in charge of overseeing physical development and other land use decisions on both state-owned and privately owned land. The EPA and Minerals Commission are required to work closely with MMDAs in the management of mining in Ghana.

Traditional Institutions

Traditional institutions include customs, laws governing land use, taboos, totems, and other value systems deep-seated in a society's way of life that are often bequeathed to the society by their previous generations, with chiefs as heads of the institutions (Gyekye, 1997). Traditional institutions are the units of organisational structure within a community and are helpful for the administration of natural resources, local political frameworks, and peacekeeping. Traditional institutions help address issues that contribute to insecurity and vulnerability in local communities (Uphoff & Buck, 2006).

The coordination of all other traditional institutions by the chief and their elders makes the chieftaincy institution very important in the traditional hierarchy of governance. Ofosu-Mensah (2010) notes that chiefs serve as mediators between the ancestors and the community members. They perform functions that include the following: regulating access to land, resolving land-related conflicts, codifying customary laws, dealing with theft, festivals, sacrifices, divorce, promoting economic development, and other spiritual interventions such as the reversal of curses. Traditional institutions support the administration and upkeep of renewable resources, such as the forest, which provides a living for many. Customary courts are used in the execution of these practices, especially in law enforcement and conflict resolutions (Sharma, 2009).

Under the traditional system, conservation of natural resources is done with great respect and strong conservation requirements (Aniah, Aasoglenang & Bonye, 2014). Institutions like land priests, chiefs, or clan heads enforce the laws governing access and use of resources through specific land use regulations. Individuals who break such rules are subjected to the appropriate punishment under the customary law. Consequently, through the use of taboos, beliefs, totem, and other sacred customs, the management of natural resources by traditional institutions was relatively successful until recently (Shanunu, Achanso & Mumuni, 2022). The incorporation of chiefs into the formal governance system led to a breakdown in accountability between chiefs and their people, thereby leading to a reduction in control and/or concern for natural resource management (Rathbone, 2000).

Traditional institutions are criticized for a number of reasons. First, they are considered androcentric, representing men’s reality while legitimising women’s subordination (Beall, 2006). The critique is founded on the argument that the chieftaincy institution is dominated by men. The performance of customary rights such as female circumcision, land tenure arrangements, and community decision-making among others, is inherently undertaken to advance the agenda of patriarchy. Even though the position of queen mother, especially in the Akan tradition of Ghana, is reserved for women, the power of the queen mother does not match that of the chief in traditional circles. Second, traditional institutions are unable to manage property properly, which increases the transaction costs associated with allocating resources to their community members (Economic Commission for Africa (ECA), 2007). Third, the glowing economic diversity as a result of globalisation is largely beyond the expertise of traditional institutions to devise strategies to reduce poverty and other hardships their constituencies face without state interventions.

As advanced by North (1990), modern state institutions should collaborate with traditional institutions in the interest of sustainable resource management, particularly in rural communities where traditional institutions are highly valued. The two institutions' integration would guarantee stronger service delivery, health, and access to justice, as well as better representation and participation (ECA, 2007). According to Article 270 of the 1992 Constitution, Ghana's laws must be in congruence with the customary rules established by the National and Regional Houses of Chiefs. It is therefore important for the formal institutions to be administered in a way that acknowledges traditional institutions since informal rules largely govern the lives and livelihoods of the majority of rural residents.

Land Tenure System in Ghana

Ghana has a dual land tenure system that combines statutory and customary tenure. The land management systems run parallel to each other, with about 80% of land under the customary system (Locke & Henley, 2016). The rights and obligations to the customary land are vested in lineages that are represented by chiefs and/or other traditional authorities, such as traditional priests, Tindanas and clan heads. The customary land held by chiefs are categorised either as stool land or skin land, as in the southern and northern parts of Ghana, respectively. The Lands Commission of Ghana manages the remaining 20% that falls under the statutory tenure of Ghana on behalf of the government (Bugri, 2008).

The customary tenure in Ghana can be broadly categorised into two systems. The first category is situations where land ownership is vested in communities with tenure relations built on territorial control. This type of land tenure is observed in southern Ghana, mainly amongst Akans (Aryeetey, Ayee, Ninsin & Tsikata, 2007). The second situation involves clans controlling land ownership. Among tribes like the Ga, this is typical (Oduro & Adamtey, 2017). Ownership of land under any of the systems may come about in four ways. First, discovery and continuous settlement. Second, conquest by conflict and subsequent settlement. Third, a gift from another group that owns land or a traditional leader. Fourth, purchase from another family or clan that owns land.

Land ownership under Ghanaian customary tenure has some distinct title or interest. The highest kind of proprietary interest under community ownership is based on allodial title, which, depending on how the property was acquired, may belong to a stool, clan, family, an earth priest, or a private individual. Allodial title holders have unrestricted, permanent control over the land. The chief or family head, who owns the land in trust and oversees it for the entire community, has the authority to dispose of it in consultation with the elders of the community. (Arko-Adjei, 2011).

Community members or subjects of a stool or skin may enjoy the usufructuary estate on the land. A clan or family member may develop any vacant communal land that is not occupied by another family member as per their inherent right to land. This includes the right to cultivate crops for subsistence purposes, erect structures, graze livestock, and gather small-scale forestry products like firewood, snails, mushrooms, herbs, and fish. Usufructuary estate holders have security for use, and their right to use only terminates upon abandonment or failure in succession (Mahama & Dixon, 2006). The community's members are allowed to transfer land among one another, but they are not allowed to transfer it to a stranger. Land can only be transferred to a stranger with the consent of the main community elders and the person in whose name the allodial title is vested.

Tenancies are agreements between allodial title holders, or usufructs, and outsiders or individuals who are not a part of the group of people who own the land. Strangers are allowed to use only the land they have been allocated for a specified use over an agreed-upon time. An agreed-upon percentage of the farm or the produce is given by a tenant farmer to the landlords. The known tenancy arrangements in Ghana are either abunu or abusa. The abunu is where the produce is shared equally (50-50), while the abusa is where a ratio of 1:2 is used, with the farmer taking two-thirds of the produce (Blocher, 2006). Without the prior consent of the landowners, strangers are not permitted to transfer land to other strangers. Additionally, they are not entitled to any of the economic rent from the land that accrues to the landowners.

Customary tenure is flooded with several challenges. First, because customary rules are so flexible, they make it difficult to handle contemporary issues in connection with land use. The issue makes it possible for individuals to manipulate others and advance their own interests at the expense of the common good (Ubink & Quan, 2008). This challenge has resulted in tenure insecurity, including the loss of farmland and usufructural rights. Second, growing urbanisation has caused agricultural land to be converted into residential land use, which has led to the forcible eviction of farmers, particularly those who are farming under tenancy agreements. Third, there is an increasing commoditization of land with absolute neglect of the fact that chiefs, clans, and family heads are to manage the land in the interests of both present and future generations. Fourth, with regard to the trust land, chiefs answer to the ancestors rather than the present beneficiaries. Therefore, the chief and the council of elders receive a portion of the money from the sale of land at the expense of the great majority of the populace.

Summary of the Chapter

The chapter revealed that in 2010, for the first time since the post-independence population census, Ghana's demography changed, with a greater proportion of urban residents than rural ones. The chapter made it clear that Accra, with more than 2.5 million citizens, was Ghana's largest metropolis. Due to Accra's expanding population, many residents rely on the rural and peri-urban areas for housing and daily necessities. The chapter also discussed the DFID sustainable livelihood framework, which is central to issues relating to livelihoods.

The chapter also demonstrated the importance of formal institutions created to control all mining activities in Ghana, including the Minerals Commission Law, 1993 (Act 450), the Mineral and Mining Act, 2006 (Act 703), the Environmental Protection Agency Act, 1994 (Act 490), the Local Governance Act, 2016 (Act 936), and the Land Use and Spatial Planning Act, 2016 (Act 925). These enactments were administered mainly by the Minerals Commission, EPA, and MMDAs. Other concepts reviewed were informal institutions, sustainable development, and Ghana’s land tenure systems. The theoretical foundation, empirical research, and conceptual framework that underlie the study are all highlighted in the ensuing chapter. The theories reviewed for the study were; urban political ecology, entitlement theory, and political settlement theory.

CHAPTER THREE

THEORETICAL REVIEW, EMPIRICAL REVIEW AND CONCEPTUAL FRAMEWORK

Introduction

The chapter discusses the theoretical underpinning, the empirical literature on sand mining, and the conceptual framework directing the research. First, a theoretical evaluation is a crucial component of research since it enhances the relevance and acceptability of research findings to the field's prevailing theories. Theoretical analysis clarifies a research's direction, bases it on theoretical ideas, and gives the research inquiry focus (Neuman, 2011; Adom, Hussein & Agyem, 2018). According to Neuman (2011) and Grant and Osanloo (2014), the theoretical perspective is important since it serves as the foundation for knowledge building in research. Additionally, it provides a foundation for reviewing literature and guides the selection of data collection and analytic techniques (Kumar, 2019; Lysaght, 2011; Grant & Osanloo, 2014).

Second, an empirical review is important to avoid duplication of research and to advance understanding of the problem being researched (Sekaran, 2003; Neuman, 2011; Griffee, 2012). According to Walliman (2011), an empirical review can be used to determine the current state of knowledge in a particular field of study. Additionally, empirical review aids in identifying knowledge gaps, highlights various research approaches that can direct the study, and helps contextualize findings (Neuman, 2011; Griffee, 2012).

Third, the conceptual framework is crucial because it offers a logical organisation of related concepts, which assists the researcher in creating a graphic illustration of how issues within a study relate to one another (Kumar, 2019; Luse, Mennecke & Townsend, 2012; Grant & Osanloo, 2014).

Theoretical Framework

The Urban Political Ecology (UPE) theory, entitlement theory, and political settlement theory form the theoretical frameworks of the study. The resource curse theory, which has been used by many researchers to explain the effects of mining, was also reviewed, though it was not central to this study. These theories were combined because they each contributed to the solution of the research problem. In general, the theories aided in understanding the variety of land claims and interests in sand mining communities, the effects of sand mining on local livelihoods, and the institutions in place to control sand mining.

Urban Political Ecology

The theory was developed as a result of urban social theory's inability to take ecological and physical factors into consideration in discourses relating to urbanisation. Heynen (2006) argues that connecting nature with urban theory is important for holistic urban analysis, which could aid urban political activism. UPE also emerged to fill the gap created by environmental theories, which have neglected urbanisation as a major driver behind the many environmental issues society faces. Williams (1973) asserts that the urbanisation process is inextricably linked to the alteration of nature and its social relationships. Urbanisation itself has been described as the process whereby nature is sacrificed for the built environment (Bookchin, 1979).

UPE emphasizes the role of capital in reforming nature's development and is rooted in the Marxist tradition of historical materialism (Heynen et al., 2006; Zimmer, 2010). As a result, UPE highlights the uneven ways that cities like Accra develop. From Accra's fringes, sand is mined in market-driven or capitalist social and political relations for the development of the city. This social, environmental, economic, and political change resulting from the rapid urbanisation of Accra leads to the emergence of new power structures where many social actors with disparate interests compete to defend and control environmental resources by engaging in power struggles based on class, ethnicity, or gender (McAdams, 1980). Environmental change is the product of this process of conflict. Therefore, UPE explains that urbanisation results in a situation in which the environment is managed and controlled to serve the interests of the affluent while the general populace is marginalised (Heynen, 2006). Better put, urbanisation enhances conditions in the urban core centres or areas inhabited by elites, while it inversely worsens conditions in other places populated by the poor.

Metabolism is a key idea in UPE and is defined as a "dynamic process by which new socio-spatial formations, material entanglement, and collabourative enmeshing of social nature emerge, present themselves, and are explicitly created through human labour and non-human processes simultaneously" (Heynen, 2014, p. 599). Metabolism relates to how social power influences the extent to which the natural environment is knotted in the process of urbanisation and produces uneven forms of power. Human labour is central to the process of metabolism because humans are able to manage their input to reflect their intentions and interests in order to satisfy their respective needs (Zimmer, 2010). It must be stated that the diverse levels of power the actors have determine who benefits or loses from this process.

The position of actors with respect to their usage of environmental resources arises from performing environmental practices that are perceived to be legitimate (Robbins & Sharp, 2006). It is through institutions — rules and norms — that the legitimacy or practices of the environment are established (Oliver-Smith, 2006). Rules governing sand mining in this sense, therefore, might also explain how sand is mined and who mines the sand. Investigating the contentious characteristics of certain institutions and behaviours is a key area of interest for UPE analyses. The theory provides the basis for examining institutions that mediate sand mining at the fringes of Accra.

UPE offers valuable knowledge of how Accra's urbanisation results in sand mining near rural and peri-urban periphery settlements, involving a variety of actors with different roles, interests, strategies, and levels of power. The theory's strength is that it emphasises how power dynamics among different social actors acting at different scales — including the state, traditional leaders, miners, sand contractors, and farmers — impact sand mining outcomes. For instance, in the sand mining industry, actors are involved in a number of conflicts for land, institutional legitimacy, and control, which leads to the use of various tactics that benefit the wealthy while marginalising the weak. When considered as a whole, this theoretical framework is useful for comprehending how Accra's urbanisation affects sand mining as well as the sources of power and interests that result in wins and losses for the various actors.

UPE is not without criticism, as some scholars have argued that most analyses tend to concentrate on cities in developed countries while ignoring the global south, where the majority of the environmental problems are found (Myers, 2008). The theory is equally criticised on the grounds that, though it acknowledges that not all actors benefit from the process of metabolism with their environmental entitlement, studies have not clearly demonstrated society's interaction with nature to identify who are the winners and losers (Zimmer, 2010). The livelihood strategies the actors in sand mining communities employ as a result of the transformation of nature are, therefore, not addressed. These lapses called for the entitlement theory.

Entitlement Theory

The three famines that occurred in Bangladesh, the Sahel, and Ethiopia between 1972 and 1974 served as inspiration for Sen's (1987) Entitlements Theory (ET), which was initially put forth in the middle of the 1970s. The Great Bengal Famine of 1943–1944, which claimed millions of lives, was definitely the source of Sen's initial inspiration to propound the theory. According to the ET, famine and poverty are usually brought on by people being unable to obtain the food that is available because they have lost their entitlements, not necessarily a lack of food supply (Devereux, 2001; Verstegen, 2001; Tiwari, 2007; Mogaka, 2013). Accordingly, famine is a man-made phenomenon that mostly affects the weak (Verstegen, 2001; Adger, 2006).

Vizard (2001) argues that ET concentrates on analysing a person’s rights and entitlements to things. ET focuses its analysis on secured and adequate access to resources (food, for example), the many channels and drivers of access, the laws and institutions that regulate access, and the unique positions and vulnerabilities of various groups (Gasper, 1993). Even though the majority of Bengal's population only experienced minor difficulties during the famine (Sen, 1986), the same could not be said of vulnerable groups, including rural craftsmen, landless farmers, and fishermen, who lost sufficient purchasing power and also lacked adequate alternative access to food (Gasper, 1993).

The ET gives more weight to how specific people or groups obtain access to food than the overall availability of food in a society. Therefore, scarcity is not a state of food shortage but rather of people not having enough to eat (Sen, 1981). The entitlement relations that control ownership, including what a person owns, the trading opportunities that are available to the person, what is given to the person for free, and what is taken away from him or her, determine that person's capacity to order food.

Endowment, entitlement set, entitlement mapping, and entitlement failure are the four main concepts on which the ET is based (Sen, 1981). First, the term "endowment set" describes all the resources or assets that a person or household owns, including their own labour (Sen, 1981; Osmani, 1993). Intangible assets like talents, labour, and community involvement are examples of these endowment sets, as are tangible assets like livestock, property, money, and equipment (Sen, 1981; Osmani, 1993). Through these endowments, a person is able to access all the various necessities required for their existence (Sen, 1981). The most vulnerable are persons or households with inadequate endowment.

Second, entitlement is the collection of goods and services that can be obtained legally by a person with his or her endowments and the available opportunities in society (Sen, 1981). It is the range of alternative livelihood options that a person has, as reflected by the laws, regulations, and procedures, that determines how both tangible and intangible assets are used. According to Vizard (2001), a person's entitlements are all of the things that are available to them as a matter of right. Carney (1998) explains that giving poor people enough access to assets and making sure that the systems and procedures that affect their ability to access chances for livelihood are efficient are the two most crucial livelihood interventions.

Third, the entitlement mapping draws attention to the relationship that describes the range of potential commodity bundles that are lawfully attainable from a given ownership bundle through trade, labour, production, inheritance, or transfer (Sen, 1981). It relates to how quickly resources from the endowment set may be turned into products and services. Fourth, entitlement failure refers to a condition of inadequate production to meet the levels of demand (Devereux, 2009). Trade-based entitlements, production-based entitlements, own-labour entitlements, and inheritance or transfer entitlements are the four legal sources of access and control over resources that Mogaka (2013) discusses. Accordingly, entitlement failures can take place from these sources in either a pull failure or a response failure fashion (Sen, 1986; Vizard, 2001). On one hand, pull failure comes when people lose their sources of livelihood, which leaves them without income to buy food, leaving them susceptible (Sen, 1981).

On the other hand, response failure occurs when there is a shortage of food production or when traders hoard food, which results in a drop in supply, which then leads to famine (Khogali & Thakar, 2001). Osmani (1993) argues that pull failure caused famine in ancient subsistence economies, whereas response failure causes modern famines. The theory postulates that both pull and response failures might occur in the present, either independently or concurrently, given that subsistence economies are still common in modern times, particularly in developing nations (Von Braun & Lohlein, 2003). Leach, Mearns, and Scoones (1997) explain that entitlement failure rather than a lack of institutionally supported claims is more likely to be the cause of the poor's incapacity to assert their rights against those of more powerful actors during struggles for access to and control over resources.

Efforts have been directed at the extension of Sen’s (1981) analysis of famine to other fields, including environmental entitlement. Sen’s (1981) theory is useful in the context of environmental entitlement to explain how unsustainable sand mining could dominate and contribute to environmental change, which affects access to and control over natural resources, particularly farmland. The effects of environmental change are socially differentiated depending on the individual household’s endowments (Leach & Mearns, 1991). The theory contributes to the comprehension of how different groups of people obtain access to and control over environmental resources and how the diverse ways the different actors use natural resources produce costs and benefits.

A typical challenge of the debates about environmental resource problems is that the arguments are often influenced by supply-side focus such that availability or scarcity is related to the total population (Leach et al., 1997). When a resource's availability declines, for instance, it is perceived as a problem that affects everyone in society, but the poor may be more affected since they rely disproportionately on that resource for their survival (Mearns, 1996). The central issue in the entitlement argument is securing access to and control over natural resources through customary laws, social conventions, norms, or the market, not just the availability of the resource (Scott, 1976; Swift, 1989).

Contrary to food entitlements, environmental entitlements emphasise the roles formal and informal institutions play in determining people's access to and claim to resources (Leach et al. 1997). Therefore, environmental entitlements are the result of two things: (1) the environmental resource bundles that people control because they produce them, own them, or belong to a particular social or economic group; and (2) their capacity to use those resource bundles effectively (Leach & Mearns, 1991).

The entitlements theory emphasises the attributes of livelihoods as mediated by households' endowments (Leach et al., 1997; Sen, 1981). It also examines variables that may have an impact on a person's entitlement, such as the tenure of natural resources, labour access and agreements, social networks, capital endowments, and access to technology, education, and training. Though the theory recognizes the role of institutions as mediators of the entitlement process, the reasons why institutions fail to effectively regulate access to, control over, and use of environmental resources are, however, not explained. The political settlement theory offers a lens to understand why institutions might not effectively mediate the entitlement process.

Political settlement theory

The relationship between institutions and natural resources causes institutions to encompass all policies, guidelines, conditions, and authorities related to the resource (North, 1990). According to the political settlement theory, institutions and other policies are created within the framework of the "social order" that results from political agreements amongst influential groups in society (Khan, 1995). It also refers to agreement among elites on how resources and power are shared and exercised, respectively (Di John & Putzel, 2009). Formal and informal institutions that allocate benefits in accordance with the relative power of influential actors are required for the achievement of political settlement. Khan (2010) defines a political settlement as an association of institutions and authorities that is both consistent with one another and durable in terms of both political and economic sustainability.

The theory advances that powerful actors would strive to alter rules unless they were compatible with the allocation of power such actors desire and the distribution of adequate benefits to them. Though government agencies mandated to enforce rules have different enforcement capabilities such as quality of personnel, resources, and internal motivation, the efficacy of enforcement of rules is greatly influenced by opposition or support from influential groups in society because rules have varying negative and positive effects for different people (Khan, 2010). Roberts (2013) argues that the regulatory system in SSA was based on a domestic elite-driven governance orientation caused by factors such as conflict and transnational influences.

The level of practical enforcement and the costs of enforcing laws depend, in great part, on the intensity of opposition to their enforcement (Khan, 2010). The regularity of violations, the cost of enforcement, or a combination of both can be used to gauge how difficult it is to maintain compliance with a rule. If there are many violations of the rule or the cost of enforcement is considerably high, then it suggests that some actors are attempting to disrupt the institution's defined means of allocating benefits in order to obtain greater benefits for themselves. The extent to which such violations would persist is determined by the relative power of the actors who stand to gain from the violation of the rule and that of those tasked with enforcement of the rule (Acemoglu & Robinson, 2012).

Khan (2010) asserts that institutions and the distribution of power are interrelated. Institutions affect the distribution of power to different actors and the financial benefits that accrue to them. Conversely, the distribution of power has an impact on institutions because strong groups are more likely to influence formal and informal institutions to accomplish the benefits they want. The implication is that an institution is likely to lead to high levels of contestation, expensive enforcement, or only very limited enforcement if the distribution of benefits is inconsistent with the distribution of holding power in society. The powerful group can undermine the institution by legal processes, violate the rule and accept the consequences or engage in open conflict.

Holding power, which is defined as the ability of a group to engage in and win conflicts, is very important in discussing the enforcement of institutions (Khan, 2010). Holding power depends on two important factors: ability to impose costs on others and the ability to absorb costs. The more effectively a group can impose costs on others, the more probable it is that they will succeed in achieving their desired result. Conversely, actors who can bear the cost of a battle can endure longer and get their desired outcome. Though economic strength is important in determining who has much power, other factors, such as the ability to absorb pain, which the poor may possess, are equally important and can explain why the rich may not always win conflict. Other important factors include determination and the ability to organise large number of people to support an issue.

According to Devkota (2010), incentives, coercion, or trust are typically the sources of holding power. First, coercive power emanates from the use of force, including the arrest of another actor, physical assault, and threats. Second, using incentives as a source of power involves finding ways to control other players' behaviour by providing rewards or money. Third, when an actor just accepts information from another actor without verifying its accuracy, this is known as trust power.

The political settlement theory helps to explain why defective institutions might exist. The theory assists in analysing the social and political-economic context in which institutions must function in order to ensure sustainable sand mining in the research areas. This theory makes an essential contribution by prioritizing informal institutions for explaining the relationship between governance and developmental issues in developing nations, where the clientelist nature of politics is widely accepted. Numerous strong organizations in emerging nations are informally structured based on patron-client networks (Khan, 2010).

In developed nations, influential groups advocate for regulations that grant them access to resources on favourable terms for productive investments. Conversely, some actors in poor nations with weak production capacities but strong informal networks can manipulate formal laws to gain resources that are frequently misappropriated (Khan, 2010). The evidence of the significant discrepancy between what formal rules state and what actually occurs in practice and the reasons why formal institutions are challenging to implement are related to the distribution of organizational power, which works by distorting the application of formal rules to bring about an allocation of rewards that more closely meets the interests of influential groups (Khan, 2010).

Natural Resources: Rent-Seeking and the Dutch Disease

Auty (1993) first proposed the resource curse theory, also called the paradox of plenty, to explain why resource-rich countries do worse economically than resource-poor nations. It asserts that resource-rich nations, areas, or locals suffer more severe declines in economic growth than resource-poor areas like the

Asian Tigers—Hong Kong, South Korea, Singapore, and Taiwan (Ernst, Hausman & O'Connor, 2007).

Numerous factors have been identified as the cause of the area's insufficient growth. First, Wexler (2009) argues that resource curses occur when there are governance problems for natural resources. Second, the slow growth experienced by resource endowed economies has also been explained by the lack of quality institutions and good governance (Beland & Tiagi, 2009). Third, mining increases economic inequalities in the producing localities and their surrounding communities. Mining accounts for substantial damage to the environment, livelihoods, and poverty among local residents (Ponce & McClintock, 2014).

A review of the theoretical and empirical literature reveals the ways in which resources might have a detrimental impact on a country's or region's economic performance. They consist of the following: (1) a rise in exchange rates; (2) an absence of learning by doing; (3) weak institutions; (4) dictatorial political systems; (5) corruption; (6) hope for better times and low savings; (7) instability of international commodity prices; (8) rent-seeking behavior; (8) unsustainable policies; (9) environmental degradation; and (10) limited local opportunities (Van Der Ploeg, 2011; Suutarinen, 2015). The three major resource curse models —Dutch disease, rent-seeking, and institution models — are proposed by Akylbekova (2015) to explain the theory. However, because institutions have been discussed in Chapter Two, emphasis would be placed on the Dutch disease model and the rent-seeking model.

Dutch disease model

The Dutch disease refers to the coexistence of flourishing sectors and trailing sub-sectors of traded goods in the economy (Sachs & Warner, 1995). By diverting resources away from the latter, the booming sector puts pressure on the lagging one and raises the relative cost of non-traded commodities (Corden & Neary, 1982). The collapse of non-mining industries, mostly agriculture, is a key indicator of the Dutch disease because of increased competition for inputs (land), which causes a sharp fall in agricultural production. Natural resource-based productions naturally restrain areas of the economy that are responsible for economic growth and cause the relative price of manufacturing products to rise, thereby potentially affecting economic growth adversely (Corden & Neary, 1982).

The impact of natural resources on the economy is explained through a number of Dutch disease models. These models include Krugman's (1987) model, which examines how natural resource appreciation limits growth in other economic sectors; the learning-by-doing model, which examines how productivity is increased over time through practice (Torvik, 2001); and the shift of labour from the industrial sector into the resource sector, which is also explained by Sachs and Warner's (1997) endogenous growth model.

Rent-seeking model

Compared to the Dutch disease model, the rent-seeking model emphasises the influence of institutional structures and strong actors on economic growth. In contrast to what the Dutch disease model predicts, Lane and Tornell (1996) contend that rent-seeking behaviours that distort redistributive processes are to blame for nations' weaker economic growth than contraction in the manufacturing sector. In this model, natural resources are overexploited as a result of harmful rent-seeking activities by powerful actors. Barbier, Damania, and Leonard (2005) claim that wealthy actors engage in resource depletion through lobbying and corrupt practices. Rent-seeking undermines equitable and fair resource distribution, lowering social equity and economic efficiency (Gylfason, 2001).

Rent-seeking has an impact on economic performance because it may encourage businesses or government organisations to abandon other productive endeavours in favour of resource extraction industries that generate profitable returns in a relatively shorter time period. For instance, this might have a spillover adverse impact on agriculture productivity because farmland may be converted for exploration and exploitation of resources, thereby negatively affecting agricultural livelihoods and sustainable growth in the host community (Fleming, Measham & Paredes, 2015). The rent-seeking model, however, is dependent on the quality of institutions because they offer a set of guidelines that may successfully discourage rent-seeking behaviour or not (Mehlum, Moene, & Torvik, 2006). Effective resource management can limit rent-seeking, but ineffective resource governance would lead to excessive exploitation of natural resources for the benefit of a select group of influential actors (Acosta, 2013; Misoczky & Bohm, 2015).

Empirical Review

The empirical literature reviewed are based on studies that centred on the effects of sand mining, alternative livelihoods, institutions, and regulations of sand mining. Eight research studies in total were reviewed. These are Peprah (2013), Oduro, Adamtey, and Ocloo (2015), Johnbull and Brown (2017), Koehnken and Rintoul (2018), Dapilah, Nielsen, and Akongbangre (2019), Gondo, Amponsah-Dacosta, and Mathada (2019), Dewi, Susilawati, and Raf (2019), and Anokye et al. (2023).

Effects of sand mining

Peprah (2013) conducted research on the opinions of sand miners regarding the effects of sand mining on land degradation and livelihoods in Wa, Ghana. The study integrated qualitative and quantitative methodologies, which allowed the investigation to produce in-depth data on sand mining. The mixed methods also assisted in the triangulation of the data sources. The qualitative data was aimed at acquiring a deeper understanding of sand mining through non-participant observation and key informant interviews, which unearthed the lived experiences of the residents. On the other side, 50 truckers provided the quantitative data. The drivers were conveniently sampled for questionnaire administration.

The choice of a convenient sampling technique for questionnaire administration is questionable since it is a nonprobability sampling method. Besides, focusing on truck drivers as the main actors in sand mining activity could result in skewed findings since Mensah (1997) found that landowners, sand miners, and regulatory agencies are also important actors in sand mining.

Sand miners, according to Peprah (2013), operated in the informal sector, which was characterised by unrestricted entry and exit, low starting capital, unregistered concessions, a lack of regulation by the responsible official authorities, and reliance on local labourers. Male youth from the mining communities were the main source of labour for loading sand manually with shovels into the tipper trucks. The manpower involved in sand mining found in the research area explains why sand mining was dominated by male youth, with the few male adults employed as truck drivers. Lamb et al.’s (2019) recent finding in Cambodia revealed that sand mining companies mostly employed workers from outside the mining communities and also relied on machine-based mining, contrary to Peprah’s finding.

The adverse effects of sand mining identified in Wa Municipality were: land degradation, unemployment due to the destruction of farmland, food shortages, an increased incidence of malaria, and the absence of reclamation of the affected land. Sand mining activities impacted the vegetation and biodiversity negatively because they exposed and destroyed the roots of trees and caused them to fall later during storms. In addition, the sand pits served as mosquito breeding grounds during the rainy season. Many tenant farmers had also lost their cultivable land to sand mining as a result of the relatively higher financial returns the miners offered to the landowners compared to the meagre returns from farming.

Peprah (2013) further found that the vast majority of sand miners disagreed with the locals regarding the detrimental effects of sand mining. The miners claimed that landowners were duly compensated for the degradation of their land. However, the landless farmers, including the spouses of the landowners, who relied completely on farming for subsistence, denied getting any kind of compensation for the loss of their farmland and crops. The position of the community members in Wa, Ghana, is consistent with Abuodha and Hayombe's (2006) earlier findings in Kenya, where it was revealed that sand mining had contributed to the loss of farmland, leading to economic hardship because not only had the local residents lost their means of livelihood, but they were also not adequately compensated to enable them to engage in other livelihood activities.

Similarly, Johnbull and Brown (2017) assessed the economic and social effects of sand mining on communities around the Victory River, Nigeria. The study's goal was to investigate the locals' opinions about the effects of sand mining. The study used a mixed research methodology. A total of 123 household heads were proportionately chosen from four study communities as the study's sample size. Key informant interviews were also held with sand miners, executives of the community development committees, sand transporters, and community leaders. Primary data were collected with questionnaires, an interview guide, and an observation guide. The data were analyzed with descriptive statistics such as charts and percentages. The qualitative data were also organised into themes to support the quantitative analysis.

The findings demonstrated that the respondents' responses to the effects of sand mining in their communities were varied. A section of the respondents reported that the sand mining industry was beneficial because it had helped in the creation of both direct and indirect employment opportunities, including the provision of support services by some local residents. Other benefits revealed were the development of infrastructure, artificial ponds for livestock, and an improved income stream for some community members. On the negative side, it was discovered that the livelihood chains of those whose survival depended on the environment had changed, resulting in a decrease in their incomes and an increase in poverty. The uncontrolled sand extraction had also contributed to an upsurge in crime, a high cost of living, air pollution, a negative change in cultural values, and the destruction of road networks. It was revealed that the relevant government agencies responsible for regulating sand mining did not enforce the laws adequately, resulting in high rates of illegal extraction.

In a much more recent study, Anokye et al. (2023) investigated the effects of sand mining on land-based livelihood securities in the Awutu-Senya East and West local government areas in the Central Region of Ghana. The study used a mixed methods approach, which allowed data to be gathered from a variety of sources for a thorough examination of the research questions. Quantitative data were collected from 431 household heads, while qualitative data were gathered from the core staff of the local government authorities, the EPA, Minerals Commission, local community leaders, farmer groups, and tipper truck drivers. Data collection instruments, including the FGD guide, interview guide, and interview schedule, were used to gather the primary data. The scope of sand mining and its consequences on farming, transport services, fishing, livestock rearing, and block production were among the variables that were measured in the study.

Anokye et al. (2023) found that sand mining was prevalent in the study areas and largely undertaken around water bodies and on farmland in the rural communities of the studied local government areas, while the urban areas served as the consumption centers. The method of sand extraction was largely accomplished by the use of machines such as excavators, payloaders, and tipper trucks. However, on some rare occasions, tools like shovels, pickaxes, and cutlasses were utilised in addition to the machinery.

On its socio-economic effects, Anokye et al. (2023) revealed that there were different realities regarding the consequences of sand mining on the security of land-based livelihoods. For example, block producers and truck drivers reported that sand mining had a favourable impact on their livelihoods, while most of the household respondents and the key informants rather mentioned that the extraction of sand from their communities had negatively affected their livelihood security. Farmer households reported reductions in crop yields, farm size, sales of produce, and income. Commercial transport operators also mentioned that they spent a lot of money to maintain their vehicles due to the deplorable road network caused by the heavy mining machinery and sand trucks. According to livestock keepers, the availability of grass to feed their animals has decreased as a result of sand mining.

The study further revealed the absence for compensation to negatively affected persons and frequent disputes among landowners, farmers, and sand contractors. Therefore, the authors advised that in order to maintain sustainable livelihoods, the appropriate stakeholders should have a more thorough knowledge of the intricate relationships between sand mining and land-based livelihood security in rural and urban areas.

The findings of Peprah (2013), Johnbull and Brown (2017), and Anokye et al. (2023) concurred, as they found that sand mining had both favourable and unfavourable effects on the livelihoods of people in the mining communities. Positively, the studies observed that sand mining contributes to employment generation either directly or indirectly through the creation of livelihood activities, including the selling of food and water to the miners and the production of blocks. The findings were consistent with those found in Ghana (Mensah, 1997) and South Africa (Mngeni et al., 2017), where the extraction of sand is an important source of employment and income. The major adverse impact of sand mining identified by the studies was the destruction of rural livelihoods, particularly agriculture, due to the degradation of farmland and other environmental resources. Other negative effects were the destruction of roads, erosion, pollution, and land slide. On the method of mining, while Peprah (2013) found that sand was predominantly mined manually with simple tools such as spades, buckets and head pans, Anokye et al. (2023) revealed that sand miners in the Awutu Senya East and West local government areas relied on machinery.

Sand mining and alternative livelihood strategies

Oduro et al. (2015) used the case study approach to examine urban growth and livelihood transformation in Bortianor, Kwashiekuma, Medie, and Ofankor, which are fringe communities of Accra. The study looked at how Accra's expansion impacted the study communities' access to assets for sustaining livelihoods as well as how the locals reacted to those changes. The study was supported by the SLA, and the mixed research technique was employed. The sample size was 198, comprising 140 household heads and 58 key informants. In addition, nine FGDs were organised with community leaders, youth, and persons engaged in sand and stone mining. The household heads were chosen by simple random approaches, while the key informant and FGD participants were chosen through the use of purposive sampling techniques. Review of documents, interviewing, FGD, questionnaire administration, and non-participant observation were among the data collection methods employed.

According to Oduro et al. (2015), the most significant shift in livelihood assets with regard to the growth of Accra was the quality of natural and physical capital. The respondents noticed changes in land usage as a result of Accra's expansion, from crop production to residential, industrial, and commercial development. An important change in livelihood asset noted was land degradation resulting from sand mining, which had rendered large acres of farmland infertile. It was revealed that farmland in the study areas had diminished because of the expansion of Accra and the prevalence of sand mining in the areas.

The transition from agricultural to non-agricultural occupations was the most obvious livelihood transformation in the study areas. Even though farming had been the primary source of income for the residents for the previous five years in all of the study areas, non-agricultural activities had increasingly taken the lead, with the exception of Kwashiekuma. The shift in livelihood was mainly towards the service sector (hospitality industry, transport services, education, health services, administrative and support services, insurance, financial services, information and communication, and real estate activities) and the commerce sector. Residents who had access to and control over a variety of resources for their livelihood were able to make use of the opportunities presented by Accra's urban expansion to improve their quality of life. However, the bulk of the resource-poor farmer households suffered the most because, in addition to lacking the resources needed to benefit from urbanisation, they had also lost their primary employment as a result of the conversion of farmland to non-agricultural use.

Another minor livelihood strategy found was agriculture intensification in connection to the cultivation of vegetables and maize. However, the intensification was marked by continuous cropping, heavy agrochemical usage, and a lack of effective soil management techniques, which Killebrew and Wolff (2010) earlier noted to have contributed to contamination of crops, soil, and both underground and surface water. To address the livelihood insecurity that the local people experienced, Oduro et al. (2015) proposed that MMDAs should include rural and peri-urban livelihood issues in their programmes.

Dapilah et al. (2019) investigated the effects of peri-urban growth on shea trees and livelihoods in the Wa Municipality of Ghana. The qualitative research method was used with data collected through interviews, FGDs, and transect walks. The SLA formed the theoretical underpinning of the study. Four peri-urban communities in the municipality — Kpongu, Guli, Nakore, and Sing — were purposefully selected. Two FGDs were organised in each community, with one of the FGDs targeting community leaders, including chiefs and opinion leaders. This group was selected in order to gather information on governance structure, resource access and exploitation, and the hierarchy of power around the resources. The other FGD dealt with locals, including farmers and shea nut processors. Interviews were also organised with officials of the Municipal Assembly, the Lands Commission, the EPA, and 32 persons purposively sampled from the study communities.

Dapilah et al. (2019) underscored that the rapid urbanisation of Wa Municipality was not generating the desired transformation in livelihoods but rather had adversely affected the shea tree population and local livelihoods in the area. The major factors that had contributed to the situation included sand and stone mining and the absence of land use plans in the research locations. The participants highlighted that the expansion of the building sector to fulfil the growing population's housing needs had led to an increase in sand mining, which had depopulated shea trees and subsequently impeded many people's livelihoods. The clearing of the land and subsequent removal of the top soil were found to cause the shea trees to fall during run-offs.

The study also revealed that mining concession agreements between landowners and sand miners were done without the attention of local community members and the Municipal Assembly. The decision to mine was therefore confined to the landowners, though the majority of the local community members were those who faced the negative externalities of sand extraction. Due to sand mining, the majority of the municipality's population, which depends on land-based occupations, no longer had access to adequate means of subsistence.

Both Oduro et al. (2015) and Dapilah et al. (2019) agreed that urbanisation in Ghana had contributed to land use change with surging sand mining on hitherto land useful for the livelihoods of many people. The situation had negatively affected the livelihoods of the local people, especially ethnic minorities (clans and families without land), the elderly, and females, who were unable to adapt to new urban land use patterns and emerging livelihood options. The dominant alternative livelihood strategies found included informal activities in the service and commerce sectors. The studies failed to assess whether the alternative livelihood strategies were viable. In addition, it was not revealed clearly whether all the negatively affected households were able to adopt new livelihood strategies or not.

Institutions and regulations of sand mining

Koehnken and Rintoul (2018) used the Quick Scoping Review (QSR) approach to examine the effects of sand mining in selected publications based on a comparison of current situations to historical aerial pictures and maps. According to Collins, Coughlin, Miller, and Kirk (2015), the QSR technique makes it possible to draw a well-informed judgement about the scope and makeup of evidence as well as a summary of what it suggests. To offer details about the background and current trends in the international sand mining sector, a traditional literature review was also carried out. The environmental, social, and political issues with regards to sand mining activities were captured. A total of 62 research papers on aggregate mining published in the English language were sampled.

The study's findings on the effects of sand mining showed that, in contrast to many developing nations, industrialised countries had few unlawful sand mining activities. The impacts of sand mining were grouped into three categories: physical, ecological, and social. The physical effects included changes to sediment composition and movement, changes to river features and morphology, changes to flow patterns, and effects on water quality. The ecological effects were reduction in fish population, depletion of other living organisms, and damage to riparian zones, while the social impacts found included unemployment due to reduced fish population, loss of land, and destruction of infrastructure.

Focusing on the regulations of sand mining, Koehnken and Rintoul (2018) found that sand mining regulations were drafted and enforced in only a few industrialised countries. The majority of sand mining regulations, however, were covered by a number of acts and ministries and were formally governed by national mining and environmental protection laws. As a result, there were numerous minor administrative agencies in charge of regulating sand mining, which adversely impacted the management of sand extraction. There were disparities in the interpretation and application of the mining rules as a result of the numerous authorities charged with overseeing the same industry. Koehnken and Rintoul (2018) also found that local government authorities had reduced technical capacity and resources, namely inadequate staff, inadequate information on sand mining, and insufficient power to implement the assigned mandate.

Gondo et al. (2019), for their part, looked into the legal and policy ramifications of sand mining along the Njelele River in South Africa. The study concentrated on a variety of sand mining's regulatory and policy ramifications. Data were collected using the mixed research technique through observation, a participatory rural appraisal, and a household questionnaire survey. Discriminant Function Analysis (DFAs) and K-mean clustering were combined by Gondo et al. (2019) to identify the key environmental factors that explained the current condition of sand mining. Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis was used to examine the regulatory and policy implications of sand mining. A total of 25 sand mining sites were randomly selected for the study.

The results confirmed earlier empirical research that four processes—clearing of the vegetation at the site, extraction of sand, conveyance of the mined sand to customers, and reclamation of the mined area—were typically involved in the extraction of sand (Schaetzl, 1990). Gondo et al. (2019) also found that about 72% of sand mining was done manually, while the remaining was done with machinery. The central government, local government officials, sand miners, buyers, and members of the community were the main sand mining actors.

The negative effects of sand extraction found in the study area were the complete removal of vegetation, reduction in fishing activities, deterioration in water quality, destruction of topsoil, destruction of the scenic landscape, damage to natural habitats, and contamination of water sources. It was further revealed that excessive extraction, accompanied by the aforementioned effects, was prominent in the communities closer to the mining sites.

On the institutional framework, Gondo et al. (2019) found that the mining industry's existing regulations were broader and much more general to the wider mining industry. As a result, the laws were inadequate for regulating the sand mining industry. The institutions were not successful in preserving sand as a resource, allowing for its orderly and sustainable usage, and limiting the negative effects related to its mining. The bureaucratic processes involved in acquiring sand mining permits were also revealed as an institutional bottleneck against the regulation of sand mining. The authors argued for strong institutions and a robust regulatory framework that focuses specifically on sand mining. The need for local government agencies to strengthen development control to ensure that unlicensed sand miners were sanctioned for their adverse externalities was recommended.

Dewi et al. (2019) investigated the effects of environmental management laws on illicit sand mining in South Buton Regency, Indonesia. The study used a qualitative research approach and collected primary data with an observation guide and an interview guide. The study elements were made up of officials of the Department of Mining, Energy, and Environment and household heads in the mining communities. Bandar, Batauga, Lakambau, and Masiri were sampled as the study communities. The authors, however, failed to indicate the actual sample size used for the study.

Dewi et al. (2019) found that the South Buton Regency government did not have regulations for sand mining and relied on broad national regulations that had few basic provisions for sand mining. As a result, sand mining was not appropriately carried out in the study communities. Another challenge revealed was that the Department of Mining, Energy, and Environment was not operating optimally because some units were not functional. The situation was compounded by inadequate staff, especially in the unit that was responsible for managing mining. The situation had led to the absence of monitoring of the sand miners by the regulators. It was further revealed that the sanctions applied to the illegal miners were not strict enough, which did not discourage the miners from illegal extraction. It also came out that the majority of the sand miners were ignorant about the processes involved in obtaining permits for sand mining.

The studies by Koehnken and Rintoul (2018), Gondo et al. (2019), and Dewi et al. (2019) concurred on the absence of specific laws for regulating sand mining. Most governments relied on broad mining regulations that did not effectively address the challenges inherent in sand mining. There were many agencies that were responsible for managing smaller aspects of the sand mining industry, and this had mostly resulted in inadequate collaboration among the agencies. Both Koehnken and Rintoul (2018) and Dawi et al. (2019) acknowledged the issue of insufficient funding for the organisations in charge of managing sand mining. The finding corroborates Mahadevan's (2019) finding that regulatory agencies lacked capacity and political support for managing sand mining.

Table 1 provides a summary of the empirical research examined in this study. This information includes the author(s) name(s), publication year, study topic, study site, research methodology, sample strategy, data collection tool, and major findings. The analysis revealed that there were empirical gaps in the body of knowledge on sand mining and local livelihoods, particularly with regard to the effects of terrestrial sand mining.

First, it was revealed from the literature that the effects of sand mining were inconclusive because different effects were reported by different actors. Second, while a lot of research has been done on how sand mining affects the environment, limited findings exist to reflect the other pillars of sustainability. Third, though some earlier studies identified the actors involved in sand mining, the analysis of their interests and power relations was not revealed. Fourth, studies on the alternative livelihood strategies employed by local residents in sand mining communities have received little attention. Fifth, few studies focused on the institutional framework and regulation of sand mining. However, in most cases, these studies concentrated only on the formal institutions and the regulatory agencies.

Table 1: Summary of the empirical review

No.	Author	Issue of study	Location	Research approach	Sampling procedure	Data collection tools	Key findings
1.	Peprah (2013)	Effects of sand mining on land degradation and livelihoods	Upper East Region, Ghana	Mixed	Convenient sampling	Questionnaires	-Sand mining is operated in the informal sector with male youth as main source of labour. -Adverse effects of sand mining found were: land degradation, unemployment, food shortage, incidence of malaria, absence of reclamation. -Farmers were not compensated for destruction of their farms.
	Johnbull & Brown (2017)	Perception on the impacts of sand mining	Nigeria	Mixed	Proportionate, simple random & purposive	Questionnaires interview guide & observation guide	-Positive and negative effects were revealed. The positive effects were employment, development of infrastructure, income & ponds for livestock, while rise in crime, destruction of roads, destruction of vegetation cover were the negative effects. -There was lack of enforcement of mining laws in the area
3.	Anokye et al. (2023)	Sand mining and land-based livelihood security	Central Region, Ghana	Mixed	Purposive, convenient & systematic sampling	Interview schedule, interview guide & FGD guide	-Sand mined around farmland and water bodies largely with machines -Negative effects on livelihoods were experienced by the residents than the positive effects -No compensation to affected persons

Source: Author’s compilation (2020)

Table 1: continued

No.	Author	Issue of study	Location	Research approach	Sampling procedure	Data collection tools	Key findings
4.	Oduro et al. (2015)	Urban growth and livelihood transformation in peri-urban communities	Greater Accra Region, Ghana	Mixed	Purposive & simple random sampling	FGD guide, Interview guide & questionnaires	-Most important change in livelihood assets were natural and physical assets -Change in livelihood from agriculture to non-agriculture activities -Alternative livelihood strategies were in service and commerce sector -The resource-rich were able to adopt alternative livelihoods effectively, while the poor were unable
5.	Dapilah et al. (2019)	Peri-urban expansion and impact on livelihoods	Upper East Region, Ghana	Qualitative approach	Purposive procedure	Interview guide, FGD guide & Transact Walk	-Rapid population increase, rise in construction, sand mining and lumbering had adversely affected shea tree population and livelihoods -Local community members and the Assembly were not involved in sand mining concession agreements -Decision to mine was made between landowners and miners
6.	Gondo et al. (2019)	Regulatory and policy implication of sand mining	South Africa	Mix	Random sampling	Observation guide, participatory rural appraisal & questionnaire	-Process for sand mining were site clearing, sand extraction, conveyance and reclamation -Sand was predominantly mined from streams manually - Major stakeholders were the community members, local government authority, miners, buyers and central government -Existence of broad regulatory institutions not specific to sand mining

Source: Author’s compilation (2020)

Table 1: continued

No.	Author	Issue of study	Location	Research approach	Sampling procedure	Data collection tools	Key findings
7.	Koehnken & Rintoul (2018)	Impact of sand mining on ecosystem structure, process & biodiversity in rivers.	Global	Qualitative	Purposive	Literature search	-Illegal sand mining occurs less in developed countries than developing countries -Sand extraction regulations covers legislative requirements of numerous Acts and ministries -Regulatory agencies had reduced technical capacity and resources to effectively work
8.	Dewi et al. (2019)	Environmental management policies on the impact of illegal sand mining	Indonesia	Qualitative	Purposive	Interview guide & observation guide	-Absence of specific regulation for sand mining -Inadequate resources for regulatory agencies -Absence of monitoring in dealing with illegal mining -Weak sanctions were applied to illegal miners -Miners were ignorant about the permit or license procedures

Source: Author’s compilation (2020)

Lessons learnt

The review makes clear that researchers used quantitative, qualitative, and mixed method approaches to investigate the problem of sand mining. As a result of its ability to apply both qualitative and quantitative measurements simultaneously in terms of data collection and analysis, the mixed-methods approach was predominantly used in studies on sand mining.

According to the review, random sampling and purposive sampling were the most commonly used sampling methods. The studies that either used a quantitative or mixed-methods approach used random sampling. However, in studies that used qualitative research methodology, non-probability approaches, in particular purposive sampling techniques, were used to pick respondents. Random sampling was employed to choose household respondents, while the purposive sampling technique was utilised to choose the sand mining towns and the players participating in sand mining.

The major instruments used to gather the data were questionnaire, interview guide, observation guide, and FGD guide. These instruments helped in gathering data from actors involved in sand mining including, community members and key officials at the regulatory agencies. In order to assure robustness in data collection and avoid the drawbacks of employing one approach, data was gathered in a variety of ways, allowing for triangulation. The collection of data from various sources ensured the validity of the responses.

The statistical analysis employed by the earlier studies for the quantitative data included chi-square, independent sample t-test as well as descriptive statistics. The descriptive statistics were mainly achieved through the application of percentages, frequencies, and charts. The t-test, on the other hand, measured differences among categories of respondents, while the chi-square was used to analyze relationships or differences among some of the variables. The qualitative data was subject to theme analysis by the researchers.

Conceptual Framework on Sand Mining and Local Household Livelihoods

The study's theoretical underpinning and the DFID Sustainable Livelihood Framework served as the basis for the conceptual framework. The conceptual framework is a harmonisation of important variables such as the actors involved in sand mining, their interests, institutions regulating sand mining, livelihood assets available to the locals, the available livelihood strategies, and the outcomes of the livelihood strategies. The increasing rate of urbanisation is responsible for the widespread sand mining from the fringes of Accra for infrastructural development to meet the housing and infrastructural requirements of the city's population. In order to build the infrastructure required at the urban core, sand is mined from the outlying settlements, where the majority of the residents are farmers. It is mined in a setting with numerous actors who are motivated by various interests and have unbalanced power relations.

Sand mining has a variety of beneficial and negative effects on people and households in the mining areas. In relation to livelihoods, sand mining has an impact on all the assets and endowments deemed essential for a household's ability to secure a sustainable income. While helping some households tap opportunities, better cope with, manage, or decrease risk and shocks, it renders other households more vulnerable. The increasing rate of sand mining has increased the number of land-related actors in the mining areas. As a result, there is a reduction in access to and control over assets that support livelihoods, such as farmland. The effects of the surging rate of sand mining are that while the interests of wealthy actors, who mostly benefit from sand mining, are enhanced, the majority of marginalized and economically weak local residents face livelihood insecurities.

The available institutions and their enforcement of land laws and regulations affect how actors behave regarding the utilisation of livelihood assets such as land. The legal frameworks, policies, and norms are supposed to set the limit for sand miners. This could be achieved through regular monitoring to ensure compliance with the rules and the application of appropriate sanctions to actors who break the rules or contribute to negative externalities. Though institutions exist, illegal sand mining may thrive because powerful actors may own political or economic resources to divert benefits to themselves. Other challenges, such as inadequate logistics and personnel at the regulatory agencies, may also affect the enforcement of the rules.

People or households in mining communities may choose from a variety of livelihood options, using their resources either as a hedge against the negative consequences of sand mining or to benefit from the industry. The household's endowment enables wealthy actors to benefit from the new livelihood options brought on by sand mining. In contrast, other households might also make use of their resources to lessen the damaging impacts of sand mining on their livelihoods. The options are referred to as alternative strategies and may include a shift from subsistence to agriculture intensification, migration, non-farm or off-farm activities, or diversification of income sources, as shown in Figure 6.

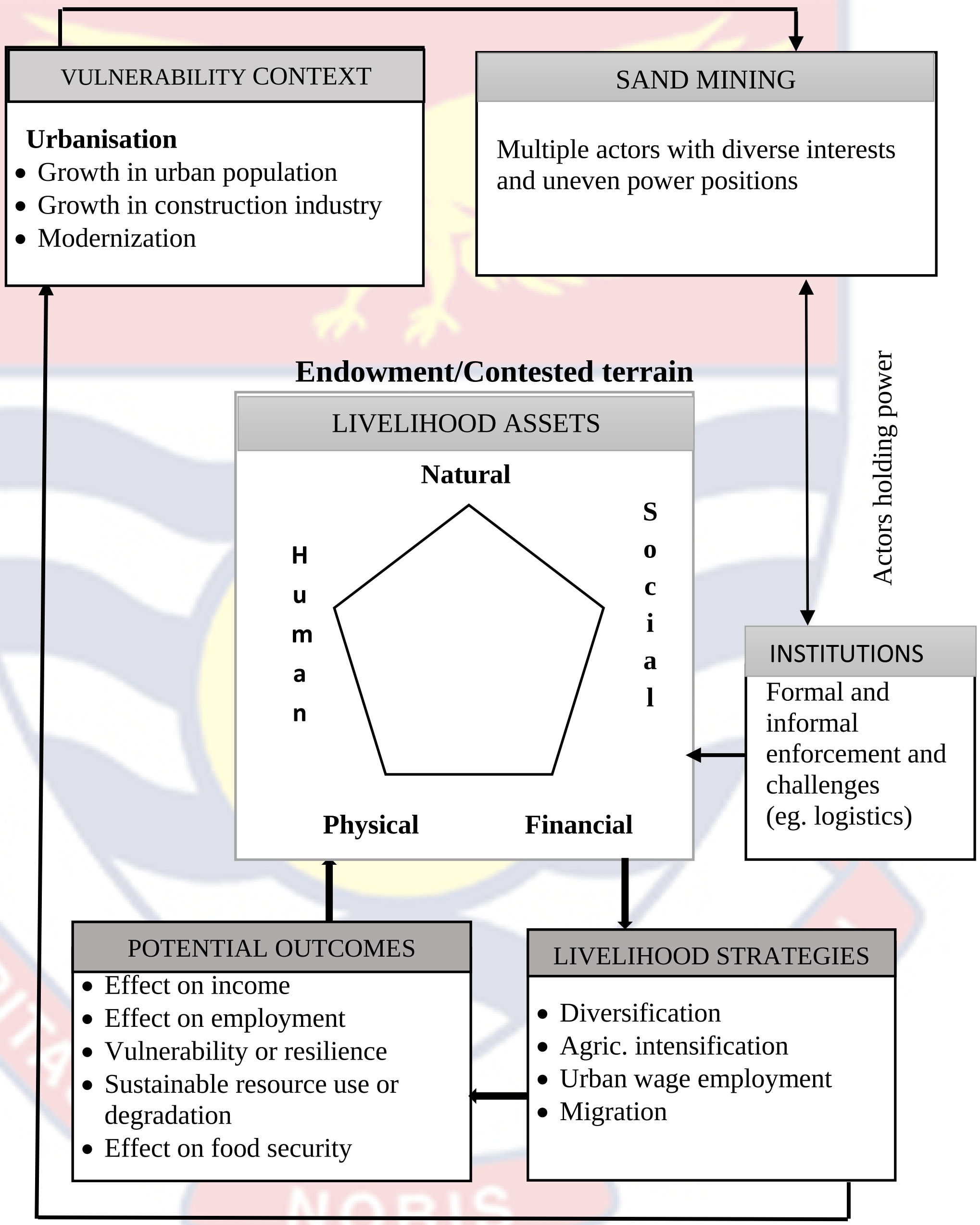

Figure 6: Conceptual framework for analyzing the effects of sand mining on household livelihoods

Source: Adapted from DFID (2000) and Sen (1981)

The effects of these alternative strategies may be positive or negative. Adequate access to and control over livelihood assets and effective institutions to check corruption and inappropriate use of land to a greater extent will determine the direction of the outcomes. Some of the positive outcomes include improved income, employment, resilience, community development, and sustainable utilisation of natural resources. The reverse is true for the negative outcomes, which may include low income, unemployment, vulnerability, degradation of natural resources, and food insecurity.

Drawing knowledge from the entitlement theory, endowment in livelihood assets varies across households. Therefore, different individuals or households would have different capacities for adapting alternative livelihood strategies, which explains why there are differential livelihood outcomes for different households in mining communities. Those with better endowments would be able to adopt rewarding livelihood strategies, while the opposite holds true for the residents who have inadequate assets to adjust their livelihoods.

The conceptual framework gives a better understanding and appreciation of the possible effects of sand mining on local household livelihoods and further helps to establish whether sand mining is sustainable in the study areas or not. The framework provides the structure to understand the livelihood strategies the residents of sand mining communities adopt as a result of the externalities of sand extraction. It is helpful for examining the assets and vulnerability context associated with sand mining. Besides, it provides an understanding of the prevailing institutions and how they are applied in relation to the different land actors in the sand mining areas.

CHAPTER FOUR

METHODOLOGY

Introduction

Research methodology is a process for systematically addressing the research problem at hand (Kothari, 2004). It is the process through which researchers approach their task of describing, assessing, and forecasting phenomena. The research methodology is important because it establishes the research's work plan. The methodology provides the theoretical basis for determining which procedures, or collection of methods, can be used for a given study (Kothari, 2004). For instance, it identifies the philosophical presumptions upon which a study's design, sample, methods, and analysis are based.

In the chapter, the research methodology used for the study is presented. It starts with the research design and then moves on to the profiles of the study areas. The chapter also discusses the study population, sampling approach, data collection, and instrument design. Other sections deal with pre-testing, field work, data processing and analysis, ethical procedures, and a summary of the chapter.

Research design

The foundation of social science research is a philosophical paradigm that guides the choice of research approach, formulation of the research question, data collection, processing, and analysis (Holden & Lynch, 2004). According to Thornhill, Saunders, and Lewis (2009), research philosophy is concerned with assumptions, the development of knowledge, and how knowledge is known. Positivism, interpretivism, and pragmatism are the three primary paradigms of research philosophy that are distinguished and covered in the writings of various scholars (Sarantakos, 2005; Scotland, 2012; Kumar, 2019). The pragmatism philosophical paradigm provides the ideal ontological underpinning for this study because both qualitative and quantitative data are required to address the research objectives.

The pragmatism paradigm of philosophy is an unorthodox epistemic position that gained popularity from the writings of American pragmatists such as Holmes, Peirce, Royce, James, Dewey, and Mead (Frega, 2011). Kelemen and Rumens (2008) argued that pragmatism contests the dualism of knowledge and experience by arguing that reality can and ought to be altered by reason and deed. Therefore, according to Creswell and Creswell (2017), pragmatism is not tied to a particular philosophy or conception of reality. To the pragmatist, reality is whatever is practical at a given moment and thrives in a physical environment that is both separate from and ingrained in the mind (Creswell & Creswell, 2017).

The pragmatism philosophical paradigm permits researchers to use methods, techniques, and procedures of inquiry that are appropriate for the particular research issue under study (Johnson & Onwuegbuzie, 2004). The mixed-methods approach is used in research that follows the pragmatic philosophical paradigm, allowing the researcher to freely draw from the strengths of both quantitative and qualitative premises (Creswell & Creswell, 2017). The study design and data collection methods for both the interpretivist and positivist paradigms can be combined under pragmatism. The paradigm allows for the use of both statistical procedures that allow researchers to generalise their findings as well as non-statistical ways of data analysis (Johnson & Onuegbuzie, 2004).

Drawing insights from the pragmatism philosophical paradigm, the study relied on a mixed research method. The adoption of a mixed-methods approach allowed for the simultaneous collection of both quantitative and qualitative data, allowing for a thorough study of the research problem (Creswell & Creswell, 2017). The validity and reliability of the data and their explanation are improved by combining different methodologies (Zohrabi, 2013). Besides, the mixed methods approach was appropriate because it allowed for both qualitative and quantitative methods of analysis concurrently. There was a slight tilt towards the application of the quantitative approach. However, objectives one and four were mostly qualitative in nature, while objectives two and three were principally quantitative in outlook.

The cross-sectional survey design was adopted as the study design. The cross-sectional survey design helped in the measurement of all the desirable variables of interest in the target population. In a cross-sectional survey study, participants are often chosen at random to respond to a variety of questions about their backgrounds, prior experiences, and opinions (Frankfort-Nachmias & Nachmias, 1996). This design's distinctive quality is that it is executed within a specified timeframe at a single point in time and reveals how variables affect one another. According to Saratakos (2005), cross-sectional designs explain the situation and circumstances that prevailed at the time of the investigation.

Profile of the study areas

The study took place in two communities, each in Ga South Municipality and Gomoa East District, in the Greater Accra and Central Regions of Ghana, respectively. Four communities were selected from these local government areas because they formed part of areas where sand mining activities were predominantly undertaken in Ghana, and the local government areas were adjoining to each other. The Ga South Municipality was established in November 2017 and is one of the 29 local government authorities in the Greater Accra Region. Its administrative capital is Ngleshi Amanfro. The municipality is bordered to the north by the Upper West Akim District, to the north-east by Ga West Municipality and Ga Central Municipality, to the east by Weija-Gbawe Municipality, to the south-west by Gomoa East District, to the west by Awutu-Senya East Municipality, and Awutu-Senya West District, and to the south by the Gulf of Guinea (Figure 7). According to the 2021 Population and Housing Census, the municipality's projected population is 350,121 residents (GSS, 2021a).

The Ga South Municipality has a land area of roughly 358.23 sq km and is largely peri-urban, with hundreds of satellite settlements and hamlets in addition to about 15 urban towns (Ga South Municipal Assembly (GSMA), 2020). About 72% of the municipality's total population is projected to reside in its major towns. The southern part of the municipality is urbanising at a rapid rate due to its proximity to the Accra Metropolitan Area, thereby serving as a centre between urban Accra and Kasoa. Kasoa is the capital town of the Awutu-Senya East municipality and is also urbanising at a high pace. As a result of the rapid urbanisation, land disputes are the main cause of conflicts in the municipality. For example, the attitude of chiefs who allocate the same parcel of land to different persons in the area for sand mining activities or as building plots mostly led to conflicts involving local farmers, prospective developers, and other landowners.

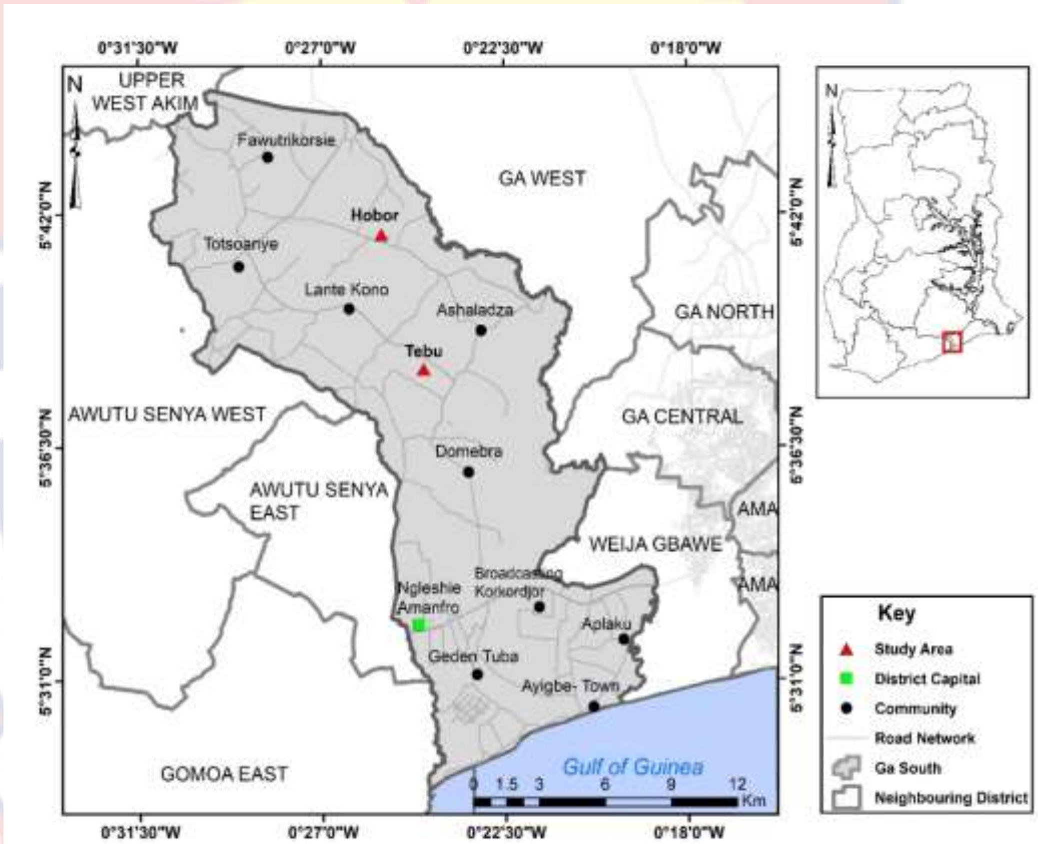

Figure 7: Map of Ga South Municipality, showing Hobor and Tebu
Source: Department of Geography and Regional Planning, UCC, 2020

With roughly 57% of the economically active people working in informal service and sales-related occupations, the local economy is steadily transitioning from agriculture and fishing to service and commerce (GSS, 2021a). Nonetheless, the agricultural sector remains a key source of employment and income for many people, particularly those in the satellite communities. Cassava, maize, groundnuts, vegetables, and cowpeas are just a few of the food crops that the municipality produces. Others include commercial crops such as pineapple, mango, cashew, and watermelon. Cattle, poultry, pigs, and microlivestock, such as rabbits and glasscutter, are the main types of livestock raised in the municipality. Mixed farming and mixed cropping are the two primary forms of farming practices. In the municipality, land may be obtained for farming purposes through a lease, a freehold, an outright purchase, or a sharecropping arrangement.

Two sand mining communities, Tebu and Hobor, were purposively selected as study areas because they were widely known for sand mining activities. Tebu is a migrant (settler) community in the municipality, and the majority of the residents come from the Volta Region of Ghana. The total houses in Tebu were 147 at the time of the study (GSMA, 2020). The residents were mainly farmers whose livelihoods depended on farmland. At the time of the study, commercial motorbikes *(Okada)* were the primary mode of transportation because the road networks connecting the community to other areas of the municipality were in very poor condition. Similarly, Hobor, literary translated to mean ‘money town’, is also a migrant community in the municipality. At the time of the survey, the town had 379 houses, with the bulk of the residents being Ewe settlers (GSMA, 2020). Hobor has a market, a CHPS Compound, and a public toilet. The road network in the community was very deplorable. Historically, the land in Hobor and Tebu were owned by the Ga clan, and the clan heads were non-residents of these towns. Real estate companies also owned land in the communities and sold them to private individuals as building plots.

The Gomoa East District, on the other hand, was established in November 2017 and has Gomoa Potsin as its capital. It is one of the 22 local government authorities in the Central Region. It is bordered to the north-east by the Agona East District, the south-west by the Gomoa Central District, the east by the Awutu Senya West District, the Awutu Senya East Municipality, the Ga South Municipality, and the south-west by the Effutu Municipality (Figure 8). A little over half (52%) of the district's population of about 308,697 people lives in urban areas (GSS, 2021a). The district makes up roughly 0.12% of Ghana's total land area, or around 276.652 sq km of total surface area.

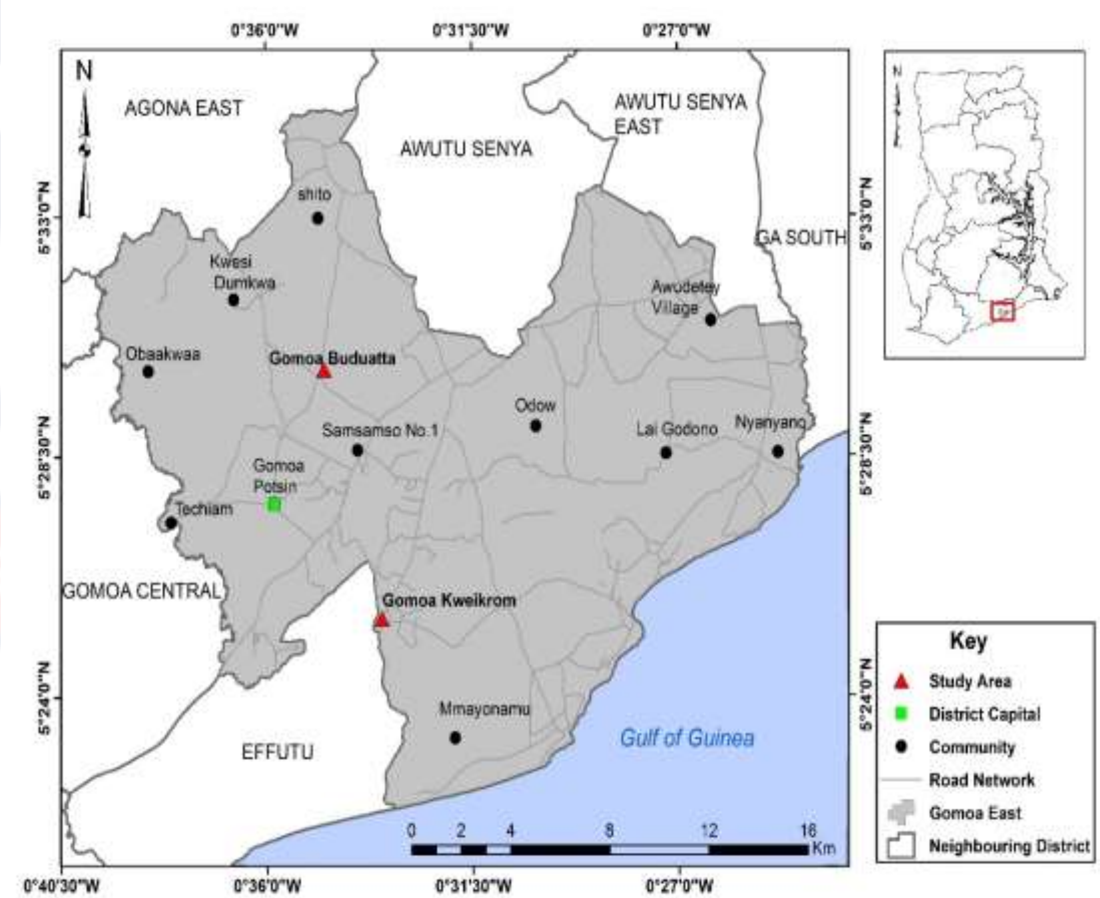

Figure 8: Map of Gomoa East District, showing Gomoa Kweikrom and Gomoa Buduatta
Source: Department of Geography and Regional Planning, UCC, 2020

About 60% of the labor force is employed in agriculture, which is the district's main economic activity and includes crop cultivation, tree planting, livestock keeping, and fish farming (Gomoa East District Assembly (GEDA), 2020). Maize, cassava, yam, sugar cane, pineapple, rice, pawpaw, vegetables, citrus, and plantains are among the crops that can be grown in the area due to its favorable ecological conditions. Non-traditional crops like vegetables, chillies, and bird eye pepper are increasingly being grown in the district. Mixed farming, monocropping and mixed cropping are the major types of farming in the district. Farmland acquisition options were comparable to those available to the Ga South municipality and included leasehold, freehold, outright purchase, and sharecropping. Some other economic activities in the district include marine fishing, which provides employment for both males and females. Trading and construction activities are also widespread in the district.

The two sand mining communities selected for the study were Gomoa Kweikrom and Gomoa Buduatta. Gomoa Kweikrom, a native Fante community, is about 24 kilometres away from Kasoa. The community had approximately 141 houses at the time of the study, with Fantes making up the majority of the population (GEDA, 2020). There was a school in the community, and at the time of the study, a CHPS compound was being built. Chieftaincy disputes, land disputes, irregular access to portable water, and poor telecommunication networks were among the major problems the community faced. Likewise, Gomoa Buduatta is an indigenous Fante community located about 23 kilometres from Kasoa. At the time of the survey, there were 312 houses in the community

(GEDA, 2020). The community had a school, a clinic, and a market (Reconnaissance Field Survey, 2020). Chiefs and some families in Gomoa Kweikrom and Gomoa Buduatta held the land in these two communities. Some parcels of land were also owned by real estate companies.

Study population

The study population was made up of household heads in Tebu, Hobor, Gomoa Kweikrom, and Gomoa Buduatta. The study communities' total housing stock was estimated to be 979 (GEDA 2020; GSMA, 2020). Besides, sand contractors, chiefs or landowners, the Mineral Commission, the EPA, local government authorities, truck drivers, community development committees in the case of the communities in Gomoa Kweikrom and Buduatta, youth groups, and women groups formed part of the population. Details of the number of housing stocks are depicted in Table 2.

Table 2: Distribution of the number of houses by MMDA and community

District	Community	No. of Houses	Percentage
Ga South	Tebu	147	15
Ga South	Hobor	379	38.7
Gomoa East	Gomoa Kweikrom	141	14.4
Gomoa East	Gomoa Buduatta	312	31.9
Total		979	100.00

Source: Field survey, 2021

Sampling procedures

The sample size for the study was chosen using the multi-stage sampling technique, which combined simple random, proportionate, systematic, and purposive sampling. First, each local government area had two sand mining towns that were purposively chosen for the study. The selection was based on the criteria that sand mining activities were predominant in those areas. Second, household heads in the chosen communities constituted the target population. Based on the database of the relevant local government bodies, the total number of households in the chosen communities was 979 (GEDA, 2020; GSMA, 2020). From the total of 979 households, a sample of 278 was selected using Krejcie and Morgan's (1970) table for calculating the sample size for a given population. The table calculates the sample size by taking into account the population size, the population proportion, which is set at 0.50, and the degree of accuracy, which is also set at 0.50, along with the chi-square for 1 degree of freedom. Third, a proportionate sample was used to produce the exact sample for each community, as shown in the sample distribution (Table 3).

Table 3: Sample distribution of household heads by community

Community	No. of Houses	No. of sampled Households	Percentage
Hobor	379	107	38.7
Gomoa Buduata	312	89	31.9
Tebu	147	42	15.0
Gomoa Kweikrom	141	40	14.1
Total	979	278	100.00

Source: Field survey, 2021

Fourth, using systematic sampling procedures, the sampled households in each of the communities were chosen based on the precise sampling interval, which was calculated by dividing the household population for each community by the corresponding target sample. In Gomoa Kweikrom, for instance, the sampling interval was four. Therefore, starting at a random location, each dwelling unit that fit the sample interval was chosen until the appropriate sample size was reached. Fifth, the household heads in the selected houses formed the sample for the study. However, simple random sampling employing the lottery technique was done to choose one household head in houses with more than one household. For all of the study communities, the same process was used to obtain the sampled household heads.

In addition to the sampled household respondents, purposive and accidental sampling methods were utilised to select 32 local and regulatory actors who served as key informants, as depicted in Table 4. This was done to guarantee that the realities of all the key players were accurately reflected in the study. Apart from the key informants shown in Table 4, FGDs comprising 7-12 persons were organised separately for selected women and youth in each of the communities. This was done because in Ghana, the majority of household heads were over 40 years old, with males more likely to assume household headship (GSS, 2019). Therefore, it was important to capture the realities of youth and females.

Table 4: List of key informants interviewed

Actor	No. interviewed
Landowners/chiefs	8
Sand contractors/miners	8
Tipper truck drivers	7
Community development committees	2
Key informant at MMDAs	2
Key informant at Department of Agric.	2
EPA	2
Minerals Commission	1
Total	32

Source: Field survey, 2021

Sources of data

Both secondary and primary sources were used to gather the study's data. The primary data were collected from household heads, key informants, and FGD participants. The secondary data were also gathered from reports from agencies such as the EPA, local government authorities and the Minerals Commission, and the records books of the sand contractors. Other secondary sources of data were legal and regulatory documents on mining and empirical literature relevant to the study.

Data collection instruments

The study used a total of four data collection tools. The major instrument for gathering information from the chosen household heads was an interview schedule. In addition to the interview schedule, an interview guide and an FGD guide were used to gather data from the key informants and the FGD participants, respectively. An observation guide was also used to gather some of the primary data. The subsequent paragraphs address the details of these instruments.

First, the interview schedule was the most suitable instrument for the household heads since the study was undertaken in peri-urban and rural communities, where data suggests that the majority of the residents have a low educational level (GSS, 2021b). The interview schedule included a series of questions that were focused on the study's specific objectives. As shown in Appendix A, there were five sections in the interview schedule, each of which had both closed- and open-ended questions. Section One concentrated on the respondents' background characteristics, such as their town, sex, age, occupation, and household size. Questions in Section Two solicited responses on the organisation of sand mining in the research communities. The next section dealt with the effects of sand mining, while Section Four looked at the alternative livelihood strategies employed by the households. Section Five concentrated on the application of the institutional framework governing sand mining.

Second, an interview guide was employed to collect qualitative data from sand contractors, truck drivers, chiefs or landowners, and the community development committee. Others included officials of the local government authorities, the EPA, District Department of Agriculture and Minerals Commission. Information collected with the interview guide focused on the organisation of sand mining, the effects of sand mining, alternative livelihood strategies used by the residents, and the institutional framework for sand mining (Appendix B).

Third, the FGD guide was used to gather qualitative data from members of the youth and women group associations. The issues captured concentrated on the organisation of sand mining, effects of sand mining, alternative livelihood strategies used by the local residents, and the institutional framework (Appendix C). Fourth, an observational guide was used to collect qualitative data to either complement or validate the data collected with the other instruments. Specific issues observed were: mining sites, permits for mining, alternative livelihood strategies used by household heads, and a count of sand currying trucks (Appendix D). In order to appreciate the volumes of sand mined from the study communities, observations of loaded trucks were done at vantage points from where trucks passed to deliver sand to the city, as depicted in Figure 9. Digital photographs were also taken to support the observation sessions.

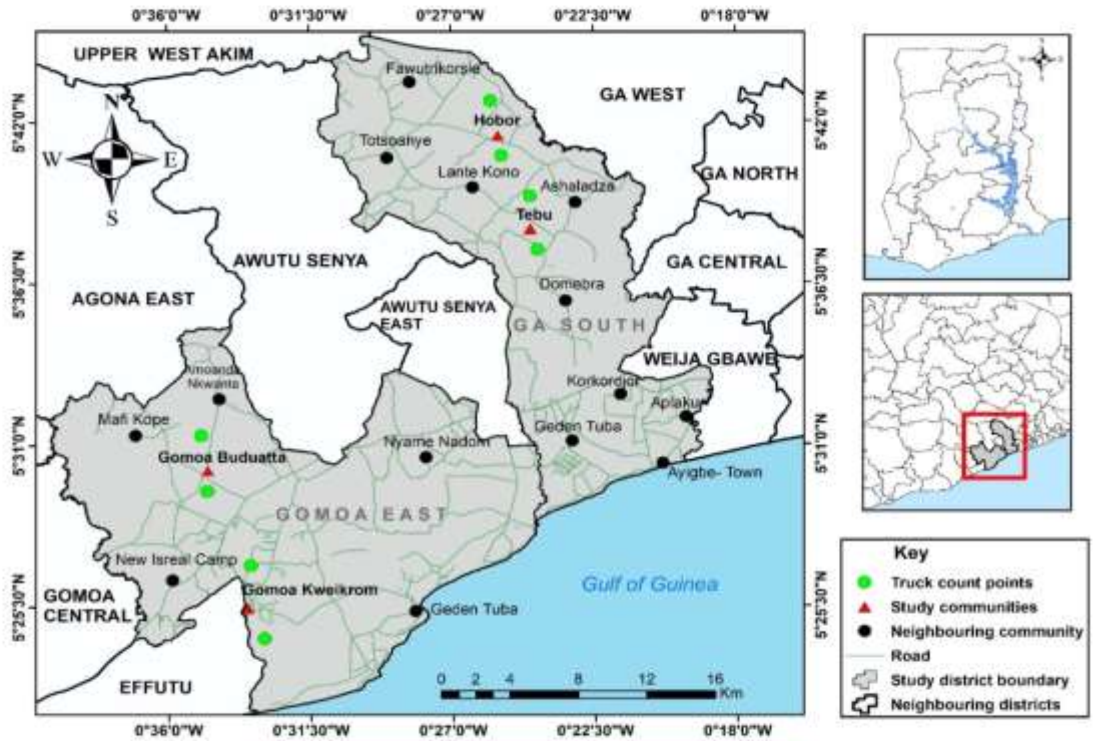

Figure 9: Map of the study areas showing the truck count points

Source: Department of Geography and Regional Planning, UCC, 2020

Pre-testing

At Gomoa Ojobi in the Central Region, 25 household heads served as respondents for the pre-testing of the interview schedule. The interview guides were pretested with one actor each, comprising a sand contractor, a landowner, a truck driver, and a management staff member of the Awutu-Senya West District Assembly. The instruments were pre-tested to guarantee their validity and reliability. Some of the instruments had flaws that the pre-testing revealed, allowing for their modification before the actual fieldwork.

Field work

As part of the community entry protocols, the researcher conducted reconnaissance visits throughout the study communities. The collection of data for the study commenced from 3rd March, 2021 to 20th May, 2021 and lasted for almost three months. The collection of data in the Ga South Municipality was from 3rd March, 2021 to 14th April, 2021, while that of the Gomoa East District was from 15th April, 2021 to 20th May, 2021 as shown in Table 5.

Two enumerators from each district with bachelor's degrees and prior experience in data collection were contracted to assist in the administration of the interview schedule. Language challenges were lessened because the enumerators were locals from the study areas. The enumerators were given a day's training on how to administer the interview schedule as well as ethical issues in social science research. The training's main goal was to prepare the research assistants to properly interpret the interview schedule for uniformity, ease of data collection, and to guard against unethical behaviour.

The researcher observed the enumerators' progress at work while conducting the key informant interviews, FGDs, observations, and administration of some of the interview schedules. The FGDs and key informant interviews were simultaneously undertaken with the household data collection in each district and lasted for nine days and 10 days in the Ga South municipality and Gomoa East district, respectively. The remaining days were used for the interviews of officials of the Minerals Commission and the EPA whose locations was outside of the study areas. All the interviews were recorded after permission were sought from the interviewees. In respect of the truck count, two persons were recruited for an independent daytime — 6 a.m. to 7 p.m. — truck counts in each community for a period of two weeks (Monday to Saturday) and one nighttime — 8 p.m. to 5 a.m. — count each for a week.

Table 5: Summary of actual data collection exercises

No.	Activity	No. of day(s)	Date	Responsibility	Town
1.	Training of research assistance	1	02/03/2021 to 02/03/2021	Researcher	Kasoa
2.	Administration of interview schedule	43	03/03/2021 to 14/04/2021	Two enumerators & researcher	Tebu and Hobor
3.	Key informants' interview	9	08/03/2021 to 16/03/2021	Researcher	Ga South Municipality
4.	FGDs	2	17/03/2021 to 18/03/2021	Researcher	Hobor and Tebu
5.	Administration of interview schedule	35	15/04/2021 to 20/05/2021	Two enumerators & researcher	Gomoa Kweikrom & Gomoa Buduatta
6.	Key informants' interview	10	20/04/2021 to 29/04/2021	Researcher	Gomoa East District
7.	FGDs	2	11/05/2021 to 12/05/2021	Researcher	Gomoa kweikrom & Buduatta
8.	Key informants' interview (EPA & MC)	4	17/05/2021 to 20/05/2021	Researcher	Accra

Source: Author's Construct (2021)

Ethical consideration

The study's approach was examined from an ethical standpoint. Before beginning the actual fieldwork, the Institutional Review Board (UCC-IRB) of the University of Cape Coast (UCC) granted ethical approval (Appendix E). The study's goals were explained to the respondents, and their consent to participate was requested. The interview schedule also included a statement on informed consent at the onset, asking for the respondents' permission. A letter of consent from the School for Development Studies, University of Cape Coast, was used to request the consent of the key informants, including the officials of the EPA, Minerals Commission, District Department of Agriculture, MMDAs, and others, before the interviews commenced. Participants for the FGDs were chosen based on their willingness to take part in the study.

None of the respondents were ever forced to take part in the survey. The respondents' and the information they gave were treated with strict confidentiality. By numerically coding each returned interview schedule, the researcher preserved the participants' identities and maintained their anonymity. Additionally, it was made clear to respondents that they had the right to withdraw their consent to participate in the study at any point in time. The research assistants who did the night truck counts were provided with logistics for their safety and allowances.

Data processing and analysis

Both quantitative and qualitative data analysis techniques were used. The Statistical Product and Service Solutions (SPSS) software version 21 was used to analyze the quantitative data after it was edited and coded. Applying techniques like descriptive statistics with tables that displayed the frequency and percentage distribution of the pertinent variables, the quantitative data were examined. The Chi-square test of independence, Kruskal-Wallis and Median test were also used for the analysis of the quantitative data.

On the other hand, Version 12 of the NVivo software was used to transcribe and analyze the qualitative data within the conceptual themes of the study. Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis was also done for the regulatory agencies in charge of sand mining. Under each of the specific objectives, there was an integration of both qualitative and quantitative analyses to improve knowledge of the issues being investigated by combining numerical strength from quantitative data with specifics from qualitative data.

Objective one was analyzed primarily with thematic analysis. However, objective two involved the use of descriptive statistics, tests of differences such as the Kruskal-Wallis and median tests, and the Chi-square test of independence to compare differences among the communities. This was done with respect to variables such as farm size, farm yield, present income, contribution of sand mining to the community, effect of sand mining on livelihoods, and availability of complaint channels, among others. A few qualitative analyses were performed to complement the quantitative analysis. Similarly, objective three was equally analysed with the Chi-square test of independence, descriptive statistics, and thematic analysis. Objective four was analysed largely qualitatively with thematic analysis in themes as well as with SWOT analysis. However, few descriptive statistics were done to supplement the qualitative analysis.

Three chapters — Chapters 5, 6, and 7 — were devoted to the analysis of the data. Chapter Five presents a discussion on the background characteristics of the respondents and the organisation of sand mining in the study communities, including the scope of sand mining, the processes involved in sand mining, and an analysis of the interest and power position of the actors. In Chapter Six, issues concerning the effects of sand mining on the locals' livelihoods and the alternative livelihood strategies the residents in the study areas adopted because of the externalities of sand mining were discussed, while Chapter Seven concentrated on the application of the institutional framework governing sand mining.

Summary of the Chapter

The chapter covered the research methodology. Four purposively sampled communities in the Ga South Municipality and Gomoa East District were profiled as the research sites. The pragmatic paradigm of research, which allows for the use of a mixed-methods research approach, was adopted for the study. The study population covered household heads, chiefs and clan heads, sand contractors, truck drivers, members of the community development committees, and members of the women's and youth groups in the sampled study areas. Others included management staff of the EPA, the Minerals Commission, local government authorities, and the Department of Agriculture. A sample of 278 household heads was statistically determined for the survey, while 32 key informants were interviewed.

Both primary and secondary sources were used to gather the study's data. The following instruments were used to collect the primary data: an interview schedule, an interview guide, an FGD guide, and an observation guide. The pretests of the instruments were administered at Gomoa Ojobi. Statistical Product and Service Solutions (SPSS) software, version 21, was used for analysing the quantitative data, while the qualitative data was analysed with Version 12 NVivo Software. Ethical consideration, which centred on informed consent of respondents, confidentiality and anonymity of responses, was also considered in this chapter. The outcomes of the fieldwork are discussed in the succeeding chapters.

CHAPTER FIVE

ORGANISATION OF SAND MINING

Introduction

The chapter deals with research question one. It includes discussions of the demographic characteristics of the household heads and how sand mining is conducted in the study communities. Specific issues dealt with under the organisation of sand mining encompass the following: the scope of sand mining in the communities, the roles of the actors involved in sand mining, the processes involved in sand mining, and illegal sand mining. The interests and power positions of the actors are also discussed in this chapter.

Profile of the Household Respondents

Demographic characteristics such as sex and age influence the control over resources and livelihood strategies of households (Vincent et al., 2011). In order to put the study into context, the background characteristics of the respondents, including sex, age, education level, primary occupation, and household size, were looked at. The details are presented in the subsequent subsections.

Sex

Males made up the bulk of the household respondents (73%), with females constituting the remaining respondents. About 84% of the respondents from Tebu were males, compared to Hobor (73.8%), Gomoa Buduatta (73%), and Gomoa Kweikrom (60%) (Table 6). The finding regarding sex was representative of both the social structure of the research communities and of the majority of rural and peri-urban locations in Ghana, where males are mostly family heads and control the productive resources of their families (GSS, 2019).

Table 6: Sex distribution of the household respondents by community

Sex	Buduatta		Kweikrom		Hobor		Tebu		Total	
	f	%	f	%	f	%	f	%	f	%
Males	65	73.0	24	60.0	79	73.8	35	83.3	203	73.0
Females	24	27.0	16	40.0	28	26.2	7	16.7	75	27.0
Total	89	100.0	40	100.0	107	100.0	42	100.0	278	100.0

Source: Field survey, 2021

Age

The oldest household head was 87 years old, while the youngest was 20. The median age was 48 years (mean = 48.49, standard deviation = 12.3 years, skewness = 0.515), with a quartile deviation of 16 years. About 65% of the respondents were in the 40-59 age group, which is consistent with the national average reported by GSS (2019). The rest of the respondents were either below 40 years of age (18.8%) or 60 years of age and above (15.6%). In relation to the communities, the majority of the household respondents (76.2%) in Tebu were found to be between the ages of 40 and 59, as opposed to 62.1% in Gomoa Buduatta and 60.7% in Hobor (Table 7).

Table 7: Age distribution of household respondents by community

Age-groups	Buduatta		Kweikrom		Hobor		Tebu		Total	
	f	%	f	%	f	%	f	%	f	%
20-39	15	17.2	3	7.5	26	24.3	8	19.0	52	18.8
40-59	54	62.1	30	75.0	65	60.7	32	76.2	181	65.6
60+	18	20.7	7	17.5	16	15.0	2	4.8	43	15.6
Total	87	100.0	40	100.0	107	100.0	42	100.0	276*	100.0

*Less than the number of respondents due to nonresponse

Source: Field survey, 2021

Educational background

A little over 37% of the household respondents lacked any kind of formal education, while 31.7% had either a middle or junior high school certificate. As depicted in Figure 10, whereas 24.1% had only some form of primary education, the rest had secondary education (4.0%) or tertiary education (2.5%). The result indicates that most of the household heads had lower chances of gaining paid employment due to their low levels of education. The percentage of household respondents without a formal education was found to be higher than the national average of 20.8% (GSS, 2021b).

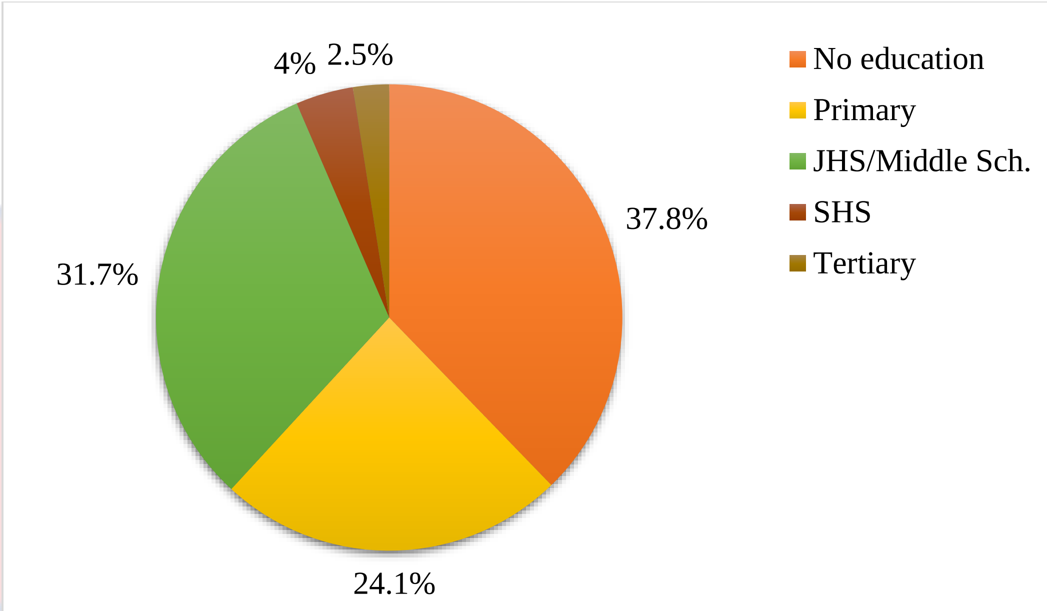

Figure 10: Educational levels of household respondents n = 278

Source: Field survey, 2021

Primary occupation

Sand mining has an impact on local livelihoods; hence, the researcher looked at the respondents' primary occupation. Farmers made up the majority of household respondents (77.0%), followed by traders (7.6%), artisans and craftsmen or women (5.4%), transporters (4.0%), and food vendors (2.2%). Only about one percent of them were employed in the formal sector (Table 8). The higher level of household head involvement in farming was consistent with the 65.2% found in rural Ghana (GSS, 2019).

Table 8: Primary occupation of the household respondents

Primary occupation	Frequency	Percentage
Farming	214	77.0
Trading	21	7.6
Craft (carpentry & masonry)	15	5.5
Transport/ Commercial motorbike or tricycle	11	4.0
Food vendor	6	2.2
Formal sector	4	1.4
Block manufacturing	4	1.4
Alcohol brewing	2	0.7
Forest gathering	1	0.4
Total	278	100.0

Source: Field survey, 2021

Further examination revealed that the minimum number of years the household heads had engaged in their primary occupation was 2 years, while the maximum was 60 years. The mean number of years spent in a particular primary occupation was 24.30 years (skewness = 0.031), with a standard deviation of 13.2 years. Apart from the majority of household respondents (77.0%), who were farmers, it was clear that the other respondents also engaged in subsistence farming to meet their household's food needs.

Household size

In most rural and peri-urban communities in Ghana, household heads depend on their children for free labour for their livelihood activities. This situation influences many rural and peri-urban families to maintain large household sizes. The findings revealed that while the highest household had 19 members, the least had one. The mean household size was 6.30 people (skewness = 0.048), with a standard deviation of 2.8. The study areas had a larger average household size than the national average of 4.0 (GSS, 2021a). Consistent with expectations, the FGD participants in Hobor explained that most household heads maintained large household sizes for free labour and also as security in anticipation that some of their children might die.

The Actors and their Roles in Sand Mining

The actors involved in sand mining are those parties who have interests and/or power to influence sand mining either directly or indirectly. The sand mining actors found in the study areas were consistent with those found in earlier studies and included landowners, sand contractors and their employees, community members, the EPA, the Minerals Commission, truck drivers, MMDAs, and community development committees in the case of Gomoa Kweikrom and Gomoa Buduatta (Mensah, 1997; Essaw et al., 2023).

Landowners

About 95.2% of the household heads noted that traditional leaders, including chiefs and clan or family heads, were actors who had the power to decide how to use land in the research areas because of the customary land tenure system in the areas. Chiefs, family, and clan heads, even though regarded as landowners, were required to hold the land and protect it for the benefit of the present and future members. The rest (5.8%) of the household heads mentioned real estate companies, which had bought vast hectares of land from traditional landowners and later sold them as individual housing plots. The finding is consistent with Locke and Henley's (2016) result, which revealed that about 80% of land in Ghana was owned and controlled by traditional leaders. The eight landowners who were interviewed were all adult males older than 50 years old.

The interactions with the landowners revealed that they performed the following roles in sand mining: release land to miners, perform traditional rituals before mining commenced, inform affected farmers to vacate the land demarcated for mining, arrange with sand contractors to compensate affected farmers, and inform relevant family members about the proposed mining to avoid litigation. All the landowners interviewed indicated that sand mining was a better economic option than farming because they received prompt payment from the miners, compared to the unpredictable and decreased income from farmers. This confirms insight from the UPE theory, which argues that wealthy actors make decisions on environmental resources based on their anticipated benefits.

Sand contractors

The sand contractors indicated that they organised the entire mining process on site, including mobilising their supporting workers. Seven out of the eight sand contractors interviewed were over 50 years old; the youngest was 27 years old. The contractors and their supporting workers were all male. Prospecting for sand, acquiring land, securing a license, preparing the site, actual mining, and reclamation were the roles of the sand contractors. It was found that sand contractors often sold a truckload of sand with an average tonnage of 20 m^3 for GHS 320 ($32) on site to truck drivers. The price was higher than the earlier

GHS 220 ($22) found by Dawson (2020) during her fieldwork in 2018. The contractors explained that the differences in the price of sand were largely caused by frequent increases in fuel prices.

The sand contractors explained that they made the following payments for each truckload of sand in order to get the business running: about GHS 60 ($6) was paid as a land fee to the landowners. An amount of GHS 70 ($7) was paid to the payloader operator, while the local government authorities charged GHS 20 ($2) as a conveyance fee for each truckload of sand. A common practice among the sand contractors was to make budgetary allocations to cater for regulatory officials and other community members who visited the site for 'chop money'.

The majority of the sand contractors belonged to the Sand and Stone Miners' Association, which was formed at the national and regional levels. The association facilitated the process for its members to secure mining licenses either at the Minerals Commission, EPA, or MMDA level. The political settlement theory argues that groups are able to mobilise support to champion their interests. Similarly, it was revealed that the majority of the sand contractors joined the association as a strategy to enhance their bargaining power and ability to influence mining outcomes in their favour. The interview with one of the sand contractors, who was also an executive member of the Central Regional branch of the sand contractor's association, revealed that the constitution of the association empowered the leadership to sanction members who engage in illegal mining. The association executive, however, could not show evidence of the constitution, proof of monitoring undertaken at their members mining sites, or actions taken against defaulting members.

Truck drivers

Trucks of generally 20 m^3 in volume were operated by truck drivers and often their assistants. The assistants, locally called 'drivers' mates, were apprentices to the drivers. The trucks were owned by people in the cities who had invested in the truck business to tap opportunities in the sand mining industry. Drawing from the UPE theory, the truck owners had strategically invested in the sand industry to tap the financial opportunities in the industry. The truck drivers revealed that they often worked from Mondays to Saturdays to convey sand to various destinations around the city. Similar to the other actors, all truck drivers interviewed and their mates were males and had mostly graduated from commuter bus *(trotro)* driving to sand truck driving due to relatively better economic opportunities in the latter. The truck drivers operated from various truck stations in and around Accra and paid a daily parking fee of GHS 20 ($2) to the station executive.

The truck drivers explained that the categories of customers who patronised their sand were individual developers, block manufacturers, government agencies, real estate developers, and building contractors. Most of the drivers preferred dealing with individual developers because they usually paid ahead of the sand delivery, unlike the alleged credit purchase by block manufacturers. The most common 20-m^3 truck of sand was sold between GHS 1100 and GHS 2300 ($110 to $230) to customers, depending on the distance to the delivery point. The drivers were required to make daily sales of GHS 800 ($80) to the truck owners. On average, GHS 400 ($40) was spent on fuel for each trip of sand delivered at the time of data collection.

The drivers earned monthly salaries of about GHS 1200 ($120), though they claimed they were supposed to be paid two days' sales (GHS 1600) as a monthly salary. The nonpayment of the required salaries to the truck drivers illustrates the UPE theory that the extraction of sand is done in a capitalist and market-driven system, which creates uneven outcomes for different actors. The wealthy actors are able to obtain high benefits from the resource compared to the economically weak actors.

Community development committees

The study communities in the Gomoa East District (Kweikrom and Buduatta) had development committees, which were constituted by the chiefs and elders with the endorsement of the community members at a town durbar. However, it was revealed that there were no development committees in both Hobor and Tebu because of two key reasons. First, the settlers did not have the mandate to make major decisions in the town unless they gained approval from the Ga clan heads. Second, the residents claimed that the towns belonged to the Gas; hence, the settlers did not see the need for the development committee. The members of the development committees were all male, numbering about seven in each town.

As the name suggests, the development committee was expected to facilitate the overall development of the community and was therefore mandated to generate a daily income of GHS 200 ($20) from each new sand mining activity in their community. The committee was also expected to undertake monitoring to ensure that sand miners operated from only allocated areas and also reclaimed the land after mining. However, in practice, these roles were not performed, except for the collection of fees from the contractors. At the FGD for women in Gomoa Kweikrom, concerns were raised about the limited accountability of the community development committee concerning revenue and expenditure from sand mining proceeds.

Community members

Over generations, land in sand mining communities was given out by traditional landowners for agricultural use. Though the bulk of the community members, mostly farmers, were not involved in the decision-making process with regards to sand mining, they bore the brunt of its adverse consequences, including the loss of farmland. This situation demonstrates that the community members had inadequate entitlements over land, thereby making them susceptible to entitlement failure as espoused by the entitlement theory.

Local government authorities

The key informants at the MMDAs explained that, consistent with the Local Governance Act, 2016 (Act 936), the MMDAs were the highest decision-making body in charge of the overall development of their areas of jurisdiction. Therefore, sand miners who operated within their jurisdiction were required to register their operations with the MMDAs and obtain permits for their activities.

It was further learned that the MMDAs were also entitled to generate revenue from sand mining through levies.

Environmental Protection Agency and the Minerals Commission

Apart from the local government authorities, the EPA and the Minerals Commission were equally mandated by law to perform specific roles in relation to sand mining in Ghana. The roles of these actors have been extensively discussed in Chapter Two of this thesis. The key informant at the EPA reported that the EPA was mandated to ensure sound environmental management during and after sand mining to forestall environmental quality, while the official at the Minerals Commission also explained that the Commission was responsible for issuing mining licenses and also controlling on-site sand mining.

The scope of Sand Mining in the Study Areas

The researcher looked into the respondents' knowledge about sand mining in their localities in order to put the study into perspective. Most (99.7%) of the household respondents stated that sand mining was common in their areas and had been practiced for the past 15 to 20 years. The FGD participants in all the study communities reported that the mining areas had progressively shifted from the farming centre to the residential areas. This was confirmed by the key informant at the GSMA in these words:

> Sand mining is widespread in Tebu and Hobor and noticeable even around residential areas. For new mines, sand extraction often commences in one spot of about an acre size and gradually expands to reach other areas. The

activity started from Ashalaja through Denkyira and quickly spread to those areas (Key informant, 2021).

The aforementioned assertion supports Williams' (1973) deduction from the UPE theory that the process of urbanisation was inextricably linked to changes in nature and its social interactions. The conceptual framework (Figure 6) also shows that the extraction of sand from the study areas was influenced by the increasing rate of urbanisation around Accra.

In respect of the actual place of mining, 99.3% of the household respondents indicated that the mining areas were farmland, while the remaining 0.5% and 0.2% mentioned that they were undeveloped land and areas near water bodies, respectively. Sand contractors had a stronger entitlement to land than farmers because of their capacity to convince landowners to allocate available land to them. This is consistent with the entitlement theory and was illustrated by the mining of sand from farmland. The implication of the finding was that agriculture-based livelihoods in the study communities were negatively impacted by the extraction of sand from farmland. The result supports prior research from Ghana (Oduro et al., 2015; Anokye et al., 2023) and Nigeria (Abraham et al., 2021), where extensive sand mining from farmland was found to have harmed farmer households' livelihoods.

Nearly 94% of the household respondents had never mined sand or given out their land to sand miners, while few others (5.8%) had ever given land to miners or participated in the activity. The household respondents who had previously given out land to sand miners were from either Gomoa Buduatta or

Gomoa Kweikrom. These respondents explained that the need to solve pressing family financial needs influenced them to allocate their farmland to sand miners. Dawson (2020) argued that the prompt monetary gains from sand mining induce many landowners to release their land for mining. The FGD participants in Hobor confirmed that, though sand mining was profitable, the local residents scarcely participated in it as a result of their limited control over land. They argued that all the land was owned by a few Ga family heads, who determined its use. According to them, ordinary residents were not allowed to mine sand from the land.

In respect of the volumes of sand mined from the study areas, details from the truck observations showed that daytime truck counts averaged 304, while 127 truck loads were recorded on average at night for the entire study areas, totaling 431 mine trucks per day, as shown in Table 9. When extrapolated to a yearly mining volume after multiplication by the six working days per week, an annual volume of 134,472 sand trucks with a volume of 4.97 million metric tonnes was established, all things being equal. Using the most common sand truck volume of 20 m^3, the yearly sand mined from the study areas could amount to 2.68 million cubic meters at an average sand density of 1.85 g/cm^3.

Table 9: Daily mean truckloads of sand by community

Time of truck count	Buduatta f	Kweikrom f	Hobor f	Tebu f	Total
Day	83	58	102	61	304
Night	44	22	36	25	127
Total	127	80	138	86	431

Source: Field survey, 2021

It should be mentioned, too, that the quantity of sand mined per acre varied depending on the depth of sand deposits and the caliber of the sand. Besides, it was learned from the sand contractors that during the wet or rainy season, relatively fewer quantities of sand could be mined due to the wet nature of the sand pits, which sometimes caused both the payloaders and trucks to get stuck in the mud. The quantity of sand mined from the study areas was comparatively less than the previous estimation of 700–1000 extracted truckloads per day reported by the Minerals Commission (Dawson, 2020). The difference might be because the Minerals Commission's estimate covered many sand mining areas in and around Accra, while this study was limited to four communities. The finding suggests that the enormous quantities of sand mined from farmland may have a detrimental impact on the local population's livelihoods and their ability to secure adequate access to food to meet their nutritional requirements.

Processes Involved in Sand Mining

The processes involved in sand mining in the study communities were licencing, land acquisition, mining on site, and reclamation. The detailed findings are presented in the sections that follow.

Licensing procedures

The key informant at the Minerals Commission explained that sand contractors were required to acquire a restricted mining lease before commencing their mining activities. The license was expected to commit the sand miners to strict requirements and legitimise their activities. For sand contractors to obtain a license, they had to go through a formal process of application and payment of requisite fees at the Minerals Commission, as well as permit procedures from other agencies, including the EPA and the MMDA responsible for the area where the concession is located. As the entitlement theory highlighted, these institutions set the modalities for the extraction of sand in the study areas.

The interactions with the sand contractors revealed that the process was very bureaucratic. It requires several follow-ups and the payment of both official and unofficial fees, which could span two years. This claim was confirmed by the key informant at the Minerals Commission, who admitted that the process was unnecessarily bureaucratic and could discourage many sand miners from obtaining the license. The Minerals Commission official remarked:

> It is very difficult to ensure that sand is mined entirely by licensed miners under the current licensing regime. All the approvals must be authorized by the Minister, who is very busy with several schedules, including gold mining issues. Some of the officials also deliberately create artificial delays in order to enhance their personal monetary interests. The sand miners are impatient to wait for several months to secure licenses for a small piece of land when they can quickly mine overnight without being noticed (Key informant, 2021).

The finding corroborates Banchirigah (2008), Afriyie, Ganle, and Adomako (2016), and Crawford, Agyeyomah, and Mba's (2017) earlier findings in Ghana that the lengthy procedures and payment of both official and unofficial fees were major factors that prevented most Ghanaians from obtaining small-scale mining licenses. In a more recent study in South Africa, Gondo et al. (2019)

showed a similar correlation between the bureaucratic licencing process and pervasive unlawful sand mining.

It was further established by the key informants at the regulatory agencies that, in order to acquire the license, sand contractors were expected to pay the following fees: First, at the Minerals Commission, an application form costs GHS 200 (US $20), processing fees of GHS 1400 (US $140), a gazette fee of GHS 600 (US $60), and a license fee of GHS 100 per 1.2 acre (US $10). Second, an amount of GHS 1,505 ($150.50) was to be paid to the EPA for application forms, processing, and permits. Third, at the GSMA, sand contractors were required to pay GHS 24,640 ($2464) for a Business Operating Permit (BOP) and a reclamation bond. Of the latter, 25% was to be refunded to the sand contractor after reclamation. The key person at GEDA also reported that to operate within the district, sand contractors were charged an amount of GHS 7,500.00 ($750), of which GHS 2,500 ($250) was for BOP and the remainder as reclamation bond. Lack of consistency in permit requirements and fees at different MMDAs was a major concern for some of the sand contractors.

It was also alleged by some of the sand contractors that the lengthy licencing processes had created a favourable condition for some officials of the regulatory agencies to demand unofficial payments from the miners so as to fast-track the license process or to verbally permit them to mine without the license. One sand contractor noted:

> With the help of the sand contractor's association contact person at the Ministry, I only had to attach the site plan for the new land to my old

license, and so I skipped most of the long procedures for a permit (Sand contractor in Tebu, 2021).

The statement is consistent with the rent-seeking model, which argues that some government officials intentionally obstruct the license process in order to extort money from the sand contractors. Based on political settlement theory, Roberts (2013) opined that the regulatory system for resource extraction in SSA was based on elite-driven governance. The key informant at the Minerals Commission confirmed that some staff of the regulatory agencies conspired with miners to ensure that not all the legal procedures were followed. The officer at the Minerals Commission shared his experience:

> The Minerals Commission has realised that once the District Assemblies collect their fees from the sand contractors, they allow the sand contractors to mine without waiting for the Minerals Commission to complete the licencing process (Key informant, 2021).

The statement means that the local government authorities were only concerned with the revenues they generate from sand mining, compared to compliance with the mining rules. However, the key informants at the GSMA denied the claim and rather blamed the Minerals Commission for trying to overlook the Assembly in the license and permit process. The statement by the key informants at the different agencies acknowledged the inefficiencies and conflicts among state actors mandated to regulate sand mining in the study areas. It was revealed that state and non-state actors blaming themselves was a common practice inherent in the licencing process, whether at the Minerals Commission, EPA, or MMDAs. This blame game might result in a situation where responsibilities are shrugged off by regulatory agencies. The fragmented approval and permitting processes involving different agencies, coupled with the excessive delays, pose a challenge to the effective licensing of sand mining.

Land acquisition

The results of the surveys showed that before mining, sand miners must obtain permission from the landowners. Results from household heads indicated that family/clan leaders (71.5%) and chiefs (22.7%) had authority and entitlement over the distribution of land to sand miners, whereas 5.8% highlighted real estate enterprises. Landowners and sand contractors also agreed that clan or family heads or local chiefs were in charge of the allocation of land to the miners. This finding is consistent with the land tenure systems among the Gas and Akans, where clan heads and family heads/chiefs, respectively, possess the highest claim over land (Aryeetey et al., 2007; Oduro & Adamtey, 2017).

It was evident from the FGDs in Hobor and Tebu (migrant communities) that while the majority of the residents were Ewes, the land was administered by the Ga clan heads, who were the allodial title holders. It was learned from some of the clan heads that the Gas followed patrilineal inheritance, so land was inherited through male members of successive generations. However, in Gomoa Buduatta, FGD participants explained that land-owning families controlled significant portions of the land, but the chief and other individuals also managed smaller portions. In Gomoa Kweikrom, the indigenous Fante chief and his family, on the one hand, and some other family heads, on the other hand, were battling for ownership of sizeable portions of the land at the Law Court at Winneba. That notwithstanding, the chief handled land administration in Gomoa Kweikrom. Respondents in each of the study communities claimed that a number of real estate firms had bought sizable hectares of land from chiefs, clan leaders, or family heads; as a result, even members of landowning families had restricted access to land.

Interactions with the sand contractors revealed that prospecting for land with good deposits of sand was a familiar practice in the sand mining industry and the first task the contractors had to fulfil before contacting the landowners. To this end, the sand contractors engaged the services of young men who toured the communities with motorbikes in search of new land. The young men dug holes with spades from different locations on any available land to determine the quality and depth of the sand deposit. The most cherished material was the smooth pale sand known locally as ‘*anwia gari*," which was perceived to expand when mixed with cement and water.

It was again indicated by the sand contractors that once the prospectors were assured of a good deposit of sand and the suitability of the land, they would conduct an investigation to identify the landowner and inform the sand contractor to enter into an agreement with the landowner. In order to ensure continuity in sand mining, the contractors working through the young men were always on the move searching for suitable land since the continuity of the business was determined by the miners’ ability to easily change to their next mining site once their current site was completely mined out.

The study further established from the sand contractors and landowners that the agreements for the allocation of land for sand mining were verbal and limited to a few clan or family elders. Most (98.7%) of the household heads who provided responses confirmed that verbal agreements were frequently made when allocating land for sand mining. Similar findings were made by Nyame and Blocher (2010) in a comparable study in Ghana, where they discovered that the majority of agreements between miners and landowners were primarily verbal in nature.

Information from the landowners showed that their agreements with the miner often cover the following key issues: size and boundary of the land, revenue sharing measures, the time period for which the land was released to the sand contractor, and post-mining management of the land. Generally, the sand contractors mostly provide a goat or sheep, two bottles of schnapps, and an amount of money ranging between GHS 500 and GHS 1500 ($50 to $150) depending on the size of the land to the landowner for traditional rituals before the mining commences. One landowner shared this about the ritual:

> Before sand can be mined, we have to solicit the approval of our ancestors and the gods by sacrificing a sheep and pouring libations. This sacrifice permits the contractor to mine the sand. The gods have to be notified of the noise and disturbance the mining activity might cause (Key informant in Gomoa Kweikrom, 2021).

The traditional ritual was well accepted by the sand contractors themselves, who held the view that permission must be sought from the ancestors to avoid misfortunes in the course of the mining. A sand contractor remarked the following about the ritual:

> I know a sand contractor who decided to forego the ritual and faced serious calamities at the mining site. On one occasion, an employee of the sand contractor was mysteriously run over by the payloader. As you know, the land is for the ancestors, so they have to be respected through the performance of the ritual (Sand contractor in Gomoa Buduatta, 2021).

The statement suggests that informal rules and customs were important considerations in the administration of land for sand mining. Leach et al. (1997) argued from the viewpoint of the entitlement theory that informal institutions perform key roles that shape the endowments and entitlements people have over natural resources.

The study further ascertained the challenges embedded in the land acquisition process. The sand contractors disclosed that they frequently encountered many land claims or conflicts, double allocation of the same land to different parties, and family disputes regarding the usage of the land. Some of the contractors explained that they regularly experience hostility from armed people who claim ownership of land already allocated for mining. The situation was very common in Tebu and Hobor because of their closeness to Accra, coupled with the presence of many land market actors in those areas. A sand contractor shared this experience:

> I paid twice for the ritual fee on this particular land before I could start mining. The first person I negotiated with was just a family member, even

> though he regards himself as the clan head. I was later approached by the clan head and some irate young men who threatened to destroy my equipment. I had no option but to pay again for this land since the land had a good deposit of sand, as you can see (Key informant in Hobor, 2021).

On the other hand, landowners outlined the following as challenges they faced with the allocation of land to sand miners: sand contractors mine beyond the agreed demarcation; theft of sand, especially at night; destruction of properties by some miners; sand contractors' claim of perpetual right over the sand on land they previously mined; refusal to reclaim the site after mining; and threats or violent attacks by some illegal miners locally called ‘galamsey’ miners.

Generally, the key informants reported that land allocations in the study areas were characterised by disputes and high contestation among family heads, family members, sand contractors, and some community members, resulting in multiple allocations of the same land to different persons. The result is in line with Ashiagbor et al.'s (2019) observation that land administration for both customary and state-owned land in peri-urban areas adjourning Accra was subject to a number of difficulties, including doubt in acquisition processes, corruption, and multiple sales of the same land to various prospective developers. It also corroborates insights from the UPE theory and empirical evidence by Asafo (2022) that there were extremely violent politics of land with intense competitions, uncertainties, and uneven access around the peri-urban fringes of Accra. The key informant at the GSMA noted that the lack of official leasehold agreements between landowners and farmers or sand miners contributed to the difficulties associated with the acquisition of land in the study areas.

The study further ascertained whether landowners informed the community members of the decision to allocate land to sand miners. Most (94%) of the household heads reported that they were never notified about the decision to give sand miners access to their farmland. Only 4.0% and 0.9% of those surveyed mentioned that they were informed about the intended mining or were unsure, respectively. According to Sen's (1987) entitlement theory, the findings clearly show entitlement failure regarding the use of land by community members. The situation frequently led to the residents unexpected evictions from their farmland, which caused livelihood insecurities. This finding is also supported by Dapilah et al.'s (2019) research in the Wa municipality, where uninformed sand mining resulted in the loss of land-based livelihoods like farming and shea butter production. Some of the landowners confirmed the low levels of participation in land use decisions among community members. A landowner shared this opinion:

> As the head of the family, I am permitted to make land use decisions for the family. The local people are largely strangers from other parts of the country and therefore have no right to question my decision. They often farm on my land without my permission. I have no responsibility for passing on information to them (Landowner in Hobor, 2021).

The quotation is in line with Heynen's (2006) argument from the perspective of the UPE theory that urbanisation creates a condition for environmental resources to be controlled and manipulated to serve the interests of a few influential actors while the majority of the people are marginalized. The finding is a deviation from expectation, as one would have anticipated that the respondents in the indigenous communities (Gomoa Kweikrom and Gomoa Buduatta) should have had better endowments of land since they had social connections to the chiefs and family heads. The FGD participants in all the study communities and the members of the community development committee corroborated the lack of information flow to community members. A community development committee member remarked:

> The landowners in this community feel no obligation to the community members since personal monetary benefit is too attractive to them as opposed to their roles as custodians of the land. We are becoming poorer day after day (Key informant in Gomoa Kweikrom, 2021).

The statement means that the majority of the residents in the study communities were not adequately involved in the land use decision-making because of the unfavourable land ownership system, which made the clan or family heads less accountable to their family members. Leach et al. (1997) argued from the viewpoint of the entitlement theory that local residents limited claims over environmental resources against those of more powerful actors account for entitlement failure and less due to the absence of resources. The finding confirms earlier findings by Arthur (2016) that, due to monetary benefits from sand mining, clan or family heads allocate land for mining without any consideration of the negative effects it has on the livelihoods of people living in the mining areas.

Consistent with the ET theory and the UPE theory, community members faced livelihood insecurities and impoverishment due to their limited control over farmland and the revenue that accrues from sand mining.

Mining on site

The majority (93.7%) of the household respondents indicated that sand was mined by Ghanaians who were non-natives of their communities, while 4.2% and 2.1% mentioned that Ghanaian natives of their communities and non-Ghanaian nationals were involved in the mining activity, respectively. This finding is consistent with Section 78 (1) of the Minerals and Mining Act, 2006 (Act 703), which restricts the mining of industrial resources to Ghanaians except where the proposed investment to be made by non-Ghanaians is $10 million or above. A sand contractor confirmed this finding:

> Most of the sand contractors and their employees, payloader operators, and tipper truck drivers are Ghanaians from outside the sand mining communities. However, the sand prospectors and a few teenagers who direct trucks to the site are often natives of the mining communities (Sand contractor in Gomoa Kweikrom, 2021).

The statement is consistent with insight from the UPE theory that urbanisation enhances the opportunities for urban actors to amass benefits for themselves, while inversely, the residents in the host communities have limited opportunities due to inadequate endowment sets.

Interactions with the key informants showed that the actual mining on site was organised by the sand contractor, who arranges for employees and earth moving equipment, hoists unique flag combinations along the road to direct tipper truck drivers to the specific site, and forwards information to truck drivers and stations about the commencement of the mining activity. At the mining site, the sand contractors often work with a few employees, including clerks who collect money from truck drivers, security men, teenagers positioned at the immediate junction of the site to direct truck drivers, and hired payloader operators (Figure 11). Apart from the sand contractors and their employees, other actors frequently seen at the mining site include the landowner’s representatives, revenue staff of the MMDAs, and local police officers. Officials from the EPA and the Minerals Commission occasionally visit the site as well to monitor the sand miners.

Figure 11: Sand contractor and workers at a mining site in Gomoa Buduatta

Photo Credit: Author (2021)

Given the comparative efficiency of machine-based mining compared to traditional harvesting with a spade and pickaxe, the dominant method of sand mining in the study areas was the use of machinery — payloaders and bulldozers. About 98.9% of the household respondents confirmed the use of earthmoving machines for sand mining. Some community members, on a smaller scale, used spades and pickaxes to load sand into tricycles for their minor construction works. The widespread machine-based mining was consistent with Lamb et al.'s (2019) finding in Cambodia, which indicated that sand was predominantly mined with earthmoving machinery. However, it contradicts Peprah's (2013) and Gondo et al.'s (2019) evidence that sand was mined manually in Ghana and South Africa, respectively. The recent departure from the traditional harvesting model could be a result of the surge in demand for sand and the need for an efficient approach that makes it possible for a large area of land to be mined within a few hours.

However, using earthmoving equipment severely damages the ecosystem. It was revealed through the field observations and also confirmed by the sand contractors that sand mining required that the topsoil and vegetation — often including food crops and trees — be pushed to the boundary of the demarcated area to expose the layers of cherished sand (Figure 12). The sand was then loaded into tipper trucks for delivery to customers. Sometimes, the topsoil that was required to be spread back on the mined-out land to restore the land to its natural and agriculturally usable condition was also sold to lawn developers or florists in the city.

Figure 12: Vegetation cleared to commence mining in Hobor

Photo Credit: Author (2021)

Reclamation

The study also determined whether sand miners pushed the topsoil back and planted trees to revegetate the site after mining. The evidence showed that it was characteristic of sand miners to abandon their sites without reclamation. About 99.4% of the household respondents mentioned that the sand contractors did not reclaim the site after mining. Interaction with the key informants revealed that, as a result of the absence of reclamation, the land was no longer agriculturally productive (Figures 13 and 14) and therefore was sold as building plots, but it often remained undeveloped for years. The key person at the EPA estimated that about 80% of mined sites around Accra were never reclaimed. The finding corroborates evidence in Akwa Ibom State, Nigeria (Abraham et al., 2021), and Indonesia (Dewi et al., 2019) that there was an absence of reclamation of sand mining sites in those countries.

Figure 13: Sand mining site not reclaimed in Tebu

Photo Credit: Author (2021)

Figure 14: Sand mining site not reclaimed in Gomoa Kweikrom

Photo Credit: Author (2021)

The absence of reclamation was not limited to the sand miners. It became evident at the FGDs in Gomoa Kweikrom that the community development committee had engaged in sand mining but failed to reclaim the land. Field observation confirmed the absence of reclamation on the said land. The finding appears to contradict earlier claims by McQuilken and Hilson (2016) that people who mined their own land were often disposed to rehabilitate the land for a possible future agricultural use. The lack of reclamation by the community development committee might be a result of the fact that the landowners in the sand mining communities preferred selling the mined land as building plots due to the expansion of Accra, which had reached those areas, rather than rehabilitating them for farming.

The key informant at the Department of Agriculture in GSMA observed that the apparent absence of reclamation prevented the productive re-use of the mined-out land for agriculture purposes and therefore could result in food insecurity in the affected communities. In the words of the official:

> No one is interested in rehabilitating the affected land. However, everyone knows very well that land is the only source of livelihood for the people. Even when the sand contractors had paid a reclamation bond to the Assembly, the funds were, in practice, not used for the rehabilitation of the land but were used to satisfy other demands (Key informant in GSMA, 2021).

The meaning of the statement from the perspective of Khan's (2010) political settlement theory is that both the sand miners and the MMDAs circumvent the reclamation of the mined-out land as a strategy to reduce their operational costs while achieving the distribution of benefits they desire. The key informants at the EPA and Minerals Commission attributed the lack of reclamation to factors including the perception by miners that reclamation was too cost-intensive (fuel and equipment rentals), repeated mining of already extracted land by other miners, the myth of miners that sand could regenerate itself over time (a consequence of mining-induced erosion from neighboring fields), and irregular monitoring by regulatory agencies due to logistics and staff constraints.

Illegal sand mining

The study found that the entire mining process was engulfed in illegal practices. Data retrieved from household heads, sand miners, and the key informant at the Minerals Commission revealed that sand miners hardly followed mining rules. A little over 56% of the household heads claimed that sand was entirely unlawfully mined from their immediate surroundings, whereas 39.9% of them claimed that it occasionally occurred legally or illegally. A few respondents also indicated that sand was always legally mined (3.2%). This result supports past findings that sand was predominantly mined illegally in Sri Lanka (Padmalal & Maya, 2014), India and Bangladesh (Gavriletea, 2017), and Morocco (UNEP, 2019) due to rising urbanisation and the need for housing facilities.

Several reasons were given by the household heads in support of their claim that sand miners largely operated illegally in their communities. The reasons assigned were destruction of farms, night mining, lack of reclamation, assault of residents by miners, and sand theft. Similar to this, discussions with sand contractors corroborated the practice since the majority of them were unable to produce the license covering their active mining operations. One sand contractor expressed his views on illegal sand mining as follows:

> No sand miner can admit that he operates completely legally throughout the year. Due to the nature of the activity, we engage in illegal practices such as mining without a license, leaving sites without reclamation, and infrequently mining sand from land that has not been allocated to us. The miners practice these, knowing very well that they can manage the sanctions that might emanate from their actions (Sand Contractor at Hobor, 2021).

The statement is consistent with the understanding from the political settlement theory that some powerful actors may deliberately undermine institutions by violating the rule and accepting the consequences if the benefits they accrue from their actions are greater than the cost.

The interactions with the key informants at the regulatory agencies and the sand contractors revealed that illegal sand mining manifests itself in two intertwined ways: mining without a permit and theft of sand. First, the key informant at the Minerals Commission reported that mining without a permit was the primary form of illegal sand mining in the study towns, and it occurred either when no license was held at all or when the registered license was misused for additional sites. This finding corroborates studies in South Buton Regency, Indonesia (Dewi et al., 2019) and Akwa Ibom State, Nigeria (Abraham et al., 2021) that showed that most sand miners ignored the acquisition of permits, while the few who acquired the mined beyond the approved threshold. It was alleged by the key informant at GEDA that mining without a license thrives on corruption amongst the sand contractors, truck drivers, and some local police officers.

Interviews with the truck drivers confirmed that they bought sand from the site without a license, mostly at a subsidised price, because the miners were unable to issue them with the Minerals Commission's waybill, which confirms that the sand was taken from a licensed site. A truck driver remarked:

> The reduction in the price of sand bought from an illegal source is to cater for bribes to local police officers along the way in order to avoid possible arrests of the drivers (Truck Driver in Gomoa Kweikrom, 2021).

About 87.8% of the household heads corroborated the alleged bribery of some state officials by the illegal miners. The respondents explained that the illegal miners were never sanctioned, even when they were caught in the act by the officials, as the officials, according to the household respondents, were allegedly bribed. The community development committee members and the FGD participants recounted instances where they reported illegal sand miners to the local police, but the cases were not pursued due to the miners' alleged networks with the police. For instance, the youth FGD participants in Tebu claimed that illegal miners deliberately break the laws without fear, knowing very well that some regulatory officials will accept bribes for their actions and leave them unpunished. According to their explanations, the miners were friends with some of the regulatory officials.

The finding corroborates earlier evidence about corruption in the mining sector in Ghana (Hilson & Maconachie, 2020; Wireko-Gyebi et al., 2020) and

India (Rege & Lavorgna, 2017), showing that widespread corruption between illegal miners and government officials has led to a highly complex parastatal governing system for sand mining activities in many institutionally weak countries of the global south.

The second type of illegal sand mining was the theft of sand. Theft of sand involved the extraction of sand from land not acquired by the miners (Figure 15). It was discovered that landowners who had good deposits of sand on their land but refused to allocate them to the miners mostly suffered from sand theft. The key persons at the EPA and the Minerals Commission explained that this category of miners usually operates at night — from 10:00 p.m. to 4:00 a.m. — and on taboo days when farmers are banned by local tradition from working in their fields. The result corroborates studies in countries such as India and Morocco (UNEP, 2019; Tastet, 2019; Pereira, 2020), where theft of sand was widespread.

Figure 15: A site in Hobor where sand was mined without permit of the landowner

Photo Credit: Author (2021)

The study further found that miners who engage in sand theft mostly operated with weapons. Key persons at the EPA, Minerals Commission, and MMDAs agreed that their inspectorate divisions did not engage in night monitoring of sand miners because it was outside their official working hours and stressed the extreme danger involved in such endeavours. This result is consistent with Beiser (2018) and Tastet (2019), who found that in an attempt to stop illegal sand mining, government officials were often beaten and some even murdered. Consistent with insights from the political settlement theory, the fear of such attacks by both the residents and the regulators had created a form of power for the sand miners and a safe haven for them to engage in illegal mining. A sand contractor admitted to carrying weapons, but he explained that the weapons were used to protect themselves from armed robbers.

It became evident from both the FGDs and interactions with the truck drivers that the violent confrontations characterising sand mining often affected farmers and truck drivers. Some truck drivers corroborated the issue as follows:

> Truck drivers are the most disliked actors by community members since we are found carrying the sand from the communities. The community members have forgotten that their leaders rather give out the land to the miners. The tipper truck drivers are just engaged in our legitimate livelihood (Key informant in Gomoa Kweikrom, 2021).

> I was once caught up in an exchange of gunshots between the sand contractor's team and some aggrieved people who claimed the mining site belonged to them. The truck drivers at the scene had to run for safety,

leaving our trucks behind. Some trucks were even destroyed by the aggrieved persons (Key informant in Gomoa Buduatta, 2021).

The statements confirm findings that sand mining activities are engulfed in violence, which mostly affects weaker actors (Beiser, 2018; Pereira, 2020). According to the majority of the drivers, finding a contractor with the highly sought-after smooth and pale sand was much more important because it enhanced their profits. Therefore, the drivers often did not worry about whether the contractor had properly acquired the land or not.

Interest Position of the Actors

Analysing the interests of the different actors helps to better understand the governance challenges in sand mining by bringing to bear the various benefits involved. The study found that there were different interests among the actors engaged in sand mining. The responses regarding the interests of sand mining actors were categorised under aesthetic, environment/biodiversity, monetary, employment, social cohesion, and agriculture/food security. The assessment involved the household respondents' opinions regarding the interests of the actors and the key informants' responses, with the latter depicted in Table 10. The positive and negative signs used in Table 10 demonstrate how the key informants rated the different interests in sand mining among the various actors (+++ = very high interest, ++ = high interest, + = medium interest, - = low interest).

First, the results revealed that monetary benefit was the most common interest among the actors. However, the household respondents indicated that the extent of interest was very high for sand contractors (98.3%), landowners

(93.5%), and truck drivers (97.4%), compared to the other actors. This finding was confirmed by the key informants, as depicted in Table 10. A landowner shared these words:

> Releasing land to sand miners is very profitable since huge amounts of money are earned within a few days, compared to the meagre and unpredictable returns from farming (Key informant in Gomoa Buduatta, 2021).

Even though community members, particularly farmers, had high monetary interests (++), their interests were in relation to adequate access to farmland and the proceeds they accrued from agriculture-related activities, not direct income from sand mining. Therefore, their interests conflicted with those of landowners who allocated land for sand extraction. Similarly, most of the household heads indicated that the MMDAs (74.6%), Minerals Commission (71.9%), and EPA (81.6%) also had a high monetary interest in sand mining. The key informants from these organisations confirmed that sand mining was a major revenue item for their agencies.

Table 10: The interest of the actors in sand mining

Interest	Sand mining actors							
	Sand Contractors	Land Owners	Truck Drivers	EPA	MMDAs	Minerals Commission.	Dev't. C'ttee.	Community Members
Environment/ biodiversity	-	-	-	+++	++	+	-	++
Monetary	+++	+++	+++	+	++	++	++	++
Employment	++	-	+++	-	-	-	-	-
Aesthetic	-	-	-	++	+	+	++	++
Social Cohesion	-	+	+	-	++	-	+++	+++
Agric./food Security	-	++	-	+	+++	+	+++	+++

Interest of actors: +++ very high interest; ++high interest; +medium interest; - low interest

Source: Field survey, 2021

It was further established by some of the sand contractors and truck drivers that the monetary benefits from sand mining activities were unevenly distributed. The respondents indicated that the revenue flows were tilted towards actors with capital or land. In that regard, sand contractors and landowners received the lion's share of the financial returns from sand mining, while actors including employees of the contractors, farmers, and the mates of the truck drivers received smaller shares of the revenue. A landowner confirmed this finding as follows:

> The money I earn from sand mining compensates me for the degradation of my land. Landowners provide land mined for the development of the city, while contractors provide the funds for the mining. Therefore, it is right that we earn more income than the others (Key informant in Hobor, 2021).

The finding is consistent with the UPE, which explains that urbanisation is a significant process that causes unequal economic gains through the exploitation of environmental resources, with higher benefits accruing to wealthy actors to the detriment of the majority of marginalised and weaker actors (Myers, 1999). It again concurs with the findings of Musah (2009) and Lamb et al. (2019) that the monetary benefits from sand mining accrue to wealthy or influential actors.

Second, with environment/biodiversity, the household heads reported very high interest for the EPA (99.3%), high interest for local government authorities (78.2%), and high interest for community members (77.6%). The household heads claimed that actors such as sand contractors and truck drivers had low interest in the environment or biodiversity conservation. The finding was confirmed by the key informants, as shown in Table 10. Relatedly, the finding on aesthetic interest followed a similar trend to that of the environment/biodiversity. The majority of household heads reported that sand contractors (89.4%), truck drivers (76.8%), and landowners (69.5%) had low aesthetic interest because they were connected with widespread environmental degradation and the high rates of unsustainable sand extraction in the study areas. This confirms earlier findings that environmental standards were not adhered to by sand miners (UNEP, 2014; Pereira, 2020).

Third, with respect to agriculture/food security, both the household heads (99.6%) and the key informants reported a very high level of interest among the community members. Likewise, the local government authorities were also rated with a very high interest in agriculture/food security (+++) through the implementation of government flagship programmes such as Planting for Export, and Rural Development, and Planting for Food and Jobs, which sought to enhance the agriculture sector. However, the key person at the Department of Agriculture in the GSMA expressed doubt about the commitments of the MMDA to promote agriculture, especially crop farming. The officer claimed that the Municipal Assembly had done very little to protect farmland in the sand mining communities, knowing very well the negative effects of sand mining on food security. According to the officer, because of the monetary benefits the Assembly generated from sand mining, it was always difficult to address complaints made against the miners.

Fourth, over 89% of the household heads reported very high and high interest in employment for truck drivers and sand contractors, respectively. This finding was confirmed by the key informants, as shown in Table 10. It was observed by the sand contractors that they usually offered seasonal employment to very few people, mostly 10 workers per contractor. This finding agrees with that of Lamb et al. (2019) in Cambodia, who found that sand mining lacks the capacity to offer direct employment for local residents, including landless farmers in the mining community. However, the finding contradicts earlier evidence in Niger State, Nigeria (Lawal, 2011), and Rio de Janeiro (Silva, 2019), where sand miners employed many local residents. The sand contractors attributed the deviation from the earlier evidence to the introduction of machine-based mining in the study areas, which required fewer workers than manual mining methods. Besides, the local residents lacked the technical skills required to operate the machines.

Fifth, while over 95% of the household heads reported very high social cohesion interest for the community members, MMDAs, and community development committees, landowners who were supposed to unite the communities were rather rated as having medium interest in social cohesion. It was alleged from the interactions with both key informants at the MMDAs and FGDs participants that the desire for quick monetary gains by landowners had diminished their duty as leaders required to pursue the welfare of their community members. This result is consistent with Ubink and Quan's (2008) finding that chiefs in Ghana transact land in their own interest without any consideration of the effects on their community members.

Power Position of the Actors

The political settlement theory argues that the interests of actors are often enhanced by their power position. Therefore, it was important to examine the opinions of the respondents on the power positions of the different actors who made decisions about sand mining. Three categories of power—coercive, incentive, and trust—were used. To begin the analysis, the household heads were asked to indicate the most powerful actor in sand mining. About 24.5% indicated MMDAs, while 20.7% mentioned sand contractors. The others reported landowners (20.2%), the Minerals Commission (9.5%), the EPA (9.2%), truck drivers (6.6%), community members (6.2%), and the community development committee (3.1%) in that order. The FGD participants and the key informants at both the EPA and the Minerals Commission also corroborated that the MMDAs were the most powerful actors in sand mining because of their proximity to the mining sites and their ability to mobilise the expertise of other agencies, such as the police, when dealing with difficult issues.

The research further disaggregated the opinions of the respondents by each source of power. In relation to coercive power, 30.8% of the household heads indicated that sand contractors often applied it at the mining sites. The others indicated landowners (21.2%), MMDAs (17.6%), Minerals Commission (11.2%), EPA (8.7%), community development committees (6.4%), truck drivers (2.9%), and community members (1.2%). Interactions with the FGD participants and the key informants revealed the following: First, it was confirmed that sand contractors, particularly those who operated at night, largely use coercive power through the physical abuse of farmers and, infrequently, landowners. An official at the Department of Agriculture in GSMA remarked:

> A farmer in Tebu reported to the Assembly that the sand miners were illegally mining around their house at night, but none of the household members could confront the miners because they carried weapons (Key informant, 2021).

Based on the knowledge gained from the political settlement theory, the above narrative emphasizes the levels of coercive power sand contractors use in the mining communities as a result of their violent reputation, which was a worry for both community members and the staff of the regulatory agencies. This result confirms Beisers' (2018) finding that the use of weapons by illegal miners intimidates even officials backed by law and prevents the officials from enforcing mining rules.

Second, the MMDAs were by law in charge of the overall spatial and land use planning in their areas of jurisdiction and thereby had coercive power over the sand miners. The key informant at GSMA and a sand contractor confirmed that the security council of the Assembly occasionally impounded mining machinery and also arrested some illegal miners. Third, the FGD participants and key informants at the Department of Agriculture reported that some landowners use coercive power in the form of threats and physical attacks to eject reluctant tenant farmers from the land they have earmarked for sand mining.

Fourth, both the EPA and the Minerals Commission also had coercive power backed by law to ensure that sand miners observed the mining regulations. In practice, however, the key informants at the EPA and the Minerals Commission accepted that their powers were not fully applied due to logistics and staff constraints. The inefficient application of the coercive powers of the regulatory actors has created a condition of elite capture, and this is consistent with the UPE theory. Influential actors exploited sand at any environmental cost to capture their monetary interests, while the vulnerabilities of the majority of the local people were heightened.

In respect of incentive power, while 36.8% of the survey respondents reported that the MMDAs possessed it, 34.6% mentioned that the sand contractors had it. Other actors mentioned by the household respondents were landowners (18.7%), truck drivers (6.1%), and community development committees (3.8%), in that order. The key informants and the FGD participants confirmed that the communities depended on their respective local government authorities for developmental projects. These incentives were a form of power the local government authorities used to influence landowners, sand contractors, and community members, particularly for revenue generation.

The interactions further revealed that the majority of the sand contractors used incentives to convince landowners to allocate land for sand mining. Some FGD participants also claimed that when dealing with the regulatory agencies, financial inducements were the form of incentive the sand contractors and truck drivers employed in order to throw the mining rules to the wind. On the part of landowners, FGD participants and some of the key informants acknowledged that a few landowners occasionally facilitated the payment of compensation to negatively affected farmers. This finding corroborates McAdams (1980) explanation of the UPE theory that urbanisation creates environmental change, which results in the use of several forms of incentives by different actors to defend their interests.

The possession and use of trust power were also examined. Most (73.2%) of the household respondents reported that the MMDAs had trust power. The other actors mentioned were community members (10.1%), the Minerals Commission (8.2%), the EPA (5.9%), and the community development committee (2.6%) in that order. The interactions with the FGD participants and key informants revealed that the MMDAs had close associations, knowledge, and proximity to the communities as well as the sand mining sites. This association has created higher levels of trust for the MMDAs. For example, in Hobor, the FGD participants mentioned that every issue in the community was brought to the attention of the Assembly Member, who often reports it to the local government authority. In respect of the EPA and the Minerals Commission, the key informants reported that the agencies had knowledgeable staff to address the issues with sand mining. Both the interviews with community development committee members and the FGDs revealed that sand contractors and landowners were the least trusted actors in sand mining. A community development committee member remarked:

> How can we trust sand contractors or landowners? They always assure the community members that their farm will not be mined and later turn

around secretly to mine the farms (Key informant in Gomoa Buduatta, 2021).

According to the insights from the political settlement theory, disputes over land use, regulations of sand extraction, and the sharing of profits from the extraction of sand typically arise due to uneven power relations among the various actors. First, the key informants at both GEDA and GSMA revealed that the conversion of farmland to sand pits was a foremost source of disputes in the sand mining areas due to the different interests in land among the landowners and sand contractors on one side and the local residents on the other. It was observed from the interactions that the landowners and sand contractors did not want to easily lose their control over land due to the relatively higher monetary returns from sand mining. The community members, particularly farmers, also demand more access to and control over cultivable land. Similar evidence was revealed by Ramachandra, Vinay, and Chandran (2018) in Aghanashini, India, that there were frequent land use disputes between local community members and key actors involved in sand mining. The FGD participants and the key informants confirmed the prevalence of land use disputes connected to sand mining. The officer at GSMA shared these views:

> About two years ago, we received reports that a young man shot his own biological brother over the allocation of his pineapple farm for sand mining. There are reports that some residents in the sand mining communities have evil intentions against people in their neighbourhood for contributing to their displacement from their farmland. Sand mining

has truly raised tension amongst landowners and farmers in the mining communities (Key informant, 2021).

The views shared here corroborate the political settlement theory. The notion of Van Leeuwen and Van Der Haar (2016) that actors will fight over environmental resources when their livelihoods and rights of use are endangered is also captured here. Land is a valuable and scarce resource; therefore, there is often competition over its access and use. Second, the key informants at both MMDAs and the Minerals Commission explained that their attempts to ensure strict adherence to the mining regulations frequently result in tensions between them and the other regulatory agencies over who has the legal mandate over certain issues. Third, community development committees' intention to obtain a certain level of control over sand mining often led to tension between landowners and sand contractors on the one hand and the committee members on the other.

Summary of the Chapter

Sand mining was widespread in all the study areas and mostly undertaken by contractors from the city. A total of 431 truckloads of sand were mined each day from the study areas during the time of data collection. When extrapolated to a year, an annual volume of 134,472 truckloads of sand was mined from the communities. Sand was largely mined with machinery from agricultural fields and, predominantly, illegally mined. The illegal practices found in the study areas included mining without permits and the theft of sand. Both practices were embedded in the lack of reclamation after mining. Weak governance, bureaucratic license processes, and the absence of monitoring were among the factors found to have promoted widespread illegal sand mining and trade. The high rate of illegal sand mining called into question the efficacy of the existing regulatory systems.

Monetary benefit was the most common interest for the sand mining actors. However, the revenues were unevenly distributed, with a larger share accruing to landowners and sand contractors. With respect to power position, local government authorities were the most powerful actors, having all three categories of power sources. Aside from local government authorities, landowners and sand contractors were also powerful actors who could influence decision-making largely through coercive and incentive power. However, community members who were in the majority had limited power regarding the extraction of sand. The next chapter looks at the effects of sand mining on household livelihoods and the alternative livelihood strategies adopted by the household heads.

CHAPTER SIX

EFFECTS OF SAND MINING ON LOCAL LIVELIHOODS AND ADOPTION OF ALTERNATIVE LIVELIHOOD STRATEGIES

Introduction

The chapter presents answers to research questions two and three, which are the effects of sand mining on the livelihoods of the locals in the study areas and the alternative livelihood strategies adopted by the local residents, respectively. On one hand, the discussion on the effects of sand mining covered issues including access to farmland, crop yields, pollution, land disputes, and the creation of employment, among others. On the other hand, the discussions on the alternative livelihood strategies pursued by household heads because of the externalities of sand mining covered the types of strategies, the outcomes of the strategies, and the challenges confronting the strategies, among others.

Effects of Sand Mining on Local Household Livelihoods

The entitlement theory and the conceptual framework (Figure 6) both suggest that sand mining has an impact on the endowments necessary for a household's livelihoods. The effects can be environmentally, economically, or socially induced and can either be positive or negative. The family heads were asked to indicate their general impressions on how sand mining was affecting local household livelihoods. The majority (86.6%) of survey respondents claimed that sand mining had no positive effects on local households' livelihoods. The result supports Anokye et al.'s (2023) finding from the Awutu Senya East and Awutu Senya West local government areas in Ghana, where the majority of research participants claimed that sand mining had a detrimental impact on their livelihoods.

Table 11: Household head's opinion about the effects of sand mining on livelihoods

Effects	Buduatta		Kweikrom		Hobor		Tebu		Total	
	f	%	f	%	f	%	f	%	f	%
Negative	75	84.3	36	90.0	90	85.7	38	90.5	239	86.6
Not sure	12	13.5	2	5.0	14	13.3	3	7.1	31	11.2
Positive	2	2.2	2	5.0	1	1.0	1	2.4	6	2.2
Total	89	100.0	40	100.0	105	100.0	42	100.0	276*	100.0

$\chi^2 = 5.215$, df = 6, $\alpha = 0.05$, p-value = .517

*Less than the number of respondents (n=278) due to nonresponse

Source: Field survey, 2021

When the findings were further broken down, it became clear that household heads in both the indigenous communities and the settler communities (Tebu and Hobor) had the same views of how sand mining affected local household livelihoods ($\chi^2 = 5.215$, df = 6, $\alpha = 0.05$, p-value = .517). Details of the reasons provided by the household respondents in support of their opinion about the impacts of sand mining on their livelihoods are presented in the subsequent sections.

Economic effects of sand mining on local livelihoods

Economic sustainability is concerned with a system of production that satisfies the consumption needs of the present generation without jeopardising those of future generations. The economic consequences of sand mining on local household livelihoods were grouped into positive and negative categories.

Negative economic effects of sand mining

The household respondents were questioned about the negative economic effects of sand mining on their household livelihoods. Reduced farm size (30.3%), low crop yields (16.5%), and destruction of farms (14.0%) were some of the negative economic effects mentioned by the respondents. The least mentioned negative economic effect of sand mining on local household livelihood was reduced grazing fields (4.4%), as shown in Table 12.

Table 12: Household responses on the negative economic effects of sand mining on local livelihoods

Negative effects of sand mining	Frequency	Percentage
Reduction in farmland	232	30.3
Low crop yields	126	16.5
Destruction of farms	107	14.0
Low purchasing power	87	11.4
High cost of living	76	10.0
Reduction in income	54	7.1
Destruction of forest-based livelihoods	48	6.3
Reduction in grazing field	34	4.4
Total	764*	100.0

*More than the number of respondents (n=278) due to multiple response

Source: Field survey, 2021

Since the majority of the residents were farmers, land was a natural capital they relied on to secure their livelihood. The study, therefore, examined the likelihood of the local residents having access to farmland. A three-point scale with the options of difficult, moderate, and easy access was employed. Generally, about 84.1% of the household heads indicated that they had difficulty accessing farmland in their communities, as shown in Table 13. The finding corroborates earlier evidence in Wa, Ghana (Peprah, 2013) and Nigeria (Johnbull & Brown, 2017; Abraham et al., 2021) that large hectares of farmland had been converted into sand mining pits, thereby making it difficult for people in sand mining communities to access farmland. The difficulty in accessing farmland was confirmed by officials at the Department of Agriculture.

> The future of farming in the sand mining communities is bleak. Almost all the farmland has been allocated either for sand mining or sold to real estate developers (Key informant GEDA, 2021).

> Some farmers in the sand mining communities farm on construction sites due to limited access to land (Key informant GSMA, 2021).

These observations are consistent with the entitlement theory and suggest that the land ownership systems in the study areas were rapidly changing from a communal ownership regime to a private property regime, which was unfavourable to the majority of the economically weak local residents. As a result, the residents did not have adequate access to and control over land to secure their livelihoods. The finding further corroborates Abass, Afriyie, and Adomako’s (2013) finding that farmers in peri-urban areas depend on construction sites as farmland due to their limited entitlement to land.

Table 13: Likelihood for household respondents to have access to farmland by community

Parameter	Buduatta		Kweikrom		Hobor		Tebu		Total	
	f	%	f	%	f	%	f	%	f	%
Difficult	66	75.0	27	67.5	99	92.5	41	97.6	233	84.1
Moderate	18	20.5	10	25.0	7	6.5	1	2.4	36	13.0
Easy	4	4.5	3	7.5	1	0.9	0	0.0	8	2.9
Total	88	100.0	40	100.0	107	100.0	42	100.0	277*	100.0

χ^2 = 25.674, df = 6, α = 0.05, p-value = .000

*Less than the number of respondents (n=278) due to nonresponse

Source: Field survey, 2021

The distribution of the household responses, as depicted in Table 13, shows that access to land was much more difficult for residents in Tebu (97.6%) and Hobor (92.5%) (both migrant communities) than in Gomoa Kweikrom (67.5%). Significant differences were found among the communities in respect of access to farmland using the Chi-square test of independence (χ^2 = 25.674, df = 6, = 0.05, p-value =.000). The finding means that indigenous communities have relatively better access to and entitlement to farmland as compared to migrant communities.

The study also determined whether the household respondents had ever lost cropland to sand miners in the previous five years — from 2015 to 2020 — and how it had impacted their livelihoods. Over the course of the five-year period, 85% of the household heads had experienced some loss of cropland to sand miners (Table 14). The result is consistent with Peprah's (2013) and Pribadi, Vollmer, and Pauleit's (2018) findings that sand mining has resulted in the loss of agricultural land in many countries.

Table 14: Household responses on loss of farmland to sand miners by community

Lost farmland	Buduatta f	Buduatta %	Kweikrom f	Kweikrom %	Hobor f	Hobor %	Tebu f	Tebu %	Total f	Total %
Loss of farmland	52	77.6	27	77.1	66	88.0	36	100.0	181	85.0
No loss of farmland	15	22.4	8	22.9	9	12.0	0	0.0	32	15.0
Total	67	100.0	35	100.0	75	100.0	36	100.0	213*	100.0

χ^2 = 11.431, df = 3, α = 0.05, p-value = .010

*Less than the number of respondents (n=278) due to nonresponse

Source: Field survey, 2021

The distribution of the household responses, as indicated in Table 14, shows a higher prevalence of loss of cropland to sand miners in the settler communities, Tebu (100%) and Hobor (88.0%), than in Gomoa Kweikrom (77.1%) and Gomoa Buduatta (77.6%). Significant differences across the communities were found using a Pearson Chi-square test of independence (χ^2 = 11.431, df = 3, = 0.05, p-value =.010). Clearly, even though the majority of the household respondents had limited entitlement over farmland, the situation was worse in the settler communities because, as Arko-Adjei (2011) argued based on the elements of the entitlement theory, tenant farmers have restricted access to and control over farmland compared to native farmers.

Additional analysis was done to determine the landholding size the household respondents lost over the five-year period. The largest amount of land owned by the household respondents in 2015 was 43 acres, while the smallest amount was one acre. The median landholding size was four acres (mean = 4.79; standard deviation = 4.135; skewness = 4.324), with a quartile deviation of two acres. However, the largest landholding size among the household respondents in 2020 was 14 acres, with one acre as the minimum. The median landholding size was one acre (mean = 2.05; standard deviation = 1.909; skewness = 3.281), with a quartile deviation of an acre.

The landholding median size for 2015 was evidently higher than that of 2020. The results showed that the average size of the landholdings among the household respondents was less than the two-acres average arable national landholding size reported by the GSS (2018). According to the findings, which are consistent with insights from the UPE theory, fewer acres were available to people in the sand mining areas for farming or other land-based livelihoods because of the allocation of more land for sand mining. This situation denies the local people in the mining areas equitable access to land to secure their livelihoods.

Kruskal-Wallis's test was employed to see if there were any variations in the size of the present landholdings among the study areas. The result showed significant differences among the communities in respect of the household heads' current landholding size (χ^2 = 9.619; P-value = 0.022), as shown in Table 15. Household respondents in Gomoa Buduatta had the biggest landholding sizes, followed by Gomoa Kweikrom (both indigenous communities), compared to respondents in the settler communities.

Table 15: The Kruskal Wallis test of differences in landholding sizes

Community	Frequency	Mean rank
Gomoa Buduatta	65	113.90
Gomoa Kweikrom	35	109.90
Hobor	72	105.81
Tebu	36	79.67

$\chi^2 = 9.619$, df = 3, $\alpha = 0.05$, p-value = .022

Source: Field survey, 2021

The median test additionally revealed that most of the household respondents in Gomoa Buduatta, 35 out of 65 respondents, had landholding sizes larger than the median size of one acre. On the other side, the majority of the household respondents in Gomoa Kweikrom (18), Hobor (37) and Tebu (26) had landholding sizes smaller than or equal to the median landholding size, as depicted in Table 16.

Table 16: Landholding size by community

Median	Buduatta	Kweikrom	Hobor	Tebu
>Median	35	17	35	10
<=Median	30	18	37	26
Total	65	35	72	36

Median = 1, $\chi^2 = 6.668$, df = 3, $\alpha = 0.05$, p-value = .083

Source: Field survey, 2021

The effect of sand mining on crop yields was also examined. As shown in Table 17, 92.2% of the household respondents in all four study areas had seen a decline in crop yields during the previous five years. The finding supports Govindaraj, Raveesha, Ahmed, Suryaprakash, Rajan, and Harsha's (2013) results that in Tumkur, India, sand mining had negatively affected crop yields. The majority of household heads in Tebu (100%) and Hobor (95.8%), both settler towns, however, reported the highest percentages of decreases in crop yields, with Gomoa Kweikrom (79.4%) having the lowest percentage. The differences across the communities in terms of reduction in crop were revealed to be significant at the 0.05 alpha level (χ^2 = 12.367, df = 3, = 0.05, p-value =.006).

Table 17: Household responses on crop yields by community

State of	Buduatta		Kweikrom		Hobor		Tebu		Total	
crop yields	f	%	f	%	f	%	f	%	f	%
Reduced	58	90.6	27	79.4	69	95.8	36	100.0	190	92.2
Increased	6	9.4	7	20.6	3	4.2	0	0.0	16	7.8
Total	64	100.0	34	100.0	72	100.0	36	100.0	206*	100.0

χ^2 = 12.367, df = 3, α = 0.05, p-value = .006

*Less than the number of respondents (n=278) due to nonresponse

Source: Field survey, 2021

The household respondents gave a number of explanations for why their crop yields had decreased over the five-year time period. First, sand miners removed the top soil, thereby making their land infertile for crop cultivation (Figures 16 & 17). Second, some sand miners and truck drivers had destroyed crops. Third, cattle grazed on crops as a result of the absence of grassland.

Figure 16: Maize farm not doing well on previously mined field in Gomoa Kweikrom

Photo Credit: Author (2021)

Figure 17: Cassava farm not doing well on previously mined field in Hobor

Photo Credit: Author (2021)

The negative effects of sand mining on crop yields were corroborated by FGD participants and some of the key informants, including landowners, community development committee members, and MMDA staff members. They corroborated the household responses and further mentioned land disputes as additional reasons for low crop yields. A member of the community development committee and an MMDA staff shared these words:

> I harvested less than half of the produce I used to harvest a few years ago because of the sand mining. The chief has allocated portions of my farm for sand mining, while some families are also fighting over the ownership of the remaining land. The miners also destroyed portions of my farm (Key informant in Gomoa Kweikrom, 2021).

The official at the GSMA also remarked:

> The agriculture extension officers reported an incidence of low crop yields in the sand mining communities at our last staff meeting (Key informant, 2021).

It can be inferred from the above quotations that farmer households in the study communities were heavily burdened as a result of widespread sand mining on farmland. While the reduction in crop yields was a livelihood concern for the local residents, it could also lead to food insecurity in the mining communities.

Aside from reductions in crop yields, the study examined the destruction of farms or farmland by sand miners. As shown in Table 18, 76.4% of the household respondents mentioned that their farms or farmland were destroyed by sand miners. The result is consistent with that of Derbile, Chirawurah, and Naab (2022), who found that farmers lose their farms and investments to sand miners overnight due to the destruction caused by the miners.

Table 18: Household responses on the destruction of farms by sand miners

Farm detsroyed	Buduatta f	Buduatta %	Kweikrom f	Kweikrom %	Hobor f	Hobor %	Tebu f	Tebu %	Total f	Total %
Destroyed	54	61.4	27	67.5	87	82.9	42	100.0	210	76.4
Not destroyed	22	38.6	13	32.5	18	17.1	0	0.0	65	23.6
Total	88	100	40	100.0	105	100.0	42	100.0	275*	100.0

$\chi^2 = 28.164$, df = 3, $\alpha = 0.05$, p-value = .000

*Less than the number of respondents due to nonresponse

Source: Field survey, 2021

A further study of the result depicted in Table 18 points out that the proportion of household respondents who had experienced destruction of their farms or farmland was greater in Tebu (100%) and Hobor (82.9%) than in Gomoa Kweikrom (67.5%) and Gomoa Buduatta (61.4%). Significant differences between the communities were found using the Chi-square test of independence (χ^2 = 28.164, df = 3, = 0.05, p-value =.000). The household heads from the settler communities (Tebu and Hobor) had higher incidences of their farms being destroyed by sand miners compared to those from the indigenous communities.

The interactions with the FGD participants and the key informants at the MMDAs, EPA, community development committee, and Minerals Commission confirmed that farms were sometimes destroyed by the sand miners. The respondents indicated that the actual crops destroyed were mostly arable crops such as cassava, yam, vegetables, maize, *ademe* (jute mallow/Corchorus olitorius), okra, plantains (musa sapientum), and pineapples. Infrequently, tree crops, particularly mango trees and palm trees, were also destroyed by sand miners. A community development committee member and an official of the Minerals Commission remarked:

> I took a loan from a microfinance institution in Kasoa and invested in a two-acre pineapple farm. I was on the farm working when the miners came to mine on adjoining land. When I confronted them, the leader assured me that they were only permitted to mine on the land adjacent to my farm. I was shocked by the destruction the miners caused to my farm when I returned the next morning. The pineapples were only a few months to harvest, yet they destroyed them (Key informant Gomoa Buduatta, 2021).

The official of the Minerals Commission noted:

> We saw farms destroyed by sand miners during our field monitoring. Unfortunately, it was very difficult to arrest the miner because the destruction often happens at night (Key informant, 2021).

The above quotations underscore the unfavourable land tenure system, entitlement failure, and insecurities the respondents faced in respect of their investments in farming due to the widespread unregulated sand mining in the study areas. Field observation confirmed several incidences of farms destroyed in the process of sand mining (Figures 18 & 19).

Figure 18: Maize farm destroyed by sand miners Tebu

Photo Credit: Author (2021)

Figure 19: Pineapple farm destroyed by sand miners in Hobor

Photo Credit: Author (2021)

The adverse effect of sand extraction on household income was also examined. Most (90.5%) household respondents said they had seen a decrease in their yearly income during the last five years, while 5.4% and 4.1% were not sure or indicated an increase in their annual income, respectively. This result supports that of Farahani and Bayazidi (2018), who found that sand mining in Asia resulted in lower incomes and higher levels of poverty among locals living in mining villages. The result was not surprising because most of the inhabitants in the research areas were farmers who had experienced negative effects such as reduction in farm size, destruction of crops, low crop yields, and difficult access to farmland. The FGD participants in all the study areas and the community development committee members also confirmed the reduction in household income. A community development committee member remarked:

> We have become poorer than before. Most residents cannot afford the things they used to provide for their family members because they no longer have adequate farmland (Key informant in Gomoa Kweikrom, 2021).

The narrative confirmed insights from the UPE theory and the entitlement theory that unequal access to and control over environmental resources account for poverty among vulnerable actors such as peasant farmers and rural artisans. Further investigations with descriptive statistics revealed that in 2015, out of 268 households that responded, the highest average yearly income from the primary occupation was GHS 35,000.00 and the lowest was GHS 1,900.00. The median annual household income was GHS 8,000.00 (mean = GHS 10,289.18; standard deviation = GHS 7,684.47; skewness = 1.361), with a quartile deviation of GHS 10,000.

Comparatively, responses from 262 household heads showed that in 2020, the highest household head annual income was GHS 40, 000.00, with GHS 1,500.00 as the least. The median household annual income for 2020 was GHS 5,000.00 (mean = GHS 6,822.57; standard deviation = GHS 6,267.84; skewness = 2.256), with a quartile deviation of GHS 5,350.00. Analysing the median for both years demonstrates clearly that the median annual income for 2015 was larger than that of 2020, even though the value of the Ghana cedi in 2015 was higher than the present value due to an increase in the relative price levels.

The researcher examined further if there were differences in the current annual income from the primary occupation among the study communities with the Kruskal-Walli's test. The result showed significant differences in the communities with respect to their 2020 annual income (χ^2 = 48.694; P-value = 0.000). Household respondents in Tebu had the largest income sizes, followed by Gomoa Buduatta, Hobor, and Gomoa Kweikrom in that order (Table 19). The surprising high income in Tebu, although their respondents had the least landholding size, was attributed to the relatively higher price of the pineapples they cultivated compared to the other communities where respondents largely cultivated staple crops.

Table 19: The Kruskal Wallis test of differences in sizes of income

Community	Frequency	Mean rank
Tebu	42	183.65
Gomoa Buduatta	85	160.27
Hobor	102	108.07
Gomoa Kweikrom	39	94.59

$\chi^2 = 48.694$, df = 3, $\alpha = 0.05$, p-value = .000

Source: Field survey, 2021

To establish where the differences in the current household income lay, further analysis was done with the median test. The result revealed that while the majority of the households in Gomoa Buduatta and Tebu reported annual incomes above the median of GHS 5,000.00, the majority of respondents from the other communities reported annual incomes either equal to or below the median, as shown in Table 20. The median test was significant at the 0.05 alpha level (Median = GHS 5,000.00, $\chi^2 = 34.933$, df = 3, $\alpha = 0.05$, P-value = .000).

Table 20: Husehold heads' annual income from primary occupation by community

Frequency	Buduatta	Kweikrom	Hobor	Tebu
>Median	51	9	38	33
<=Median	34	30	64	9
Total	85	39	102	42

Median = 5,000, $\chi^2 = 34.933$, df = 3, $\alpha = 0.05$, p-value = .000

Source: Field survey, 2021

It is important to acknowledge that in the research communities, as in most places in Ghana, informal business owners, including farmers and traders, scarcely keep records of accounts. As a result, the data on the respondent's annual income was based on recall. Therefore, the findings might not represent the exact state of the respondents' income. Besides, subsistence farmer households consume a substantial portion of their farm produce (GSS, 2018), but such products were not considered in the estimations. That notwithstanding, the result was largely valid since most of the household respondents and FGD participants acknowledged that they received comparatively less monetary value from their farming activities or other primary occupations compared to their previous incomes.

Several reasons were provided by the household heads, FGD participants, and key informants at the local government authorities to explain the reduction in household income in the study areas. These included displacement from farming, destruction of forest-based livelihoods (hunting and forest gathering), poor rainfall, reduction in farm sizes, destruction of crops, and low purchasing power. For instance, household heads who were traders said that their reduced income was due to the limited purchasing power of the locals. They explained that, as farmers made up the majority of the population in the study areas, anything that lowered farmer income had an indirect impact on trading operations as well. The female FGD participants in Hobor argued that since the miners had destroyed the sources of income for farmer households, most of the residents did not have money to buy from traders. The respondents claimed that while the negative impacts of sand mining on household income were largely felt in the mining communities, the financial benefits were instead transferred to the urban areas where the sand contractors and other actors resided and conducted business.

The respondents who raised livestock, such as cattle, goats, and sheep, indicated that sand mining had a detrimental impact on their livelihoods because of the clearing of vegetation, which consequently made it difficult for them to find pasture to feed the livestock (Figure 20). Interaction with FGD participants revealed that some livestock farmers had sold the majority of their animals as a result of inadequate grassland. The finding is similar to Adedeji, Adebayo, and Sotayo's (2014) evidence in Nigeria that sand mining affects livestock rearing negatively because of the devegetation linked with the activity.

Figure 20: Cattle being led by a herder struggles to find feed in Hobor

Photo Credit: Author (2021)

The following implications may arise from the difficulty of keeping livestock: first, a possible reduction in protein intake for rural and peri-urban dwellers since the majority of them keep livestock. Second, there might be livelihood insecurities for the residents employed in livestock farming. Third, the reduction in livestock could have an indirect effect on the livelihoods of farmer households because livestock is a vital source of organic manure for rural and peri-urban farmers, as confirmed by Sekaran, Lai, Ussiri, Kumar, and Clay (2021).

Positive economic effects of sand mining

Though the majority (241) of respondents reported no positive economic impacts of sand mining, a small number (37) of them nonetheless highlighted some favourable benefits that came to either themselves or their family members. Three key positive economic effects emerged from the interactions with the respondents who mentioned the positive economic effects of sand mining on local livelihoods. As indicated in Figure 21, the majority (56.9%) of household heads who answered positively to the economic effects of sand mining reported an increase in ancillary (indirect) employment, with the remainder referring to either a rise in construction-related livelihoods (33.3%) or the direct employment of household members in sand mining (9.8%). The finding is in line with those of Johnbull and Brown (2017) in Nigeria and Asante et al. (2014) in Ghana, who found that sand mining increases indirect employment prospects in mining areas as a result of the migration of mining-related actors into the mining areas.

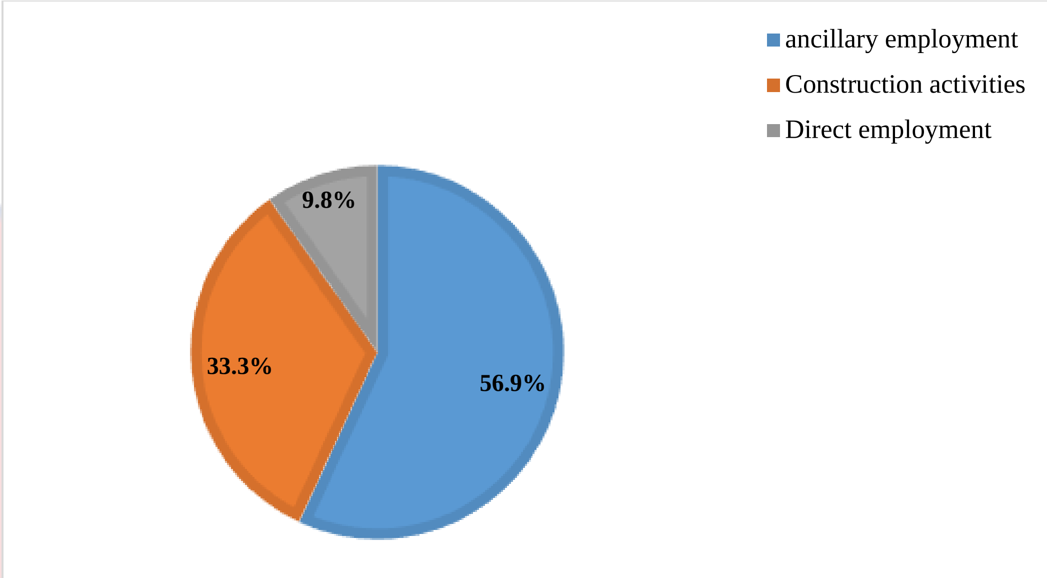

Figure 21: Positive economic effects of sand mining

N=37 because only a few of the respondents reported positive economic effects

Source: Field survey, 2021

Interactions with FGD participants and key informants at the local government authorities confirmed that sand mining had promoted indirect employment opportunities such as trading, block making, increased mobile money merchants, and vulcanizing services for tipper truck drivers (Figure 22). Firstly, trading activities, including the sale of water, soft drinks, and food, both in the study communities and at the mining sites, had increased. The majority of the women who engaged in these trading activities had previously been forced out of farming due to widespread sand mining. The official at GEDA confirmed that trading activities had increased in the mining areas because of the presence of many sand mining actors. The officer noted:

The continuous influx of both actors, such as truck drivers and miners, into the towns that are involved in sand mining has stimulated petty trading and vulcanizing businesses (Key informant, 2021).

Figure 22: A lady selling food and drinks to sand miners at a site in Hobor

Photo Credit: Author (2021)

The above statement means that the extraction of sand has caused mining actors to migrate into the host communities, resulting in the creation of indirect employment prospects for the local residents. The FGD participants and a few of the key informants, however, noted that taking part in these trading activities was not without obstacles because it was very challenging to predict the miners' locations due to their nomadic practices. A member of the community development committee shared this experience:

My wife was compelled to sell food and drinks to the sand miners after her farmland was allocated for sand mining. She often complains that the

> miners mostly buy food from Kasoa or from vendors along the highway and buy less from her. Another problem is that it is sometimes difficult for her to locate the sand miners, even after several phone calls. Besides, she is always exposed to dust and noise pollution (Key informant in Gomoa Kweikrom, 2021).

The narrative suggests that even though sand mining provided indirect employment to some local residents in the form of trading, the employment opportunities were not sustainable due to unpredicted sales, exposure to harsh weather conditions, stress associated with finding customers, and unstable income.

Secondly, the moulding of concrete blocks at abandoned mining sites was reported by the FGD participants and some of the key informants as another indirect employment opportunity. It was revealed that some young men took advantage of the abandoned mine sites with considerable quantities of sand to mould blocks. The youth FGD participants in Gomoa Kweikrom explained that, with the use of ponds created by the sand contractors, some young men carried cement in tricycles to the abandoned mine site to mould the blocks. However, it was indicated by the FGD participants that private developers preferred blocks moulded by well-established shops to those made at the mining sites. The builders doubt the quality of blocks moulded at abandoned mining sites based on the assumption that the blocks lack the appropriate cement-to-sand ratio, thereby adversely affecting the rate at which the blocks were sold. It can be inferred that the incomes of these block manufacturers were unstable and unsustainable in the long run.

Thirdly, increased construction-related employment was mentioned by the key informants at the MMDAs and the FGD participants. As a result of the increasing urbanisation that had caught up with the sand mining communities, coupled with the availability of sand, the building of private houses in the study communities was on the increase. The interactions with the respondents showed that local residents, often men who had masonry, electrical, plumbing, or carpentry skills, had the opportunity to secure employment in the local construction industry. However, the local craftsmen were usually contracted as construction labourers, thereby receiving a smaller income. Besides, the employment was seasonal, as it took the individual private builders about 10 years to complete their housing projects. An official of GEDA remarked:

> The private developers always contract master craftsmen from the cities because they hold the opinion that the local craftsmen lack modern building techniques. As a result, the locals are usually employed as construction labourers with insufficient daily wages, which cannot cater for their household needs. The construction work is also largely seasonal, and sometimes it takes between two and three weeks for them to find a job (Key informant, 2021).

The narrative means that the increasing construction activities in the study areas did not assure the locals sustainable employment because they were seasonal in nature and offered insufficient incomes for the craftsmen. The private developer's preference for craftsmen from the city over the local craftsmen made the locals to underuse their skills and less productive than they should be.

Fourthly, the key informants and the FGD participants concurred that some local residents were directly employed by the sand miners. The interviews revealed that due to the widespread use of earthmoving machines, few workers (about 10) were employed by the sand contractors. The key informants at the EPA and Minerals Commission explained that the workers were often exposed to several occupational health and safety challenges, including dust inhalation, exposure to hot weather or rainfall, irregular working times (night shifts), and noise pollution. This confirms the finding of Ayaaba, Yuan, and Ni (2017) that artisanal miners are exposed to health challenges.

It must be recognised that the entire sand value chain offers several employment avenues to people far beyond the mining communities, including truck drivers, sand contractors, payloader operators, building contractors, and real estate developers (Mensah, 1997; Saviour, 2012). But the livelihoods of those who live in the communities where sand mining occurs were the main focus of this study. Therefore, the evidence suggests that sand mining does not provide sustainable direct employment to the residents of the mining communities.

Environmental effects of sand mining on livelihoods

Much like its economic effects, the environmental effects of sand extraction on local household livelihoods were divided into two categories: negative and positive effects.

Negative environmental effects of sand mining on local livelihoods

The researcher inquired about the negative environmental effects caused by sand mining as a result of the mining practices and how they impeded the residents' livelihoods. These adverse environmental impacts include the ways sand mining affects both the mining site itself and the surrounding environment. According to the distribution of household responses on the negative environmental effects of sand mining, ponds that were made on farmland were mentioned by 22.3% of the respondents (Table 21). The official at EPA headquarters clarified that ponds were created by the payloaders, as they often dug until they reached the bedrock where water could not infiltrate. As a result, large volumes of water run off into the ponds when it rains. The finding corroborates Peprah's (2013) and Johnbull and Brown's (2017) findings that ponds are a major negative environmental effect of sand mining.

Table 21: Household responses on the negative environmental effects of sand mining

Reason	Frequency	Percentage
Ponds on farmland	247	22.3
Gullies/soil erosion	242	21.8
Deforestation/loss of biodiversity	208	18.7
Pollution (noise & dust)	183	16.0
Flooding	94	8.5
Destruction of water bodies	83	7.5
Damage to aesthetic beauty	31	2.8
Change of river course	13	1.2
Increased depth of water table	8	0.7
Total	1,109*	100.0

*More than the number of respondents due to multiple responses

Source: Field survey, 2021

The study discovered that ponds of different sizes had the following effects on local household livelihoods: firstly, they made mechanised farming more difficult because the lands' undulations made it harder to use tractors to till them. Secondly, crops could not be planted in the ponds because they collected water when it rained, and this made the problem of insufficient farmland worse (Figures 23 and 24). Thirdly, because private developers frequently need to purchase sand from other locations to fill in the ponds before construction, building on sites with ponds comes at a high financial and environmental cost.

Filling ponds did not only raise the cost of construction but also encouraged further degradation of land in other places.

Figure 23: Pond on a mined site in Tebu

Photo Credit: Author (2021)

Figure 24: Pond on a portion of farmland in Gomoa Kweikrom

Photo Credit: Author (2021)

Apart from the ponds, which limited the quantity of farmland available to farmers, gullies or soil erosion (21.8%) was also reported as another negative environmental effect of sand extraction on household livelihoods. Gullies or erosion, as explained by the key informants, are related to that resulting from the degradation of farmland, access roads linking the communities to the farms and other areas, and that around residential areas (Figure 25). The finding that sand mining causes gullies or erosion in the mining villages and negatively impacts locals corroborates that of Haghnazar, Sangsefidi, Mehraein, and Tavakol-Davani (2020).

Figure 25: Gully induced by sand mining destroys nearby farmland and access road in Gomoa Kweikrom

Photo Credit: Author (2021)

The interactions with the key informants and FGD participants confirmed that gullies or erosion linked to sand mining negatively impacted the livelihoods of the locals. The youth FGD participants in Hobor explained that transporting farm produce to the local market was a very difficult task for farmers due to the deplorable access roads caused by gullies. The officials of the EPA and Department of Agriculture also noted:

> The existing farmland experiences erosion or gullies induced by the removal of large volumes of soil from the adjoining land, together with the destruction of the vegetation cover that protects the land from the impact of heavy run-offs (Key informant in EPA headquarters, 2021).

The staff at the Department of Agriculture in GEDA remarked:

> The ultimate outcome of gullies is deteriorated soil fertility, which contributes to low crop yields (Key informant, 2021).

The prevalence of gullies or erosion on farmland and access roads had negative consequences for farmers and other land-based livelihoods. The gullies and erosion did not only reduce soil fertility and crop yields, but they also increased the transportation charges farmers paid whenever they had to rely on vehicles to convey farm produce to the communities because of the bad nature of the road network.

Apart from the ponds and gullies, the household heads also made it clear that deforestation (18.7%) was a significant adverse environmental impact of sand mining. It was learned from the EPA staff that trees were felled during the sand excavation process. As a result, large areas of forested land and vegetation have been degraded in the sand mining communities without any plan for replacement (Figure 26). The evidence corroborates earlier findings by Peprah (2013) that sand mining had resulted in the depopulation of several economic trees in Northern

Ghana, thereby eroding the livelihoods and incomes of many local residents. Related to deforestation was the damage to aesthetic beauty (2.8%), where the natural landscape was also destroyed.

Figure 26: Deforested site ready to be mined in Gomoa Kweikrom

Photo Credit: Author (2021)

Several reasons were mentioned by the key informants and FGD participants to explain how deforestation affected household livelihoods in the study areas. First, it became clear that deforestation had a negative impact on rainfall patterns since some rainfalls were enhanced by the existence of vegetation cover. Second, as a result of the destruction of wildlife habitat, deforestation had a negative impact on biodiversity and, consequently, the local ecology. The reduction of biodiversity diminished access to resources needed by households whose livelihoods were tied to the forest, such as hunters and other residents who searched for snails, mushrooms, and fruits as their source of nourishment. To emphasise the importance of biodiversity as reported by GSS (2019) in GLSS 7, hunting, wild honey, and wild fruits alone contribute an annual value in sales of about GHS 40.4 million to Ghana's revenue. Thirdly, the livelihoods of locals who practice herbal medicine were impacted by the extensive cutting down of medicinal plants due to sand mining.

The results depicted in Table 21 further show that pollution (16.0%) also negatively affected local household livelihoods. Several explanations were offered by the household heads and FGD participants on how pollution affected their livelihoods. First, in connection with noise pollution, participants in the FGDs reported that the tipper trucks and earthmoving equipment used by the sand miners caused so much noise and vibration that it interfered with their sleep, particularly at night. As a result, the locals' productivity suffered because they were frequently exhausted during the daytime when they had to work. Second, farmers who responded to the survey noted that the dust that comes from mining sites and/or tipper trucks — which are typically not covered — falls on their crops and has a negative impact on the growth of the plants. Third, dust pollution affected the quality of the products of craftsmen and traders. Fourth, the dust pollution generated more unpaid housework for women who had to regularly clean their houses, thereby negatively affecting their productive working hours.

Flooding (8.5%) was yet another adverse environmental impact of sand mining on household livelihoods. Related to the flooding was the destruction of water bodies (7.5%). The interactions showed that, as a result of damages to the water bodies, including streams and rivers, along with huge ponds created on adjoining farmland, farmers were frequently at risk of flooding their farms whenever there were heavy rainstorms. The result corroborates Lawal's (2011) finding that sand mining damages water bodies, which causes nearby farms to flood. For example, FGD participants in Hobor reported that farmers who ploughed along the Densu River often had their crops destroyed by flooding because of the change in the river course induced by sand mining around the river.

Positive environmental effects of sand mining

Despite the dominance of the negative environmental impacts of sand mining on local livelihoods, some respondents mentioned a few positive effects. The positive environmental impacts linked to sand extraction on local livelihoods were on sources of water and firewood/charcoal burning. The FGD participant offered four key explanations in support of how ponds created by sand miners positively impacted local livelihoods. First, farmers used water collected in the ponds to nurse seedlings and nurture them after transplanting. Second, local car washers, block producers, and masons all relied on the ponds for free water. Third, water collected in ponds was a source of drinking water for livestock. Fourth, despite significant health risks, Gomoa Kweikrom inhabitants frequently use water drawn from ponds for household uses (Figure 27).

Figure 27: Use of pond water for both block making and washing of clothes in Gomoa Kweikrom

Photo Credit: Author (2021)

Aside from ponds being sources of water, the FGD participants mentioned firewood collection as another positive impact of sand mining on the local residents' livelihoods (Figure 28). It was discovered that some locals, free of charge, collected the tree branches that the miners had felled and sold them as firewood. A small number of locals also used these trees and their roots to make charcoal, which was then sold in the study areas and other towns for good prices. The financial gain from this occupation was, however, temporary and ultimately unsustainable. This is due to the fact that all the vegetation would eventually be degraded, leaving individuals who were engaged in the firewood and charcoal burning businesses jobless.

Figure 28: Firewood collection at sand mining site in Gomoa Kweikrom

Photo Credit: Author (2021)

Social effects of sand mining on local livelihoods

The key informants, FGD participants, and household heads claimed that there were no positive social effects of sand mining in the study areas. The evidence from the household survey showed that, out of 658 multiple responses, ailment (27.1%) and land-related disputes (21.0%) were the most prevalent adverse social impacts of sand mining in the study communities. About 14.7% of the responses related to hunger or low nutrition, while 1.2% were linked to teenage pregnancies (Table 22). A detailed discussion of the key social impacts of sand mining is presented in subsequent paragraphs.

Table 22: Household responses on the negative social effects of sand mining

Reason	Frequency	Percentage
Ailment	247	27.1
Land-related disputes	242	21.0
Hunger or malnutrition	208	14.7
Destruction of medicinal plants	183	10.8
Relocation of some families	94	10.6
School dropout	83	9.9
Late stay in farms	31	4.7
Teenage pregnancy	13	1.2
Total	658*	100.0

*More than the number of respondents (n=278) due to multiple response

Source: Field survey, 2021

The interactions with the key informants revealed that sand mining had created poor environmental conditions, which had promoted various forms of ailments in the study areas. The household respondents mentioned that malaria was the most prevalent sickness (47.8%) in the study areas. They asserted that the ponds were breeding places for mosquitoes that spread malaria. Respiratory disease was the second most prevalent illness (18.1%) reported by household heads as a result of the inhalation of dust that came from mining pits and tipper trucks. In addition, skin diseases (14%) were cited, as well as depression (10.7%), diarrhea (4.2%), worm infestation (3.1%), and other illnesses (2.1%). The FGD participants and community development committee members corroborated the household responses and further indicated that the destruction of farms by sand miners was equally a major source of illness. A community development committee indicated:

> My friend collapsed when he found out that his farm had been destroyed by the sand miners. He was subsequently hospitalized for some days. He told me that he often experienced hypertension whenever he thought about the incident (Key informant in Gomoa Kweikrom, 2021).

The above statement suggests that sand mining activities cause both direct ailments such as respiratory sickness and malaria and indirect disorders, including mental health problems, due to the destruction of some of the residents' properties. The finding corroborates that of Farahani and Bayazidi (2018), who found that residents in sand mining communities in Iran suffered unduly from respiratory and malaria-related sicknesses. The researcher retrieved data on the top ailments reported at the Out-Patient Department (OPD) at the CHPS Compound in Hobor for the years 2019, 2020, and 2021. The evidence also corroborated the finding, with malaria, upper respiratory tract infections, diarrhoea, and transport accidents being the most reported health issues for three consecutive years.

The household heads were further asked to recall the last time a household member fell sick prior to the data collection exercise. The finding showed that 48.0% mentioned two weeks, followed by last quarter (45.8%), half a year (5.1%), and a year ago (1.1%) in that order. The percentage of household heads who reported being sick two weeks prior to the data collection was greater than the 15.7% national average reported by the GSS (2019). Further examination showed that 91.7% of the household heads had a household member missing work or school as a result of the last ailment they claimed was caused by sand mining. About 77.3% of the household heads also stayed home for less than a week to take care of a sick household member, while 14.4% stayed home for a period of 7 to 14 days, or over two weeks (1.1%).

The interactions revealed that the bad health conditions brought on by sand mining had a detrimental impact on the locals' livelihoods, the education of their children, and other socio-economic activities. This finding corroborates Ghanney's (2020) and Bendixen et al.'s (2021) studies that sand mining negatively affects the education of children and the health of local residents in sand mining areas.

Another negative effect of sand mining related to health was the destruction of medicinal plants. For the treatment of common illnesses, including malaria, boils, anaemia, and worm infestations, many rural and peri-urban residents turn to herbal remedies (Ziblim, Timothy & Deo-Anyi, 2013). For some of the locals, the removal of medicinal plants due to sand mining had negatively impacted their health. Sections of the female FGD participants in Tebu argued that because sand miners had stripped the area of its vegetation, the locals had a very difficult time finding some types of medicinal herbs. The result is in line with research by Bewiadzi, Awubomu, and Glover (2018) that found that the mining of construction aggregates had reduced the number of medicinal plants and, as a result, negatively impacted the health of local residents in Daglama, in the Ho municipality of Ghana.

Apart from ailments and the destruction of herbal plants, hunger/malnutrition was mentioned by the respondents. In order to assess this, the average number of meals each household member consumed each day for 2015 and 2020 was requested from the household respondents. On one hand, the minimum number of meals eaten by household members each day in 2015 was two, while the maximum was five. The median number of meals per day was three (mean = 2.9594; standard deviation = 0.51838; skewness = 0.585). On the other hand, in 2020, three meals a day were the most, and one was the least. The median household number of meals per day was two (mean = 1.8745; standard deviation = GHS 0.46242; skewness = 0.443), which is less than the national average of three meals reported by the Food and Agricultural Organisation of the United Nations (FAO) (2009). This result supports Sen's (1987) entitlement theory, which explains that marginalised populations, such as landless peasants, frequently lack sufficient market control over food and alternative access because of their restricted access to and control over environmental resources.

Participants in the FGDs observed that both the quantity and diversity of meals for their household members had decreased. The increasing hunger and malnutrition among the locals were attributed to a number of factors. First, it was stated that family heads could not afford to provide adequate and regular food for their dependents with no or little regular income. Second, mango, pawpaw, and avocado trees, as well as other vegetables like turkey berry (Salanum torvum) and *kontomire* (Xanthosoma mafafa), which were widely available and could be harvested for free by anyone to improve their diet, were all destroyed by the sand miners. Third, the cost of food had increased in the study communities due to the reduction in crop yields.

Aside from the reduction in meals per day, the relocation of household members was mentioned as an adverse social effect of sand mining. The FGD participants and the household heads indicated that, due to the destruction of farmland, some household members had relocated to distant communities and other regions in search of land or better employment opportunities. It was noted that the condition had led to some families breaking down, children being neglected by their parents, youth developing social vices, and a shortage of farmworkers, which was locally called gang farming or '*ndoboa'* in the study areas.

Further inquiries from the household heads showed that the majority (79.5%) had planned to relocate to other areas, while the remaining 20.5% had no plans of relocating. The reasons assigned by the respondents who wanted to relocate to other areas included the search for farmland, the quest for better infrastructure, better job possibilities, joining a spouse who had already moved, and improving trading activities. In line with the conceptual framework (Figure 6), some residents in the study areas migrate to other areas as a strategy to ease the adverse impacts of sand mining on their lives. On the other hand, those who had no plans of relocating mentioned the following as reasons: social connection in the community, financial requirement to relocate, old age, availability of social support in their present locations, and access to free accommodation in the family house.

The researcher learned from the household heads that the relocation of some parents to distant places and/or late stays on farms (4.7%) by some farmers to protect their farms from illegal sand miners had contributed to the incidence of teenage pregnancies. The FGD participants confirmed the finding and attributed the increased incidence of teenage pregnancies to improper parental control, the absence of some parents in the study communities due to relocation, and the inadequate provision of essential necessities such as sanitary pads, clothes, and food for the young girls. The FGD for females in Tebu and Hobor revealed that the absence of some parents, coupled with their worsening financial condition, had made it easy for commercial motorbike riders and truck drivers to seduce young girls with packaged food and/or maintenance money for sex. The results support those of Bansah et al. (2018) and Ghanney (2020), who found that sand mining and artisanal small-scale gold extraction both contribute to teenage pregnancies in the host communities.

Protection and support against the risk of sand mining

The findings on the impacts of sand extraction showed that the negative impacts on the livelihoods of the locals outweighed its positive impacts. The researcher, therefore, inquired about the protection the residents had against the negative social, economic, and environmental externalities of sand mining. The result in Table 23 revealed that 71.2% of the household heads indicated no complaint channels for addressing problems with sand miners, while the remaining had structures to resolve their complaints.

Table 23: Household responses on the availability of compliant channels by community

Availability of compliant channel	Buduatta f	Buduatta %	Kweikrom f	Kweikrom %	Hobor f	Hobor %	Tebu f	Tebu %	Total f	Total %
Not available	55	65.5	32	55.0	83	79.0	33	78.6	193	71.2
Available	29	34.5	18	45.0	22	21.0	9	21.4	78	28.8
Total	84	100.0	40	100.0	105	100.0	42	100.0	271*	100.0

χ^2 =10.732, df = 3, α = 0.05, p-value = .013

*Less than the number of respondents (n=278) due to nonresponse

Source: Field survey, 2021

Further, disaggregation of the result showed that the proportion of household heads who had no complaint channel in Hobor (79.0) and Tebu (78.6%) was higher than that of Gomoa Kweikrom (55.0%) and Gomoa Buduatta (65.5%). The communities were statistically different in relation to the availability of complaint mechanisms (χ^2 = 10.732, df = 3, α = 0.05, p-value = .013). The difference could be explained in two ways: first, indigenous residents had the option to complain to the allodial title holders, unlike settlers, who had limited relations with the landowners. Second, the settlers had no formal agreement governing the use of their farmland; therefore, they could not seek legal redress.

The household heads who indicated the availability of a compliant channel reported their grievances to the following: local police (38.3%), local government authority (26.0%), chiefs/landowners (19.4%), spiritual leaders (7.6%), Assembly members (6.5%), and community development committee (2.3%). However, on a two-point scale of effective or ineffective, the majority (84.0%) of the household heads said that the complaint channels mentioned were ineffective. The reasons the household respondents assigned were: police demanding money before helping; MMDAs did not pursue such cases; miners influenced the outcome of the complaints; and time wasting due to frequent follow-ups by the complainant to the authorities. On the other side, reasons for the effectiveness of the complaint channel were the allocation of new farmland and the payment of compensation by the landowners.

The key informants at the regulatory agencies denied the absence of complaint platforms for addressing mining-related issues. From their perspective, three factors adversely affected the compliant channels. First, the agencies had inadequate human and financial resources to investigate the high volumes of complaints. Second, the lateness in lodging complaints against miners made it hard for the regulators to follow up on the issues since the miners operated in a migratory manner. Third, the unwillingness on the part of the local residents to volunteer information on the illegal miners. The key informants in the MMDAs indicated that occasionally, the Municipal/District Security Council addressed sand mining complaints and arrested illegal miners. However, he explained that none had been done in 2021 during the period of data collection. An officer at the Department of Agriculture in GSMA noted:

> It is the Assembly’s responsibility to ensure that the environment is safe for both humans and nonhumans. The Assembly is also mandated to protect the livelihoods and socio-cultural needs of the residents. At

> present, the sand mining situation is widespread and difficult to control. As a result, the complaints are equally overwhelming for the Assembly. The Assembly itself became a victim of the situation when sand was stolen from our land earmarked for a farming project (Key informant, 2021).

The above narrative means that the regulatory agencies had not lived up to the expectations of the local people with respect to providing a channel through which their challenges with sand mining could be addressed effectively. Therefore, protecting the environment and the livelihoods of the people living in the sand mining towns was not pursued because the residents were left to their own fate in respect of the prevalent sand mining.

In order to address the detrimental effects of sand mining on the livelihoods of the residents in the mining areas, the household respondents indicated what they anticipated the regulatory agencies to do. In connection with the MMDAs, 24.9% of the household heads expected them to acquire hectares of farmland and lease them out to farmers to enhance their livelihoods. The others mentioned the provision of free farm inputs to farmers (21.0%), low interest credit to the residents (17.9%), passing by-laws to regulate sand mining (13.3%), zoning the community to reserve land for farming (11.3%), providing alternative livelihoods for affected households (5.2%), constructing a market for the community to enhance trading (4.1%), and helping adversely affected farmers receive compensation from the miners (2.3%).

The household heads expectations for the EPA and the Minerals Commission were to ensure regular compliance monitoring of sand miners (33.0%), initiate nighttime monitoring of illegal miners (27.2%), facilitate prosecution of illegal sand miners (14.9%), set up suboffices in the mining communities (9.4%), assist farmers to receive compensation (6.1%), form a joint taskforce with community members (4.9%), and enhance permit procedures by including community members and opinion leaders (4.5%).

The researcher inquired whether the sand contractors supported the host communities to address the adverse impacts of sand mining. Most (95.7%) of the household heads indicated no support from the contractors for their communities. A few others said the miners provided support (2.9%), while the remaining were not sure (1.4%). The finding corroborates Arthur's (2016) study that sand miners barely provided support for the development of mining communities. Similarly, this confirms the UPE theory that because environmental resources are extracted in capitalist relations, their benefits largely accrue to wealthy actors compared to the residents of the host communities. The provision of free sand for the construction of community centres, support for the celebration of the annual community festival, and provision of 'chop money' to some community members were the forms of support indicated by the household heads who acknowledged the contribution of the sand contractors towards the development of their towns.

When asked about what they expected of the sand contractors, 29.3% of the survey respondents reported that the sand miners should reclaim the land after mining; others indicated that the miners should desist from destroying crops

(21.9%), support farmers with farm inputs (20.5%), pay commensurate compensation for farms destroyed (12.2%), support the community with essential infrastructure like roads and public toilets (10.3%), and support farmers with capital to start new businesses (5.8%), in that order. All the FGDs also corroborated that sand miners should reclaim the land after mining, give adequate notice to the residents, and allow farmers to harvest their crops before the miners start their mining operations on cultivated land. They were of the view that the land could be used again for farming after a few years of fallowness if reclaimed.

On whether sand mining should be banned in the study communities due to its negative effects on local livelihoods, the majority (68.3%) of the household heads wanted it banned, while 31.7% said it should be practiced, as shown in Table 24. The finding contradicts Burgin's (2020) evidence that in North Stradbroke Island, local residents were not supportive of the decision to ban sand mining in their community. The residents of North Stradbroke Island's support for sand mining can be attributed to the benefits they receive from the miners, including direct employment, the construction of roads, and educational support for children.

Table 24: Household heads' opinion on banning of sand mining by community

Ban sand mining	Buduatta f	Buduatta %	Kweikrom f	Kweikrom %	Hobor f	Hobor %	Tebu f	Tebu %	Total f	Total %
Ban	57	66.3	17	43.6	81	77.1	30	73.2	185	68.3
Not to be ban	29	33.7	22	56.4	24	22.9	11	26.8	86	31.7
Total	86	100.0	39	100.0	105	100.0	41	100.0	271*	100.0

$\chi^2 = 15.393$, df = 3, $\alpha = 0.05$, p-value = .002

*Less than the number of respondents (278) due to nonresponse

Source: Field survey, 2021

The distribution of responses, as depicted in Table 24, showed that the proportion of household heads who wanted sand mining banned was higher for Tebu (73.2%) and Hobor (77.1%) than for Gomoa Kweikrom (43.6%). Significant variances were shown among the study communities from the outcome of the Chi-square test of independence ($\chi^2 = 15.393$, df = 3, $\alpha = 0.05$, p-value =.002). The reasons indicated by the household heads who wanted sand mining banned were to preserve farmland, protect local livelihoods, eliminate inter-generational inequity over land, ensure food security, and restore harmony in the communities. On the other side, those who said sand mining should not be banned cited the following: it is useful for the construction industry, should rather be regulated, hectares of land have already been destroyed, and it is a source of employment for some people.

Alternative Livelihood Strategies

The interactions with the respondents showed that because of the noticeable transformation in land use from agriculture to non-agriculture activities, some of the residents in the study areas adopted alternative livelihood strategies either to tap new opportunities or to reduce and manage the shocks associated with sand mining. The finding agrees with the understanding from the conceptual framework (Figure 6) that residents in sand mining communities adopt alternative livelihood strategies due to the externalities resulting from the extraction of sand. This section addresses the alternative livelihood strategies: how they were financed, the challenges confronting the strategies, the income from the strategies, and the support required to enhance the adopted strategies.

The researcher first inquired about the respondents' endowment set because it determines, to a large extent, their ability to adopt alternative livelihood strategies, as explained by the conceptual framework and the entitlement theory. The results showed that 49.2% of the household respondents had access to natural assets (Table 25). The interactions with FGD participants confirmed their dependence on natural assets for their livelihoods. However, it was learned that the natural assets had diminished due to widespread sand mining, which had degraded vast hectares of arable farmland, forests, biodiversity, wildlife, and other environmental resources. This finding confirms the UPE theory, which argues that the natural environment is controlled and manipulated by wealthy actors to the disadvantage of vulnerable actors.

Table 25: Household respondents endowment set

Household assets/capital	Frequency	Percentage
Natural asset	264	49.2
Human asset	126	23.5
Social asset	117	21.7
Financial asset	24	4.5
Physical asset	6	1.1
Total	537*	100.0

*More than the number of respondents (n=278) due to multiple response

Source: Field survey, 2021

About 23% of household heads were endowed with human capital, which came in two forms. First, free labour was provided by household members due to the large household size and higher number of grown household members. Second, there was the possession of employable skills such as masonry, carpentry, and driving or motorcycle riding by some of the household heads. The least mentioned household asset was the physical asset (1.1%) due to the poor road network and absence of essential infrastructure in the research areas.

On the adoption of alternative livelihood strategies, the majority (57.0%) of the household heads had adopted some strategies to complement their primary occupations, as shown in Table 26. The household responses showed that the minimum number of years the respondents had adopted alternative livelihoods was one and the maximum number of years was 10. The median was three years (mean = 3.43, standard deviation = 1.686, skewness = 0.760), with a quartile range of two years.

Table 26: Household responses on adoption of an alternative livelihood strategy by community

Alternative strategy	Buduatta f	Buduatta %	Kweikrom f	Kweikrom %	Hobor f	Hobor %	Tebu f	Tebu %	Total f	Total %
Adopted	32	51.6	22	57.9	71	68.9	14	34.1	139	57.0
Not adopted	30	48.4	16	42.1	32	31.1	27	65.9	105	43.0
Total	62	100.0	38	100.0	103	100.0	41	100.0	244*	100.0

$\chi^2 = 15.463$, df = 3, $\alpha = 0.05$, p-value = .001

*Less than the number of respondents (n=278) due to nonresponse

Source: Field survey, 2021

Further analysis showed that the proportion of respondents who had adopted alternative livelihood strategies was higher in Hobor (68.9%), followed by Gomoa Kweikrom (57.9%), than in Tebu (34.1%). The Chi-square test of independence disclosed that there were variances among the study areas in connection with the adoption of alternative livelihood strategies ($\chi^2 = 15.463$, df = 3, $\alpha = 0.05$, p-value =.001). Generally, the percentage of household respondents who had adopted alternative livelihood strategies was greater than the 34.6% national average for rural Ghana (GSS, 2019). The difference might be as a result of the adverse externalities of sand mining on household heads' livelihoods and the need for them to adopt other alternative strategies, as shown in the conceptual framework (Figure 6).

The 139 household heads who had adopted alternative livelihood strategies attributed it to the following factors: inadequate farmland (38.8%), low crop yields (20.7%), inadequate income from primary occupation (16.2%), mitigation of risk in primary occupation (14.6%), and tapping investment opportunities in the local economy (9.7%). These reasons suggest that the household heads adopted alternative livelihood strategies largely as a survival strategy rather than as an investment opportunity. This finding corroborates Tadele’s (2021) study that alternative livelihood strategies in rural and peri-urban Ethiopia were often influenced by survival-induced factors.

On the part of the 105 household respondents who had not adopted alternative livelihood strategies, the lack of startup capital (78.0%) was the dominant explanation offered. This finding confirms Doso, Cieem, Ayensu-Ntim, Twumasi-Ankrah, and Barimah's (2015) and Roy and Basu's (2020) findings that startup capital was the main restraint to the adoption of alternative livelihood strategies, even in gold mining communities. The other reasons mentioned were the absence of investment opportunities in the communities (8.5%), old age (4.9%), lack of skill (4.9%), and the unattractiveness of the alternative livelihood options (3.7%).

It was appropriate for the researcher to examine the coping strategies used by the respondents who had not adopted alternative livelihood strategies. About 31.6% of the household heads indicated a reduction in their household food consumption. While 19.8% asked for support from extended family members, 16.9% indicated that they used agriculture intensification techniques such as fertiliser application, lining, and pegging for optimal yields on their remaining small-sized farmland and the adoption of high-yielding varieties of crops. Other coping strategies reported were buying on credit (14.1%), migration to distant places for farmland (10.1%), and borrowing farm produce from friends (7.6%), in that order. The key informants and FGD participants agreed with the coping strategies mentioned by the household heads. An official of the Department of Agriculture in GEDA remarked:

> Due to the reduction in farmland and loss of soil fertility, many farmers engage in agriculture intensification, such as fertiliser application and the use of high-yielding varieties of crops. The problem is that some farmers apply too much fertiliser to their crops with the aim of increasing the yield. I think many farmers lack knowledge about the appropriate proportion of fertiliser required on their fields (Key informant, 2021).

It can be inferred from the narrative and the conceptual framework (Figure 6) that in an effort to salvage the adverse impacts of sand extraction on crop yields, farmers who could afford inorganic fertiliser applied it disproportionately to their little farms as part of their coping strategies. The finding agrees with Killebrew and Wolff's (2010) and Oduro et al.'s (2015) findings that intensive use of agro-chemicals in peri-urban areas due to the reduction in farmland has resulted in contamination of crops, soil, and water bodies.

Types of alternative livelihood strategies adopted and funding sources

The distribution of responses by the household heads who had adopted alternative strategies showed that 36.2% were engaged in petty trading. The trading activities mentioned were the buying and selling of farm produce in front of their homes, table-top provision shops, hawking, the sale of cooked food such as porridge, rice, *kenkey,* and roasted corn, and the sale of used clothes, shoes, towels, and bedsheets. The other alternative livelihood strategies reported by the household heads were construction labouring jobs (19.0%), which were utilised by young men; commercial motorbike riding (10.1%); block making (8.0%); and bicycle or motor repairs (1.4%), as shown in Table 27. The evidence suggests that the residents of sand mining communities predominantly diversify into the non-agricultural sector. This evidence confirms findings in Malawi, and Ethiopia (Nagler & Naude, 2014), and Ghana (Afriyie, Abass & Adjei, 2020) that most rural and peri-urban dwellers diversify into the commerce and service sectors as a result of diminished farmland.

Table 27: Alternative livelihood strategies adopted by household heads

Types of adopted strategies	Frequency	Percentage
Petty trading	51	37.0
Construction labour	26	18.7
Commercial motorbike (Okada)	14	10.0
Block making	11	7.9
Staking lotto	10	7.2
Firewood/charcoal burning	9	6.4
Alcohol sale (drinking spot)	8	5.7
Security job (watchmen)	5	3.6
Mobile money vending	3	2.1
Bicycle/motor repairs	2	1.4
Total	139	100.0

Source: Field survey, 2021

The researcher examined the sources of startup capital for the adopted alternative livelihood strategies. This examination was important in determining how rural and peri-urban dwellers obtain capital to enhance their livelihoods. The result showed that about 67.6% of the household heads used their personal savings as capital, while 14.3% relied on the assistance of family members and friends. The other sources of startup capital reported were loans (13.3%), group savings/susu (2.9%), and NGOs (1.9%), in that order. The finding is consistent with Hofstrand's (2013) and GSS's (2019) findings that personal savings and support from family members and friends were the major sources of startup capital for income-generating activities. The result again showed that sand contractors did not provide startup capital for the local residents as corporate social responsibility (Doso et al., 2015).

As part of the items on startup capital, most (74.0%) of the household heads reported that they had no access to credit, compared to 26% who claimed that they had access to credit, as depicted in Table 28. The finding agrees with Roy and Basu’s (2020) study that people in peri-urban and rural areas have difficult access to credit, which restricts their adoption of alternative livelihood strategies. The finding means that while the natural capital stock in the research areas was under threat of degradation, the majority of the local residents lacked the financial capital endowment to switch into the alternative livelihood sector.

Table 28: Household responses on access to credit by community

Credit accessibility	Buduatta f	Buduatta %	Kweikrom f	Kweikrom %	Hobor f	Hobor %	Tebu f	Tebu %	Total f	Total %
No access	38	45.2	33	86.8	80	85.1	34	100.0	185	74.0
Access	46	54.8	5	13.2	14	14.9	0	0.0	65	26.0
Total	84	100.0	38	100.0	94	100.0	34	100.0	250*	100.0

χ^2 = 54.347, df = 3, α = 0.05, p-value = .000

*Less than the number of household respondents (n=278) due to nonresponse

Source: Field survey, 2021

Table 28 further revealed that a higher proportion of the household heads in Gomoa Buduatta (54.8%) had access to credit than those in either Tebu (0%), Gomoa Kweikrom (13.2%), or Hobor (14.9%). Significant differences were found among the communities at the 0.05 alpha level (χ^2 = 54.347, df = 3, α = 0.05, p-value =.000). It was evident from the FGDs that while the residents in Gomoa Buduatta relied on bank agents who often visited their community to offer small loans to qualified residents, their counterparts in the other study areas rejected such opportunities out of fear of bank credit and rather sought credit from informal sources.

The 185 household respondents who indicated that they had restricted access to credit mentioned the following reasons: lack of information on where to access credit; lack of collateral security or guarantee for loans; high interest rates on loans; beliefs and fears about loans; already having several unpaid informal debts; and unfavourable repayment schedules. The finding corroborates earlier results in rural Afghanistan (Moahid & Maharjan, 2020) and Cameroon (Atamja

& Yoo, 2021) that rural and peri-urban dwellers have inadequate access to credit because of fear of default consequences, a lack of collateral, and a high interest rate. Correspondingly, the evidence corroborates the GLSS7 results on access to credit among Ghanaians (GSS, 2019).

Outcomes of the alternative livelihood strategies

Insights from the entitlement theory and the conceptual framework (Figure 6) illustrate that the outcomes of alternative livelihood strategies can either be positive in the form of additional income, employment, food security, enhanced resilience to shocks, and sustainable natural resource usage, or the reverse of these in the case of negative outcomes. Therefore, the outcomes of the alternative livelihood strategies were examined based on these parameters.

In respect of income, 46.8% of the household respondents who had adopted alternative strategies reported an increase in their income, while 45.3% and 7.9% indicated no change and a reduction in their income, respectively. Further analysis showed that the highest annual income from alternative livelihoods was GHS 18,000.00, and the least was GHS 700.00. The median alternative livelihood annual income was GHS 4,800.00 (mean = GHS 5,439.27; standard deviation = GHS 3,401.490; skewness = 1.405), with a quartile deviation of GHS 4,250.00. It is evident from the finding that, though the alternative livelihood strategies provided some extra income to the respondents, the median income from these strategies was less than the national average income of GHS 8,034.30 reported by GSS (2019). The finding suggests that the adopted alternative livelihood strategies did not offer equivalent or, ideally, greater income to the residents than what they earned from their original livelihoods.

The respondents indicated that the incomes earned from their alternative strategies were used to purchase food items, pay medical bills, invest in farming, invest in alternative strategies, pay school fees, pay utilities (water, electricity, mobile phone credit), pay association dues, make funeral donations, and provide basic necessities such as clothes for household members. Another expenditure item that emanated from the female FGD participants in Hobor was the payment of offertory at church. The finding is consistent with Danso-Abbeam, Dagunga, and Ehiakpor's (2020) and Mohapatra and Giri's (2021) studies that investment in alternative livelihood strategies provides an opportunity to earn extra income, which supplements the consumption and other basic needs of household members.

On the food security and consumption outcomes, the evidence showed that the respondents were divided. For the four study communities put together, 40.6% of the household heads noted an increase in their household access to food after adopting the alternative strategy, while 35.6% and 23.8% mentioned no change or reduction in their household access to food, respectively. The FGD participants confirmed that their household access to food had remained relatively stable after adopting the alternative livelihood strategy. For instance, FGD participants who had diversified into the trading of food products shared the view that their household members used some of the products to satisfy their consumption needs. The finding corroborates the conceptual framework (Figure 6); Mishra, Mottaleb, and Mohanty (2015); and Madaki and Adefila's (2014) finding that the adoption of alternative livelihood strategies contributes to food safety and access to essential services for the members of the participating households.

The study also investigated the survey respondents' opinions about the resilience outcomes of the alternative livelihood strategies. On a three-point scale, the majority (79.1%) of the household heads noted an increase in their household strength to handle shocks from sand mining after adopting the alternative livelihood strategy. The remaining noted no change (18.0%) or reduction (2.9%) in their ability to handle shocks. This result agrees with evidence in Tanzania (Katega & Lifuliro, 2014) and Nigeria (Madaki & Adefila, 2014) that alternative livelihood strategies assist participating farmer households to handle shocks and trends. Similarly, the majority of the FGD participants who had adopted alternative livelihood strategies confirmed that there was an improvement in their household's ability to handle the adverse externalities of sand extraction.

The reasons provided by the household respondents and the FGD participants to explain the increase in their household resilience were extra income from the alternative strategy, available food from the adopted strategy, enhanced social esteem, and the ability to solicit support from community members due to security from the new strategy. On the other side, those who reported a reduction in their household's resilience to handle shocks after adopting the alternative strategies mentioned low patronage of services, low or irregular income, risk, including accidents involved in the adopted strategies, and seasonality of employment.

In relation to the employment outcome from the alternative strategies, most (62.4%) of the household respondents reported that the alternative strategy had increased employment opportunities for their household members, while the remaining either indicated a reduction in employment (21.3%) or no change (16.3%). Interactions with the key informants at the Department of Agriculture confirmed that some local residents who lost their livelihoods to sand mining had gained employment in the alternative livelihoods sector. One of the officers remarked:

> The department has introduced alternative livelihood strategies, including snail farming, grasscutter rearing, mushroom farming, and soap making, to the negatively affected farmers in the sand mining areas. I have noticed that other local residents are also employed in the construction sector (Key informant in the Department of Agriculture in GSMA, 2021).

The sustainable use of resources was also examined as part of the outcomes of the adopted alternative livelihood strategies. About 63.5% of the household respondents mentioned no change in the sustainable use of resources, while 26.7% and 9.8% indicated reduced and increased sustainable use of resources, respectively. The FGD participants and some of the key informants confirmed that the adoption of alternative livelihood strategies had not contributed positively to the sustainable use of resources due to the following reasons: first, alternative strategies such as charcoal burning and firewood collection contribute to the further depletion of the few remaining trees in the communities. Second, demand for sand by construction labourers promotes widespread sand mining in other new areas. Third, frequent accidents by commercial motorbike riders required that the income of other household members be used to cater for the medical treatment of the accident victims.

The researcher also examined the opinions of the household respondents about the overall sustainability of their alternative livelihood strategies compared to their primary land-based livelihoods. Generally, for the four communities put together, most (56.1%) of the household heads reported that their primary livelihoods were more sustainable than the adopted strategies, while the rest were not sure (27.3%) or reported the sustainability of the adopted strategies (16.5%), respectively, as shown in Table 29. The finding supports Hilson and Banchirigah's (2009) study that alternative livelihood programmes in mining communities were unpopular and unsustainable with the target group compared to their original livelihoods. The finding was again confirmed through interactions with the FGD participants and the key informants in the Department of Agriculture. The officer at the Department of Agriculture in GEDA noted:

> The majority of the people in the mining communities have no other skill apart from farming, which they inherited from their forebears (Key informant, 2021).

The narrative is consistent with insights from entitlement theory and the conceptual framework (Figure 6). The quotation implies that most of the respondents in the research areas had limited endowments to enable them to secure sustainable livelihoods through alternative livelihood strategies. Therefore, if land-based livelihoods were not protected in the sand mining communities, alternative livelihood strategies might not yield the expected sustainable outcomes.

Table 29: Household responses on which livelihood strategy was much sustainable

Parameter	Buduatta		Kweikrom		Hobor		Tebu		Total	
	f	%	f	%	f	%	f	%	f	%
Primary livelihood	16	50.0	7	31.8	48	67.6	7	50.0	78	56.1
Not sure	14	43.8	8	36.4	9	12.7	7	50.0	38	27.3
Adopted livelihood	2	6.3	7	31.8	14	19.7	0	0.0	23	16.5
Total1	32	100.0	22	100.0	71	100.0	14	100.0	139*	100.0

$\chi^2 = 24.212$, df = 6, $\alpha = 0.05$, p-value = .000

* Responses are only by household heads who had adopted alternative strategies

Source: Field survey, 2021

Further analysis with the Chi-square test of independence revealed that the communities differed on the views of the household heads about the sustainability of their primary livelihoods as compared to the adopted alternative livelihood strategies ($\chi^2 = 24.212$, df = 6, $\alpha = 0.05$, p-value =.0000). A greater proportion of the household respondents in Hobor (67.6%) and Tebu (50.0%) indicated that their primary livelihoods were more sustainable than the adopted strategy, compared to those in Gomoa Kweikrom (31.8%). This might be a result of the fact that the residents of Hobor and Tebu were settler farmers who had relatively limited knowledge of other alternative livelihood strategies compared to farming, which they had practiced for decades.

Challenges of the adopted alternative livelihood strategies

The researcher examined the challenges confronting the alternative livelihood strategies adopted by the household heads. The responses were largely on petty trading, commercial motorbike (okada), firewood and charcoal burning, and construction labouring jobs. About 31.4% of the household heads reported low sales due to the reduced purchasing power of the community members, while 19% indicated low capital to expand their businesses. The other challenges were increased credit purchases (16.8%), difficult access to raw materials (12.4%) with respect to strategies such as charcoal or firewood production, and difficult tasks (7.3%) mentioned by construction labourers and hawkers, as shown in Table 30.

Table 30: Household responses on challenges confronting the alternative livelihood strategies

Forms of challenges	Frequency	Percentage
Low patronage	43	31.4
Low capital to expand	26	19.0
Credit purchase	23	16.8
Difficult access to raw materials	17	12.4
Difficult task	10	7.3
Costly flue	8	5.8
Frequent accidents	7	5.1
Police harassment	3	2.2
Total	137*	100.0

*Less than number of household respondents (n=278) due to nonresponse

Source: Field survey, 2021

The household respondents and FGD participants were asked to indicate the support they required in order to enhance their alternative livelihood strategies or to enable them to adopt such strategies. The common supports reported by the respondents were to: improve access to low-interest credit; enhance local economies through the construction of trade-related infrastructure like markets; legalise commercial motorcycles (okada); and provide entrepreneurial training in alternative strategies. Other forms of support mentioned include enhanced salaries for construction workers and the construction of road networks to connect the communities to other parts of the local government areas.

Summary of the Chapter

The chapter discussed how sand mining had impacted local household livelihoods and the alternative livelihood options the local people had chosen as a result of sand mining's externalities. The findings showed that sand mining had both positive and negative effects on the locals' means of subsistence. However, it was evident that the adverse impacts of sand extraction were largely experienced by the majority of the local residents more than its positive effects. On one hand, the negative effects of sand mining included difficult access to farmland, low crop yields, destruction of crops, ponds on farmland, soil erosion, ailments, and land disputes. On the other hand, the positive effects were increased ancillary (indirect) employment, increased construction activities, and the direct employment of a few residents.

About 57% of the household respondents had adopted alternative livelihood strategies to smoothen their household income and consumption. The dominant strategies adopted were petty trading, construction labour jobs, and commercial motorbike riding (Okada). The major sources of funding for the alternative livelihoods were personal savings and borrowing from informal sources such as friends and family members. The respondents who had not adopted alternative livelihood strategies attributed it to the following reasons: lack of startup capital, absence of investment opportunities, old age to add a new strategy, and unattractiveness of the alternative livelihood options. The challenges the respondents faced in their alternative livelihood strategies were low sales due to the reduced purchasing power of the community members, limited capital to expand, and credit purchases that were sometimes not paid at all.

CHAPTER SEVEN

APPLICATION OF THE INSTITUTIONAL AND REGULATORY FRAMEWORK FOR SAND MINING

Introduction

The seventh chapter of this thesis deals with research question four. The chapter's focus is on both the formal and informal rules governing sand mining and how they were applied by the regulatory bodies or the traditional leaders. The examination also looks at the difficulties the regulatory bodies encountered when carrying out their duties.

Formal institutional framework for sand mining

Sen's (1987) entitlement theory opines that legitimacy for access to, control over, and use of environmental resources was gained through either formal or informal institutions. According to the political settlement theory, however, powerful actors may disrupt institutions in order to obtain the benefits they want, rendering the institutions useless. This part evaluated how the sand mining institutions were employed in the research communities.

The key informants at the regulatory agencies revealed that the extraction of sand was regulated by a broad framework designed for the diverse mining industry, with much focus on highly priced minerals such as gold compared to industrial minerals. The sand mining regulations spanned the legislative requirements of numerous acts and ministries. This finding supports that of Koehnken and Rintoul (2018) and Dewi et al. (2019) who found that most countries lack rules designed to specifically handle the unique difficulties associated with sand mining. The key informants at the Minerals Commission and EPA concurred that gold mining pulled the highest share of the agencies' total resource allocation for management of the mining industry because of its relatively better financial importance to Ghana. The key informants also noted that the public outcry over the adverse effects of gold mining was also responsible for the relatively high concentration on its regulation.

The section that follows presents results from the relevant legal frameworks on sand mining and factors that affect their implementation. The results are founded on the interactions with the key informants at the relevant state agencies, a review of the legal frameworks, and the opinions expressed by the household heads.

Minerals and Mining Act, 2006 (Act 703)

Interactions with sand contractors revealed that the Minerals Commission had granted restricted mining leases for sand mining to some miners, though their businesses were not registered with the Registrar General's Department, contrary to Section 10 of Act 703. The key person at the Minerals Commission confirmed the finding and alleged that the situation was due to the interference of some powerful officials. The official remarked:

> Some of the sand miners are well connected to 'big men' in authority. It is very difficult to reject their applications as public servants. It is very difficult for us to monitor this category of sand contractors, even when they engage in illegal practices (Key informant in Minerals Commission, 2021).

The statement means that the ineffective regulation of sand mining was linked to political patronage and rent-seeking, which undermines the efforts of regulatory agencies. The quotation means that the alleged powerful persons influence the regulatory officials to bend the rules in favour of their cronies. The finding confirms the political settlement theory, which argues that some regulatory organisations in less developed countries were based on patron-client networks, which allowed powerful actors to influence formal and informal institutions in order to earn their desired benefits. It again corroborates empirical evidence in Ghana (Hausermann & Ferring, 2018) and Niger (Hilson, Goumandakoye & Diallo, 2019) that local business persons and politicians assist some individuals to acquire mining licenses contrary to the requirements in the legal frameworks.

Interactions with the key informants showed that sand contractors often use a single license to mine in other areas beyond the boundaries of what their licenses cover, in contravention of Sections 13(1) and 82(1) of the Minerals and Mining Act 2006 (Act 703). The key informant at the Gomoa East District Assembly confirmed that the phenomenon was widespread and attributed it to the infrequent compliance monitoring by the EPA and Minerals Commission. Some of the sand contractors, on their part, blamed the practice on bureaucratic and centralised licencing procedures. One of the sand contractors hinted:

> When I finished mining the demarcated area my license covered, the landowner agreed to allocate additional land to me. Because the area was almost joined to the already mined site, we felt it was not necessary to

apply to the Minerals Commission for a permit since both areas had similar features. The landowner also urgently needed money and could not wait for me to go through the lengthy license procedures, indicating that he would find another miner (Sand Contractor in Gomoa Kweikrom, 2021).

The narrative means that some sand contractors used a single permit for different sites as a way of avoiding the alleged bureaucratic license procedures. Similarly, the key person at the Minerals Commission further linked the defiance of Section 10 of Act 703 to the difficulties inherent in monitoring sand miners and the limited knowledge some of the sand miners had of the mining laws. The result corroborates Dewi et al.'s (2019) finding in Indonesia, where the use of single permits for different sites was attributed to inadequate monitoring by the regulators.

In respect of the bureaucratic license procedures, the key informant at the Minerals Commission acknowledged that the excessive delays inherent in the processes were a breach of Sections 12 and 13(1) of Act 703, which mandate the Minerals Commission to officially inform the applicant within 150 days of the status of the application. The official further explained that the Commission's inability to comply with the regulation was as result of the multiple hierarchies of institutions and governance structures, with some overlapping responsibilities, heightening the bureaucratic process. The key informants at both the EPA and MMDAs corroborated that the delay in the license process was due to the heavy schedules the agencies had to accomplish, coupled with limited collaborations between the state agencies. The finding confirms understandings from the UPE theory and Gondo et al.'s (2019) argument that the interactions among several agencies responsible for regulating sand mining cause multiple power dynamics and bureaucratic processes, which subsequently lead to illegal mining.

Apart from the delays in the processing of sand mining licenses, the key informant interviews also revealed that the 21-day mandatory publication of notice in connection with the application of mineral rights was not efficiently undertaken as required in Section 13 (3b) of the Minerals and Mining Act 2006 (Act 703). The key informant at the Minerals Commission explained that the publication was to give landowners adequate notice about the intended mining undertaking and also provide an avenue for possible public agitation against the proposed mining. However, the key informant said that the Commission preferred to publish the notice in the daily newspapers over posting copies of the application in the mining communities. He remarked:

> The Commission previously sent all proposed applications to the MMDAs for them to paste copies in the sand mining communities. The MMDAs are not cooperative and often fail to publish the applications. All they care about is using the application as an avenue to generate revenue from the sand miners. We have decided to use newspaper publications instead of relying on the MMDAs (Key Informant in Minerals Commission, 2021).

Based on insights from political settlement theory, the statement suggests that the regulatory actors had equally positioned themselves in order to divert benefits from sand mining to their organisations. Since most of the local people hardly ever read the daily newspapers, the use of newspapers to distribute such information implied that the majority of them lacked access to the information. The household survey confirmed the lack of awareness about the publication of proposed mining notices. All (100%) of the household heads answered that they had never seen the publication either in the newspapers or in their respective communities. The key informant at the GSMA corroborated that the information asymmetry in relation to the publication of proposed mining undertakings was partly accountable for the many land use disputes embedded in sand mining in the municipality. This finding is similar to that of Hausermann and Ferring (2018), who found that residents of host communities were not informed about mining undertakings in their towns.

The study further ascertained whether adversely affected persons were compensated in accordance with Section 72(5) of Act 703. About 70% of the 205 household heads who answered the question said that adversely affected persons receive nothing as compensation for damages to their crops, land, or other properties, while a few others mentioned cash compensations (28.3%) or farmland (1.0%), as shown in Table 31. Key informants at the MMDAs and the Minerals Commission confirmed the nonpayment of compensation to negatively affected farmers. The finding is similar to that of Peprah (2013), who found that adversely affected residents in sand mining communities were largely not compensated by the miners.

Table 31: Distribution of household heads views about payment of compensation by communities

Form of compensation received	Buduatta		Kweikrom		Hobor		Tebu		Total	
	f	%	f	%	f	%	f	%	f	%
Nothing	25	48.1	18	72.0	75	87.2	27	64.3	145	70.7
Cash	25	48.1	7	28.0	11	12.8	15	35.7	58	28.3
Land	2	3.8	0	0.0	0	0.0	0	0.0	2	1.0
Total	52	100.0	25	100.0	86	100.0	42	100.0	205	100.0

*Less than the number of respondents (n=278) due to nonresponse

Source: Field survey, 2021

The disaggregation of the findings in Table 31 revealed that household heads in Gomoa Buduatta had the highest proportion of affected persons who had received cash (48.1%) and alternative farmland (3.8%) as compensation. The youth FGD participants in Gomoa Buduatta disagreed with the FGD participants in the other study areas on the nonpayment of compensation to negatively affected residents. It was reported by the youth FGD participants in Gomoa Buduatta that the relatively higher proportion of cash compensation for negatively affected individuals in their community was as a result of the frequent blockage of the only access road from the mining site by the development committee and the youths to demand compensation from the miners. The action of the youth is consistent with knowledge from political settlement theory and demonstrates the use of holding power to achieve the desired distribution of benefits for their relatives.

Further analysis of the cash compensation paid to some of the negatively affected people showed that the amount of money was very small and subjectively determined by the sand miners alone. According to key informants at the MMDAs, sand miners regularly ignored the Land Valuation Department when calculating how much compensation to pay negatively impacted individuals, which was supposed to be based on the regulations governing public property valuation. One key informant hinted:

> The sand contractors solely decide how much to pay as compensation to the affected farmers. As a result, the meagre compensation often ranges between GHS 150 and GHS 450 ($15 to $45) in total, irrespective of the size of the farm or crops destroyed. Sometimes, the police consult the Department of Agriculture to calculate the cost of the crops destroyed, but the farmers often complain that our recommendations are not implemented (Key informant in the Department of Agriculture in GSMA, 2021).

This statement means that the regulatory agencies did not assist negatively affected residents in receiving commensurate compensation for the damages to their farms. The household respondents mentioned that the meagre compensations were largely used for the following expenditures: food items, payment of bills, investment in trading activities, and investment in other farms. The finding is consistent with Abuodha and Hayombe's (2006) earlier findings in Kenya. They came to the conclusion that farmers who were negatively impacted by sand mining did not receive sufficient compensation to allow them to participate in other forms of livelihood activities.

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

The key informants at the EPA explained that the relevant laws the agency used to regulate sand mining were the EPA Act, 1994 (Act 490), and the Environmental Assessment Regulation, 1999 (LI 1652). First, it was found that, though under Regulation 20 (1) of LI 1652, the EPA was required to process applications for environmental permits and communicate the decision to the applicants within a period of not more than 90 days, the process often lasts for months. The key informant at the EPA headquarters attributed the delays to the inadequate staff strength of the agency to handle the overwhelming volume of inspection, monitoring, and other extension services the agency had to fulfill. The result is in line with Dewi et al.'s (2019) finding in Indonesia that the Department of Mining, Energy, and Environment in South Buton Regency did not perform efficiently in the regulation of sand mining due to inadequate staff.

Second, it came out that some sand miners operated without an environmental permit, in breach of Section 2(11c) of LI 1652. The key informants attributed the low levels of compliance with permit acquisition to the 'moral hazard' problem of the miners and the low penalty regime for offenders. One of the key informants indicated that the miners repeatedly preferred to break the law since they did not pay the entire price for their conduct. The officer shared these words:

> The sanction for sand mining offences under Section 29 of the Environmental Assessment Regulation, 1999 (LI 1652) is GHS 200 ($20).

> It is more economically rational for sand miners to break the rule than to comply with it. The penalty should be adjusted upward to deter miners from such practices (Key informant in the EPA Headquarters, 2021).

The statement means that because the sanction for noncompliance was relatively cheaper, the sand miners preferred the payment of penalties to the permit acquisition. This result is in line with the understanding from the political settlement theory that powerful actors such as miners can undermine institutions by violating the rule and accepting the consequences, especially when the relative cost to them is cheaper.

Third, it was learned that the EPA did not enforce Regulations 23 of LI 1652, which required mining companies, including sand contractors, to provide reclamation bound as part of their reclamation plan when applying for an environmental permit. The interviews with some of the sand contractors confirmed that the local government authorities rather demanded a reclamation bound to serve as a surety to cover the cost of environmental rehabilitation. It was explained by the key informant at the Kasoa EPA office that, in the absence of the bond, the agency lacked the financial strength to rehabilitate the mined-out sites.

Fourth, household respondents claimed that they had limited knowledge of environmental protection as a result of the EPA's failure to embark on regular public sensitization programmes in the sand mining communities, as outlined in Section 2 of the EPA Act, 1994 (Act 490). The majority of the household respondents (95.6%) claimed that the EPA had never provided public education on how to manage environmental resources in their communities. All the FGDs corroborated the household respondents' views. For instance, the female FGD participants in Gomoa Buduatta were of the view that it was the first time they heard that the EPA was mandated to provide public education in their communities. The key informants at the EPA acknowledged the low levels of community engagement and sensitization. The officer indicated that the EPA was constrained with both human resources and logistics to fully discharge public education on environmental enhancement programmes.

Effectiveness of the formal rules

The researcher explored further by seeking the household respondent's opinion on whether the formal rules that regulated sand mining were effectively applied. On a three-point scale, most (98.9%) of the household respondents indicated that the formal rules were not effective in regulating sand mining, as shown in Table 32.

Table 32: Household respondents' opinion on the effectiveness of formal rules regulating sand mining in the study communities

Formal rules	Frequency	Percentage
Not effectively applied	274	98.9
Effectively applied	2	0.7
Not sure	1	0.4
Total	277*	100

*Less than the number of respondents (n=278) due to nonresponse

Source: Field survey, 2021

The responders were asked a follow-up question to justify their selected responses. About 49% of the household respondents who indicated the ineffectiveness of the formal rules attributed it to the absence of monitoring by the regulatory agencies. Others mentioned alleged corruption among the regulatory agencies and miners (25.2%), the influence of government officials and big men to twist the rules (13.6%), rules not clearly crafted for sand mining (9.5%), and the absence of sanctions for offenders (2.8%) in that order. On the other side, those who mentioned the effectiveness of the formal rules cited the frequent presence of local police officers in the mining sites, even though police officers were not supposed to regulate sand mining unless under the leadership of either the Minerals Commission, EPA, or MMDA or if it was to address a conflict at the site.

The study again ascertained the opinion of the respondents on whether penalties were applied to illegal sand miners. The distribution of the respondent’s opinions clearly showed that 51.6% indicated that no penalties were awarded against miners for noncompliance with the mining rules. About 37.9% were not sure, and the remaining said illegal miners were sanctioned (10.5%). The household respondents who said noncompliance penalties were applied to illegal miners cited the following as examples: arrest by the local police, payment of money to police and other regulatory officers, and infrequently temporary stoppage of the mining activities by the regulatory officials. On the other hand, those who mentioned that illegal miners were not punished mentioned the following reasons: illegal miners continued to operate even after the regulatory agency’s intervention; miners had no fear of the laws; miners destroyed properties; and there had been no prosecution of illegal miners.

Key regulatory challenges

According to the political settlement theory, regulatory officials find it difficult to implement legislative frameworks due to a lack of funding and potential conflicts of interest among some of the regulatory actors. The World Bank (2002) further noted that creating regulatory frameworks in developing nations was not the most crucial task, but also having regulatory agencies that had the right calibre of resources and the ability to implement the framework was important. This section looks at the bottlenecks of the formal regulatory agencies mandated to regulate sand mining through a strengths, weaknesses, opportunities, and threats (SWOT) analysis.

Interactions with the key informants brought out the SWOT of the agencies, as shown in Table 33. The weaknesses and threats found were a lack of collaboration among the agencies, inadequate logistics, inadequate staff, low compliance monitoring, information asymmetry about sand mining, the dispersed or widespread nature of sand mining, and interferences by big men.

First, it was gathered from the key informants that the collaboration between the state agencies was very poor and often terminated after the issuance of permits and licenses to the miners. The key informant in the Minerals Commission confirmed the finding in these words:

> The lack of collaboration has created inter-institutional conflicts and suspicion among the regulatory agencies. This manifested in a 'blame game' syndrome where officials in different agencies saw others as the

cause of the problems characterising sand mining (Key informant in Minerals Commission, 2021).

The finding is consistent with Koehnken and Rintoul's (2018) argument that many administrative agencies responsible for enforcing sand mining regulations affect the effective control of sand extraction due to limited collaboration, inconsistencies between jurisdictions, and erroneous interpretations of the laws.

Second, the key informants mentioned inadequate staff for the regulatory agencies considering the volumes of work they have to discharge. For instance, the key informant at the EPA Kasoa office hinted:

> Aside from addressing issues with sand mining, we also focus largely on illegal gold mining activities, which have gained national discourse and public outcry. We cannot be everywhere at the same time with our current staff strength (key informant in Kosoa EPA office, 2021).

The implication of the quotation is that the inadequate staffing situation did not only affect the regulators' ability to perform their administrative functions, but it also hindered them from pursuing frequent compliance monitoring exercises in the sand mining communities. This is similar to Adu-Baffour, Daum, and Birner's (2021) finding that inadequate logistics and staff of the regulatory agencies were accountable for the noncompliance with mining rules in Ghana.

Third, the interactions brought out the issue of inadequate technology and logistics for the regulatory agencies. It was discovered that the widespread sand mining in the studied areas was carried out in a migratory manner from various sites. The regulatory agencies, however, lack state-of-the-art technology and logistics such as remote sensing or satellite imagery facilities as well as vehicles to detect unlawful extraction of sand in real-time. The key informant at the EPA headquarters noted:

> We don't have enough vehicles or logistics for our routine monitoring exercises. As a result, we are unable to embark on regular compliance monitoring at the mining sites as expected (Key informant, 2021).

The finding is grounded in the political settlement theory, which shows that inadequate logistics adversely affect regulatory agencies' ability to effectively control natural resource exploitation. In line with this, Kuter (2013) explained that the effective access to and application of contemporary methods of compliance monitoring were part of the reasons why the regulatory bodies in Australia's mining industry were largely effective.

Fourth, the researcher learned that the regulating bodies had incomplete and inaccurate information about the situation of sand mining in the study towns. For instance, the key informants at the EPA and Minerals Commission admitted that they were not aware that sand mining was widespread in Tebu and certain areas in Gomoa Kweikrom, chiming with an earlier finding that regulatory agencies were largely unaware of illegal sand mining sites in Nigeria (Abraham et al., 2021). The information gap may undermine the implementation of appropriate strategies to address the adverse impacts of sand mining in the study areas. The finding also corroborates the assertion of Hilson and Maconachie (2017) that information gaps among the regulatory agencies often led to the development of regulatory frameworks that did not address the complicated mining sector inundated with illegal activities.

Fifth, though the MMDAs had the power to enact by-laws to regulate sand mining, none of the MMDAs in the study areas had passed such laws as an additional legal framework. The key informants at the respective MMDAs noted that their offices were working assiduously to pass by-laws for sand mining in the near future. The absence of the by-laws on sand mining raised concerns among FGD participants as to whether the local government authorities were genuinely dedicated to stopping unlawful sand mining or not. The finding corroborates Musah's (2009) finding that the East Gonja District in Ghana did not have by-laws on sand mining and also failed to enforce the national laws on mining, though sand mining was widespread in the district.

Table 33: Strength, Weakness, Opportunities and Threats (SWOT) matrix

Agency	Strengths	Weaknesses	Opportunities	Threats
EPA	• Existing laws on environment • Legal backing • Qualified staff	• Limited staff • Inadequate logistics • Low collaboration • Low monitoring • Information asymmetry on sand mining • Absence of state-of-the-art technology	• Global recognition (SDGS) • Collaboration with other agencies (logistics, joint monitoring)	• Urbanisation • Political/big men interference • Assault by illegal miners • Dispersed mining locations
Minerals Commission	• Existing laws on mining • Legal backing • Qualified staff	• Limited staff • Inadequate logistics • Low collaboration • Bureaucracy • Low monitoring • Information asymmetry on sand mining • Absence of state-of-the-art technology	• Media attention • Collaboration with other agencies (logistics, joint monitoring)	• Political/big men interference • Assault by illegal miners • Dispersed mining locations
MMDAs	• Legal backing • Proximity to mining site • Close association/ representation in the communities	• Inadequate logistics • Low collaboration • Lack of bye-laws • Low monitoring	• Media attention • Collaboration with other agencies (logistics, joint monitoring)	• Assault by illegal miners • Urbanisation • Political interference

Source: Field survey, 2021

The findings with respect to the regulatory challenges underscore the weakness of the regulatory agencies in safeguarding the ecology and livelihoods of the local residents. In the event that the regulatory agencies are constrained by inadequate human resources, logistics, information, and collaboration, ensuring sustainable sand mining becomes an impossibility. The consequence is that the local residents would have to bear the adverse consequences of sand mining. That notwithstanding, the SWOT analysis revealed an opportunity for the agencies to coordinate and collaborate through the sharing of both logistics and human resources for joint monitoring exercises. This will ensure efficient use of the few resources available to the agencies by eliminating duplication of similar tasks among them. The agencies could also work with the media to reduce the threat and interference of big men.

Informal institutions and sand mining

The key informants at the MMDAs, EPA, and Minerals Commission agreed that customary law allowed traditional institutions to prohibit or accept practices that negatively impact their community's well-being. This section looks at the traditional institutions in the study communities and how they regulate sand mining. First, the study asked the respondents about the traditional rules in their communities and their applications to sand mining. About 98.5% of the household respondents mentioned that the traditional rules did not relate to sand mining. This finding confirms Saviour's (2012) argument that many sand mining host communities had no customary rules to regulate the activity. The absence of customary rules for sand mining was confirmed by the FGD participants and the community development committee members. For instance, the youth FGD participants in Tebu expressed concerns that their ancestors could not anticipate that their community would be confronted with sand mining, so they did not pass any informal rules to regulate the activities.

Further interactions with the FGD participants showed that existing belief systems, such as taboos, largely restrained farmers from working on their farms on certain days, while sand contractors were permitted to mine (Table 34). This result was confirmed by a landowner who doubled as a clan head. He noted that:

> Once the sand miners performed the traditional rites by offering goats or sheep and drinks to the ancestors, they obtained permission to work even on taboo days. Some large-scale commercial pineapple farmers equally observe the ritual and are therefore exempt from the taboo. The peasant farmers can do likewise if they wish (Landowner in Gomoa Kweikrom, 2021).

The narrative suggests that the customary rules were not favourable to peasant farmers. The discrimination with respect to the application of taboos against farmers had created a condition where illegal sand miners operated on taboo days, knowing very well that the farmers would be absent from their fields. Due to this, some farms were destroyed by the miners on such days, which had made livelihoods of the local people more precarious. Aside from the unfavourable taboos, FGD participants in Hobor and Tebu alleged that the landowners claimed everlasting control over sand on land they had leased to private developers or farmers. They expressed concerns that the situation had contributed to tenure insecurities and land disputes.

Second, the study ascertained the opinion of the household respondents on the effectiveness of the traditional leaders in regulating sand mining in their communities. About 99% of household heads indicated that the traditional leaders were ineffective in the management of sand mining. The reasons assigned by the household heads included corruption of the traditional leaders such as chiefs, clans or family heads; no monitoring by the chiefs/landowners; involvement of chiefs in illegal sand mining; disregard of traditional leaders by nonindigenous settlers; chiefs or clan heads being equally vulnerable to illegal miners; and chiefs or clan heads no longer having respect due to unfair land use decisions. A landowner in Hobor corroborated the household heads. He hinted that:

> Some of the traditional leaders assist the miners and other wealthy people in breaking the same informal rules they are supposed to enforce. I heard that illegal miners, aided by some people in this community, boldly mined portions of our cemetery because of money (Key informant, 2021).

The statement illustrates the ineptness of traditional institutions, including informal rules, because of the traditional leader's involvement in illegal practices. Field observations also confirmed that illegal sand mining had happened at a cemetery in Hobor. The finding is consistent with Johnbull and Brown's (2017) evidence in Nigeria, where there were alterations in cultural values and rules by chiefs in favour of sand miners as a result of monetary benefits.

Table 34: Summary of traditional rules in the study communities

Similar informal rules for all communities	Different informal rules for the communities			
	Gomoa Buduatta	Gomoa Kweikrom	Hobor	Tebu
• No farming on certain days in the week — either Tuesday, Wednesday, or Friday • Compulsory communal labour • Traditional ritual should precede sand mining and any major investment	• Community members can freely access forest-based produce • No cursing or fighting • Land is owned by family heads • Abusa as dominant share cropping arrangement	• Land is allocated by the chief • No cursing or fighting • Abusa as dominant share cropping arrangement	• No milling on Wednesday and Friday • Ban on eating certain food on certain days in the week • Land owned and allocated by Ga clan heads • Both Abunu and Abusa as share cropping arrangements	• No milling on Wednesday • Land owned and allocated by Ga clan heads • Both Abunu and Abusa as share cropping arrangements

Source: Field survey, 2021

Interactions between the formal and informal institutions in sand mining

North (1990) argued from the perspective of the entitlement theory that formal institutions were highly entwined with informal institutions, and the effectiveness of one particular institution, to a very large degree, rests on the functionality of the other. Therefore, this section examines the relationships between the formal and informal institutions regulating sand mining in the study communities.

The interactions with the landowners and key informants at the regulatory agencies showed a dissonance between the formal and informal institutions. According to the Minerals and Mining Act, 2006 (Act 703), while traditional leaders were the custodians of land, the state owned the resources on the surface of or underneath the same land. The key informant at the Minerals Commission reported that this arrangement was not well understood and/or accepted by the landowners or chiefs. It was revealed that the arrangement had created an agency for the traditional rulers to manoeuvre the formal rules with illegal miners on the blind side of the state actors. Some of the landowners confirmed this finding and noted that:

> The state must integrate traditional leaders into the regulation and enforcement of mining rules in order to promote trust and information sharing. As it stands now, landowners hold the impression that while the land belong to us, the regulatory agencies accrue gains from sand mining. Therefore, some landowners also allocate land and collaborate with illegal

> sand miners so as to enjoy some of the benefits (Landowner in Gomoa Buduatta, 2021).
>
> The state agencies expect us to monitor the activities of sand miners, but they have marginalised landowners in the licencing process. How can we support them if the relationship between us is poor? They have to acknowledge that we have better knowledge of the local terrain than they do (Landowner in Tebu, 2021).

The above narratives confirm the limited collaboration between both informal and formal actors in the management of the extraction of sand in the research areas. This finding is consistent with Boafo, Paalo, and Dotsey's (2019) finding that chiefs often abandon their role as partners in regulating mining activities as a result of the disregard shown by state actors.

The finding is consistent with understandings from the political settlement theory. It points to the possibility for the formal state institutions to be stifled by the local actors as a result of inadequate collaboration, which will obviously undermine the effective regulation of sand mining. The gap created by the insufficient collaboration between state regulators and chiefs or clan heads had rather created a condition for chiefs or clan heads to collaborate with illegal sand miners. Given this situation, the key informants at the EPA requested that the MMDAs regularly engage chiefs or clan heads through their Assembly members to build a better relationship towards sustainable management of sand mining.

Summary of the Chapter

The chapter explored the application of the institutional framework for mining in the study areas. The discussions centred on the Minerals and Mining Act, 2006 (Act 703), the EPA Act, 1994 (Act 490), the Environmental Assessment Regulation, 1999 (LI 1652), and the available informal institutions in the study areas. The chapter also looked at the key regulatory challenges facing the formal regulatory agencies. The chapter revealed that there was no specific regulatory framework for sand mining in Ghana. Therefore, sand mining was regulated within the broad framework developed for the entire mining sector. Formal rules on issues including processing time for licenses, compensation to affected persons, notice to landowners and community members, and the provision of reclamation bonds were not applied as stipulated in the relevant laws.

The examination of the challenges confronting the formal regulatory agencies pointed out the following issues: inadequate resources for the agencies; absence of collaboration among the agencies; interferences by government officials or big men; inter-institutional conflicts; and information asymmetry in sand mining. The chapter also showed that there was a divide between formal and informal institutions in the regulation of sand extraction. As a result, customary actors preferred collaborating with illegal miners to state actors due to the alleged marginalisation of customary actors. The chapter that follows discusses the summary, conclusions, and recommendations.

CHAPTER EIGHT

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

The chapter concentrates on the summary of the study and the conclusions drawn. Additionally, it offers recommendations based on the findings, contributions to knowledge, and suggestions for further study.

Summary

The study assessed the effects of terrestrial sand mining on local household livelihoods in the Ga South Municipality and Gomoa East District of Ghana. It was guided by four specific objectives. In order to gather quantitative information from 278 household heads and qualitative information from 32 key informants and focus group discussions with women and youth groups in each of the study communities, a cross-sectional survey design and concurrent mixed-methods research technique were used.

The sampling procedure encompassed both probability and nonprobability methods. First, the multi-stage sampling technique, with a combination of purposive, proportionate, systematic, and simple random sampling techniques, was employed to select the household respondents. Second, the key informants — including landowners, sand contractors, truck drivers, local government officials, the EPA, and the Minerals Commission — and FGD participants were selected using convenient and purposeful sampling approaches. The data were collected with an interview guide, interview schedule, FGD guide, and observation guide.

The quantitative data was analyzed using Statistical Product and Service Solutions, version 21, while NVivo 12 was used for the qualitative data analysis. The key findings of the study were as follows:

1. The majority of respondents were aware that sand mining was a common practice in their areas, started about 15 years ago, and was done mostly on farmland.
2. An estimated average of 431 truckloads — with the most common being 20 m^3 of Howo Sinotruck — of sand were mined daily from the study communities. The annual sand mined from the study areas was, therefore, estimated at 2.63 million cubic meters at an average sand density of 1.85 g/cm^3.
3. Sand mining was mostly illegally undertaken and manifests itself through mining without a license, theft of sand, or both. The illegal sand mining thrived on factors such as a lengthy licencing process, bribery among the actors, and inadequate monitoring by the regulatory agencies.
4. Monetary benefits were the most common interest among the actors involved in sand mining. However, the revenue from sand mining was unevenly distributed among the actors. The actors with capital (sand contractors) and landowners earned a higher share of the proceeds. As a result of the monetary benefits, landowners preferred to allocate land to sand miners compared to farmers.
5. The majority of the household respondents reported that they had experienced the adverse effects of sand mining on their livelihoods compared to the

positive effects. On one hand, some of the negative effects were limited access to farmland, loss of farmland to miners, destruction of farms or farmland, reduction in income, erosion, destruction of water bodies, destruction of wildlife habitat, ailments, land disputes, and hunger. On the other hand, the sale of food and drinks to miners, vulcanizing services, mobile money services, firewood and charcoal burning, and direct employment of a few residents by sand miners were the positive effects of sand mining.

6. About 71% of the respondents had no complaint channels to address the adverse effects of sand mining. The remaining respondents used the local police (40.3%), MMDAs (26.0%), chiefs/landowners (19.5%), development committees (7.8%), and Assembly members (6.5%) as complaint channels. Yet, the majority (84.0%) of the household heads mentioned that the complaint channels were ineffective in addressing their grievances.
7. The majority (57.0%) of household heads had diversified into alternative livelihood strategies. The dominant strategies were petty trading, construction labour jobs, commercial motorbike riders (okada), and block making. Most (67.6%) of the respondents used their personal savings as startup capital, while the others relied on the support of family and friends (14.3%), loans (13.3%), group savings (2.9%), and NGOs (1.9%).
8. Most of the household respondents noted an increase in their household's strength to handle shocks (79.1%) and increased employment of household members (62.4%) as outcomes they had experienced from adopting an alternative livelihood strategy. On income outcomes, 46.8% reported an

increased income, while 45.3% and 7.9% indicated no change and a reduction in their income, respectively. On the food security outcome, 40.6% noted an increase in their household access to food, 35.6% noted no change, and 23.8% mentioned a reduction in their access to food.

9. The regulatory framework for mining was broadly designed for the diverse mining industry, with less attention placed on industrial minerals like sand compared to prized minerals such as gold.
10. Some of the rules governing sand mining, such as the acquisition of licenses, the time period for processing licenses and permits, the posting of reclamation bonds, and the publication of mining applications, were not adequately applied as stipulated in the regulatory framework. The reasons for the inadequate application of the mining rules were inadequate collaboration among the state regulatory agencies as well as with the traditional leaders, inadequate staff and logistics for the regulators, inadequate compliance monitoring, information asymmetry about the state of sand mining, and interferences by 'big men'.

Conclusions

The following conclusions were reached based on the findings of the study:

First, sand mining was widespread in the study areas and inadequately organised. It was largely illegally undertaken on farmland by non-residents of the host communities. Illegal extraction of sand was evidenced by the absence of a licecse or permit, a lack of reclamation, the theft of sand, and the physical abuse of some local residents, especially farmers. The practice was driven by the monetary interests of the major and powerful actors, such as landowners and sand contractors, who earned a relatively larger share of the revenue. The absence of compliance monitoring, particularly at night, lengthy license procedures, and the prevailing land tenure arrangement were the reasons accountable for the widespread illegal sand mining.

Second, most of the household heads and FGD participants reported adverse economic, social, and environmental impacts of sand mining on their household livelihoods, even though a few respondents acknowledged some positive effects. The negative effects were shown by the reduction in farm sizes, reduction in crop yields, irregular income, inadequate compensation to negatively affected persons, reduction in food intake, ailment, frequent tension, and land disputes among the sand miners, landowners, and community members. The livelihoods of the locals were not sustainable due to the continuous destruction of their farmland.

Third, alternative livelihood strategies, especially commerce and service-related activities, were adopted by the majority of the household heads to reduce the harmful consequences of sand mining. Personal savings and support from family or friends were the major sources of startup capital for the adopted livelihood strategies. Although the alternative livelihood strategies had enhanced the income, employment, consumption, and resilience of some participating household heads, they faced challenges such as low patronage, credit purchases, limited access to adequate credit to expand, and health and safety concerns in relation to some of the strategies.

Fourth, sand mining was governed by the broad formal institutional framework designed for the entire mining sector, with less focus on industrial minerals compared to prized minerals. The enforcement efforts of the regulatory agencies were insufficient and had contributed to the widespread, unsustainable extraction of sand in the research communities. The inadequate application of the institutional framework was a result of factors including weak collaboration among the regulatory agencies, inadequate human resources, inadequate logistics, interference by government officials or big men, information asymmetry, and weak collaboration between traditional institutions and formal state institutions.

Overall, the study showed that there were different perspectives about the impacts of sand mining on local household livelihoods. While the majority of the residents in the study areas reported that the extraction of sand had negatively affected their livelihoods as a result of the unsustainable mining practices, a few others reported positive effects. The negative effects occurred because the sand miners, who were largely unmonitored, degraded farmland without any plan of reclamation. Despite the relatively higher revenue generated from sand mining compared to farming, the proceeds were unevenly distributed. Sand contractors and landowners receive the largest share of the revenue, while weaker actors, including farmers, often suffer disproportionately and receive inadequate compensation or nothing for their losses.

Recommendations

Based on the findings, the following recommedations were made:

Local government authorities should:

1. Work with landowners and LUSPA to create planning schemes that identify the areas that are suitable for each land use, such as sand mining, farming, and residential. By protecting farmland, this would guarantee controlled peri-urban growth, restore lost local livelihoods, and ensure food security for the people in the sand mining areas.
2. Collaborate with landowners to lease farmland for a lengthy number of years to the MMDAs and then allocate the land to the local farmers. The MMDAs should facilitate the payment of rent to the landowners from their funding sources, while the local farmers are made to pay back such rent to the MMDAs after the harvest and sale of their farm produce. This would ensure regular and stable rent for the landowners, thereby convincing them to release land for farming.
3. Constitute a committee involving landowners, Assembly members responsible for the sand mining community, officers of the Department of Agriculture, and the Land Valuation Board to effectively address complaints, including the payment of appropriate compensation to negatively affected persons. The payment of adequate compensation would help the negatively affected individuals adopt alternative livelihoods.
4. Collaborate with the Business Advisory Centre-National Board for Small-Scale Industries (BAC-NBSSI) and the target residents in the sand mining

communities to introduce desirable alternative livelihood strategies to mitigate the effects of sand mining. Interventions such as entrepreneurial training, artisanal skill development, commerce, and business advisory services are examples of alternative livelihood support strategies that may be provided for the affected households.

5. Collaborate with the other regulatory agencies and the Ghana Police Service to enforce the existing mining regulations, especially at night.

The Minerals Commission and EPA should:

6. Ensure effective and efficient collaboration through joint compliance monitoring exercises and engagements with local actors. The collaborations are useful for the achievement of the following: First, it would address the bureaucracy in the licencing process. Second, the involvement of key local actors such as the Assembly Member and chiefs or landowners would offer better knowledge of the location of the miners since the local actors have better knowledge of the local terrain. Third, the collaboration would ensure optimal use of the limited resources available to the regulatory agencies by eliminating duplication of similar tasks among the agencies.
7. Ensure that illegal sand miners and dishonest state regulatory officials are appropriately sanctioned to serve as deterrents to others. This is important because some miners preferred working illegally because the sanction systems were ineffective.

8. Organise training workshops for traditional rulers, the local government authorities, and the residents in the mining areas in land management to ensure effective and sustainable management of land resources.
9. Insist that sand miners pay a reclamation bond to serve as surety so that in the event that the miners fail to undertake post-mining rehabilitation of the affected sites, the reclamation bond would be utilised for that purpose.

Policy makers/central government should:

10. Review the mining legislation in order to develop a national policy specifically for sand mining since the current rules are not particularly clear on sand mining.
11. Provide the regulatory agencies with adequate human, financial, and logistical resources including, state-of-the-art monitoring technologies, to enable them to undertake much more proactive compliance monitoring of sand miners.
12. Ensure the development and promotion of alternative building materials that are less dependent on sand, including steel and fibre for the construction industry.

Landowners should:

13. Allow farmers to harvest their produce before allocating cultivated land to sand miners.
14. Have a written contract with the sand miners to commit them to operate only on the demarcated land and also reclaim the land after mining.

Contribution to Knowledge

First, the research has added another dimension to the already existing knowledge on sand mining, particularly the current state of terrestrial sand mining in the study areas. It has also built on earlier studies that identified the actors involved in sand mining by examining the specific roles each actor played. The study further analysed the interests and power positions of the identified actors, which is very imperative for natural resource governance.

Second, the study adds to what is already known about how sand mining affects the quality of life of people in the mining areas. The study provided a much broader sustainability approach to the analysis by considering all the pillars of sustainable development in relation to how local household livelihoods were impacted by the externalities of sand extraction. In addition, most of the previous studies concentrated on river or beach sand mining, but this study has contributed to knowledge about the effects of terrestrial sand mining on local livelihoods. The study also backed ongoing arguments that while sand mining has positive benefits, the livelihoods of most of the locals in the host communities are negatively affected.

Third, though there was literature on alternative livelihood strategies in mining areas in Ghana, the literature neglected the strategies in sand mining communities. The contribution to knowledge is that most household heads in the sand mining communities had adopted alternative livelihoods as a survival strategy to smoothen their incomes and consumption. Sand contractors did not provide any form of support to the negatively affected residents to start alternative livelihoods.

Fourth, previous investigations appeared not to have examined the institutional framework governing sand mining in Ghana. The earlier studies largely examined the problems that confront the regulatory agencies in the discharge of their mandate. The study filled this grey area as it found that overall, there were no specific rules governing sand mining in Ghana. The broad mining legislation tilted towards prized minerals, was used to regulate the sand mining industry. Fifth, although studies had been carried out with the UPE theory, they concentrated on urban areas in industrialized countries. Bringing the rural and peri-urban perspectives into the analysis added another dimension to the theory.

Limitations

The first challenge faced was receiving actual data on household income for the past years since the respondents did not keep records of their activities, especially their farm income. Therefore, there was a possibility of recall bias, which suggests that the change in income found might not be a true reflection of the respondents' financial conditions. In spite of these pitfalls, the results are valid because triangulations using other methods show clearly that the income of household heads in the research areas has been negatively impacted by sand mining. Second, the study was undertaken in four sand mining localities in Ghana and also in respect of terrestrial sand mining. The generalisation of the result to other areas must be done carefully because communities have different land tenure arrangements and characteristics. Besides, terrestrial sand mining might be different from river and marine sand mining. Third, the study could not account for the exact quantity of sand mined from the study areas because of the sporadic nature of the sand mining in these areas, inadequate record-keeping by the sand miners, and limited sand mining during the rainy season, which sometimes caused both the payloaders and trucks to get stuck in the mud.

Suggestions for Further Research

Based on the findings, further research is required in these areas:

1. An extensive analysis of the sand value chain is required to determine where the gains and losses related to sand mining are placed. This is because this study found that there was an uneven distribution of revenue and losses from sand mining among the actors.
2. Quantification of the exact monetary cost, such as that associated with erosion and species loss, must be examined.

REFERENCES

Abass K., Afriyie K., Adomako J. A. A. (2013). Household responses to livelihood transformation in peri-urban Kumasi. *Journal of Sustainable Development. 6*(6), 121–136.

Abraham, C. M., Essien, K., Umoh, E. U., Umoh, E. C., & Ehiremem, L. E. (2021). Towards effective monitoring of sand mining sites and post management techniques in sand dredged environment of Akwa Ibom State, Nigeria. *Global Journal of Ecology*, *6*(1), 92-99.

Abuodha, J. O. Z., & Hayombe, P. O. (2006). Protracted environmental issues on a proposed titanium minerals development in Kenya's south coast. *Marine Georesources and Geotechnology*, *24*(2), 63-75.

Acemoglu, D., & Robinson, J. (2012). Institutions, political economy and growth. Nobel prize 2012 presentations. Retrieved from https://nobel2012.iies.su.se/Presentations/Acemoglu.pdf.

Acosta, A. (2013). *Extractivism and neoextractivism: two sides of the same curse*. Quito, Amsterdam: Transnational Institute/Rosa Luxemburg Foundation.

Adedeji, O. H., Adebayo, H. O., & Sotayo, E. I. (2014). Assessing environmental impacts of inland sand mining in parts of Ogun State, Nigeria. *Ethiopian Journal of Environmental Studies and Management*, *7*(5), 478-487.

Adger, W. N. (2006). Vulnerability. *Global environmental change*, *16*(3), 268-281.

Adjarko, H., Gemadzie, J., Agyeman, K. (2016). Construction related environmental laws and policies in Ghana. *Asian Journal of Science and Technology*, *7*(5), 2984- 2992.

Adom, D., Hussein, E. K., & Agyem, J. A. (2018). Theoretical and conceptual framework: Mandatory ingredients of a quality research. *International journal of scientific research*, *7*(1), 438-441.

Adu-Baffour, F., Daum, T., & Birner, R. (2021). Governance challenges of small-scale gold mining in Ghana: Insights from a process net-map study. *Land Use Policy*, *102*, 3-4.

Afriyie, K., Abass, K., & Adjei, P. O. W. (2020). Urban sprawl and agricultural livelihood response in peri-urban Ghana. *International Journal of Urban Sustainable Development*, *12*(2), 202-218.

Afriyie, K., Ganle, J. K., & Adomako, J. A. A. (2016). The good in evil: A discourse analysis of the galamsey industry in Ghana. *Oxford Development Studies*, *44*(4), 493-508.

Akubia, J. E., & Bruns, A. (2019). Unravelling the frontiers of urban growth: spatio-temporal dynamics of land use change and urban expansion in greater Accra metropolitan area, Ghana. *Land*, *8*(9), 1-23.

Akylbekova, D. (2015). *Analyzing the Resource Curse theory: A comparative study of Kazakhstan and Norway*. Lund, Sweden: Lund University.

Angelo, H., & Wachsmuth, D. (2015). Urbanizing urban political ecology: A critique of methodological cityism. *International Journal of Urban and Regional Research*, *39*(1), 16-27.

Aniah, P., Aasoglenang, A. T., & Bonye, S. Z. (2014). Behind the myth: Indigenous knowledge and belief systems in natural resource conservation in North East Ghana. *International Journal of Environmental Protection and Policy*, *2*(3), 104-112.

Ankarloo, D. (2002). New institutional economics and economic history. *Capital & Class*, *26*(3), 9-36.

Anokye, N. A., Mensah, J. V., Potakey, H. M. D., Boateng, J. S., Essaw, D. W., & Tenkorang, E. Y. (2023). Sand mining and land-based livelihood security in two selected districts in the Central Region of Ghana. *Management of Environmental Quality: An International Journal*, *34*(1), 21-36.

Arko-Adjei, A. (2011). Adapting land administration to the institutional framework of customary tenure: The case of Peri-Urban Ghana. Amsterdam, Netherlands: Delft University Press.

Arthur, V. (2016). *The degraded sand mining site at Golinga, Northern Ghana.* United Nations University Land Restoration Training Programme [final project] Retrieved from https://www.unulrt.is/static/fellows/document/Arthur2016.pdf.

Aryeetey, E., Ayee, J. R. A., Ninsin, K. A., & Tsikata, D. (2007). *The politics of land tenure reform in Ghana: from the Crown Land Bills to the Land Administration Project (Technical Report).* Accra, Ghana: ISSER, University of Ghana.

Asabonga, M., Cecilia, B., Mpundu, M. C., & Vincent, N. M. D. (2017). The physical and environmental impacts of sand mining. *Transactions of the Royal society of South Africa*, *72*(1), 1-5.

Asafo, D. M. (2022). Fragile and compromised housing: Implications of land conflicts on housing development in peri-urban Accra, Ghana. *Housing Studies*, *37*, 1-24.

Asante, F., Abass, K., & Afriyie, K. (2014). Stone quarrying and livelihood transformation in Peri-Urban Kumasi. *Journal of Research in Humanities and Social Sciences*, *4*(13), 93-197.

Asante, L. A., Gavu, E. K., Quansah, D. P. O., & Osei-Tutu, D. (2018). The difficult combination of renting and building a house in urban Ghana: analysing the perception of low and middle-income earners in Accra. *GeoJournal*, *83*(6), 1223-1237.

Asare, K. Y., Agyenim, J. B., & Koomson, F. (2021). Non-farm livelihood diversification: strategies and constraints in selected rural and peri-urban communities, Ghana. *Journal of Agribusiness and Rural Development*, *59*(1), 5-15.

Ashiagbor, G., Amoako, C., Asabere, S. B., & Quaye-Ballard, J. A. (2019). Landscape transformations in rapidly developing Peri-urban Areas of Accra, Ghana: results of 30 years. *Open Geosciences*, *11*(1), 172-182.

Ashley, C., & Carney, D. (1999). *Sustainable livelihoods: Lessons from early experience* (7th ed.). London: Department for International Development.

Atamja, L., & Yoo, S. (2021). Credit Constraint and Rural Household Welfare in the Mezam Division of the North-West Region of Cameroon. *Sustainability*, *13*(11), 59-64.

Auty, R. M. (1993). *Sustaining Development in Mineral Economies: The resource curse thesis*. London: Routledge.

Ayaaba, E., Li, Y., Yuan, J., & Ni, C. (2017). Occupational respiratory diseases of miners from two gold mines in Ghana. *International journal of environmental research and public health*, *14*(3), 23-37.

Bagchi, P. (2010). Unregulated sand mining threatens Indian rivers. *The Journal India Together*, *21*, 7-9.

Banchirigah, S. M. (2008). Challenges with eradicating illegal mining in Ghana: A perspective from the grassroots. *Resources policy*, *33*(1), 29-38.

Banchirigah, S. M., & Hilson, G. (2010). De-agrarianization, re-agrarianization and local economic development: Re-orientating livelihoods in African artisanal mining communities. *Policy Sciences*, *43*(2), 157-180.

Bansah, K. J., Dumakor-Dupey, N. K., Kansake, B. A., Assan, E., & Bekui, P. (2018). Socio-economic and environmental assessment of informal artisanal and small-scale mining in Ghana. *Journal of Cleaner Production*, *202*, 465-475.

Barbier, E. B., Damania, R., & Léonard, D. (2005). Corruption, trade and resource conversion. *Journal of Environmental Economics and Management*, *50*(2), 276-299.

Beall, J. (2006). Cultural weapons: traditions, inventions and the transition to democratic governance in metropolitan Durban. *Urban Studies*, *43*(2), 457-473.

Bebbington, A., & Humphreys-Bebbington, D. (2018). Mining, movements and sustainable development: Concepts for a framework. *Sustainable Development*, *26*(5), 441-449.

Beiser, V. (2018). *The World in a Grain: The story of sand and how it transformed civilization.* New York: Riverhead Books.

Beland, L., & Tiagi, R. (2009). *Economic freedom and the resource curse: An empirical analysis.* Toronto, Canada: Fraser Institute.

Bendixen, M., Iversen, L.L., Best, J., Franks, D.M., Hackney, C.R., Latrubesse, E.M., Tusting, L.S. (2021). Sand, gravel, and UN sustainable development goals: conflicts, synergies, and pathways forward. *One Earth, 4* (8), 1095–1111.

Benson, P., & Kirsch, S. (2010). Capitalism and the Politics of Resignation. *Current anthropology*, *51*(4), 459-486.

Bewiadzi, S., Awubomu, R., & Glover, N. (2018). Searching and Cracking: Stone Quarrying, Livelihood and the Environment in the Daglama Quarry Site in the Ho Municipality. *West African Journal of Applied Ecology*, *26*, 149-166.

Blocher, J. (2006). Building on custom: land tenure policy and economic development in Ghana. *Yale Hum. Rts. & Dev. LJ*, *9*, 166-202.

Boafo, J., Paalo, S. A., & Dotsey, S. (2019). Illicit Chinese small-scale mining in Ghana: Beyond institutional weakness? *Sustainability*, *11*(21), 5943.

Bookchin, M. (1979). "Ecology and revolutionary thought", *Antipode*, *10*(3), 21–32.

Bugri, J. T. (2008). The dynamics of tenure security, agricultural production and environmental degradation in Africa: Evidence from stakeholders in north-east Ghana. *Land use policy*, *25*(2), 271-285.

Burgin, S. (2020). Sand mining on North Stradbroke Island: An Islander view of the rehabilitation of the land. *International Journal of Environmental Studies*, *77*(6), 954-968.

Carney, D. (1998). Sustainable rural livelihoods. What contribution can we make? Nottingham: Russell Press Ltd.

Chambers, R. (1983). *Rural development: putting the last first*. London, UK: Longman.

Chambers, R. (1995). Poverty and livelihoods: whose reality counts? *Environment and urbanisation*, *7*(1), 173-204.

Chambers, R., & Conway, G. (1992). *Sustainable rural livelihoods: practical concepts for the 21st century*. UK: Institute of Development Studies.

Chehabeddine, M. R., Grabowska, S., & Adekola, A. F. (2022). Building a model for securing regional development from ecological threats. *Insights into Regional Development*, *4*(2), 22-40

Cobbinah, P. B., & Amoako, C. (2012). Urban sprawl and the loss of peri-urban land in Kumasi, Ghana. *International Journal of Social and Human Sciences*, *6*, 388-397.

Cobbinah, P. B., Gaisie, E., & Owusu-Amponsah, L. (2015). Peri-urban morphology and indigenous livelihoods in Ghana. *Habitat International*, *50*, 120-129.

Collins, A., Coughlin, D., Miller, J., & Kirk, S. (2015). *The production of quick scoping reviews and rapid evidence assessments: A how to guide*. UK: Natural Environment Research Council and Environment Agency.

Corden, W. M., & Neary, J. P. (1982). Booming sector and de-industrialisation in a small open economy. *The economic journal*, *92*(368), 825-848.

Crawford, G., Agyeyomah, C., & Mba, A. (2017). *Ghana–big man, big envelope, finish: Chinese corporate exploitation in small-scale mining*. London, UK: Palgrave Macmillan.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approach*. London: Sage publications.

Csaki, C., & Tuck, L. (2000). *Rural Development Strategy: Eastern Europe and Central Asia* (Vol. 484). World Bank Publications.

Danso-Abbeam, G., Dagunga, G., & Ehiakpor, D. S. (2020). Rural non-farm income diversification: implications on smallholder farmers' welfare and agricultural technology adoption in Ghana. *Heliyon*, *6*(11), 53-93.

Dapilah, F., Nielsen, J. Ø., & Akongbangre, J. N. (2019). Peri-urban transformation and shared natural resources: the case of shea trees depletion and livelihood in Wa municipality, Northwestern Ghana. *African Geographical Review*, *38*(4), 374-389.

Darkwa, L., & Attuquayefio, P. (2012). Killing to protect: Land guards, state subordination and human rights in Ghana. *International Journal of Human Rights*., *9*(17), 141-162.

Davis, M. (2006). *Planet of Slums*. London: Verso.

Dawson, K. (2020). *Shifting sands in Accra, Ghana: The ante-lives of urban form.* Published PhD. thesis, London: London School of Economics and Political Science.

De Haan, L., & Zoomers, A. (2005). Exploring the frontier of livelihoods research. *Development and change*, *36*(1), 27-47.

Derbile, E. K., Chirawurah, D., & Naab, F. X. (2022). Vulnerability of smallholder agriculture to environmental change in North-Western Ghana and implications for development planning. *Climate and Development*, *14*(1), 39-51.

Devereux, S. (2001). Sen's entitlement approach: critiques and counter-critiques. *Oxford Development Studies*, *29*(3), 245-263.

Devereux, S. (2009). Why does famine persist in Africa? *Food security*, *1*(1), 25-35.

Devkota, R. R. (2010). *Interests and power as drivers of community forestry: a case study of Nepal*. Göttingen, Germany: Universitätsverlag Göttingen.

Dewi, I. K., Susilawati, S., & Raf, N. (2019). Implementation of environmental management policies on the impact of illegal sand mining. *Earth and Environmental Science*, *343*(1), 21-29.

DFID (1999). *Sustainable livelihoods guidance sheets*. London, UK: Department for International Development.

DFID (2000). *Sustainable livelihood: current thinking and practice*. London, UK: Department for International Development.

DFID (2003). *Promoting institutional and organisational development*. London, UK: Department for International Development.

Di John, J., & Putzel, J. (2009). *Political Settlements: Issues Paper*. Birmingham: Governance and Social Development Resource Centre.

Dick, E., & Schraven, B. (2021). *Rural-Urban Migration in West Africa: Contexts, Trends, and Recommendations*. in: Global Knowledge Partnership on Migration and Development (KNOMAD), Policy Brief (February 2021).

Dick-Sagoe, C., & Tsra, G. (2016). Uncontrolled Sand Mining and its Socio-Environmental Implications on Rural Communities in Ghana: A Focus on Gomoa Mpota in the Central Region. *International Journal of Research in Engineering, IT and Social Sciences*, *6*, 31-37.

Diesendorf, M. (2000). Sustainability and sustainable development. *Sustainability : The corporate challenge of the 21st century*, *2*, 19-37.

Doso, J. S., Cieem, G., Ayensu-Ntim, A., Twumasi-Ankrah, B., & Barimah, P. T. (2015). Effects of loss of agricultural land due to large-scale gold mining on agriculture in Ghana: the case of the Western Region. *British Journal of Research, 2*(6), 196-221.

Economic Commission for Africa (2007). *Relevance of African traditional institutions of governance.* Addis Ababa: Economic Commission for Africa.

Ehwi, R. J., Asante, L. A., & Morrison, N. (2020). Exploring the Financial Implications of Advance Rent Payment and Induced Furnishing of Rental Housing in Ghanaian Cities: The Case of Dansoman, Accra-Ghana. *Housing Policy Debate*, *30*(6), 950-971.

Ellis, F., & Freeman, H. A. (Eds.). (2004). *Rural livelihoods and poverty reduction policies*. Oxon, UK: Routledge.

Ernst, U., Hausman, P., & O'Connor, S. (2007). From Curse to Cures: Practical Perspectives on Remedying the Resource Curse. *Development Alternatives*, *11*(1), 1-43.

Essah, M., & Andrews, N. (2016). Linking or de-linking sustainable mining practices and corporate social responsibility? Insights from Ghana. *Resources Policy*, *50*, 75-85.

Essaw, D. W., Mensah, J. V., Anokye, N. A., Tenkorang, E. Y., Boateng, J. S., & Potakey, H. M. D. (2023). Governance for Sustainable Sand Mining in Two Selected Local Government Areas in the Central Region of Ghana. *Society & Natural Resources*, 1-20.

Evers, B. A. (2018). *Why adopt the sustainable development goals? The case of multinationals in the Colombian coffee and extractive sector:* Published master thesis, Erasmus University Rotterdam.

Farahani, H., & Bayazidi, S. (2018). Modeling the assessment of socio-economic and environmental impacts of sand mining on local communities: A case study of Villages Tatao River Bank in North-western part of Iran. *Resources Policy*, *55*, 87-95.

Fleming, D. A., Measham, T. G., & Paredes, D. (2015). Understanding the resource curse (or blessing) across national and regional scales: Theory, empirical challenges and an application. *Australian Journal of Agricultural and Resource Economics*, *59*(4), 624-639.

Food and Agricultural Organisation of the United Nations (FAO) (2009). Nutrition country profile of Ghana. Retrieved from https://www.moh.gov.gh/wp-content/uploads/2016/02/Nutrition-Country-Profile-Ghana.pdf.

Forsyth, T., Leach, M., & Scoones, I. (1998). *Poverty and environment: Priorities for research and policy*. Farnham, UK: Institute of Development Studies.

Frankfort-Nachmias, C., & Nachmias, D. (1996). *Research methods in the social science* (5th ed.). London: St Martin's Press.

Franks, D. M. (2020). Reclaiming the neglected minerals of development. *The Extractive Industries and Society*, *7*(2), 453-460.

Frega, R. (2011). *Evolutionary Prolegomena to a Pragmatist Epistemology of Belief*. Lanham, MD: Lexington books.

Ga South Municipal Assembly (2020). *2020 Annual Action Plan*. Ngleshi Amanfro, Ghana: Ga South Municipal Assembly.

Gasper, D. (1993). Entitlements analysis: relating concepts and contexts. *Development and change*, *24*(4), 679-718.

Gavriletea, M. D. (2017). Environmental impacts of sand exploitation. Analysis of sand market. *Sustainability*, *9*(7), 1-26.

Getzner, M., & Islam, M. S. (2013). Natural resources, livelihoods, and reserve management: a case study from Sundarbans mangrove forests, Bangladesh. *International Journal of Sustainable Development and Planning*, *8*(1), 75-87.

Ghana Statistical Service (2018). *Ghana Census of Agriculture National Report*. Accra, Ghana: Ghana Statistical Service.

Ghana Statistical Service (2019). *Ghana Living Standards Survey report of the Seventh round*. Accra, Ghana: Ghana Statistical Service.

Ghana Statistical Service (2021a). *Ghana 2021 Population and housing census general report volume 3A: population of Regions and District.* Accra, Ghana: Ghana Statistical Service.

Ghana Statistical Service (2021b). *Ghana 2021 Population and housing census general report volume 3D: literacy and education.* Accra, Ghana: Ghana Statistical Service.

Ghanney, R. A. (2020). Academic performance of basic school pupils in sand winning areas: the case of selected Junior High Schools in the Awutu-Senya West, Ghana. *European Journal of Social Sciences Studies*, *5*(6), 152-170.

Gillespie, T. (2018). Collective self-help, financial inclusion, and the commons: Searching for solutions to Accra's housing crisis. *Housing Policy Debate*, *28*(1), 64-78.

Gomoa East District Assembly (2020). *2020 Annual Action Plan.* Gomoa Potsin: Gomoa East District Assembly.

Gondo, T., Amponsah-Dacosta, F., & Mathada, H. (2019). Regulatory and policy implications of sand mining along shallow waters of Njelele River in South Africa. *Jàmbá: Journal of Disaster Risk Studies*, *11*(3), 1-12.

Gough, K. V., & Yankson, P. (2011). A neglected aspect of the housing market: The caretakers of peri-urban Accra, Ghana. *Urban Studies*, *48*(4), 793-810.

Govindaraj, G., Raveesha, S., Ahmed, T., Suryaprakash, S., Rajan, K., & Harsha, K. N. (2013). Sand mining from agricultural and common property land in peri-urban areas: an assessment of economic loss and factors responsible for transformation from agriculture to mining. *Indian Journal of Soil Conservation*, *41*(1), 61-68.

Grant, C., & Osanloo, A. (2014). Understanding, selecting, and integrating a theoretical framework in dissertation research: Creating the blueprint for your "house." *Administrative Issues Journal: Connecting Education, Practice, and Research*, *4*(2), 12–26.

Griffee, D. T. (2012). *An introduction to second language research methods: Design and data* (1st ed.). California, USA: TESL-EJ Publications.

Gyekye, K. (1997). *Tradition and modernity: Philosophical reflections on the African experience*. Oxford: Oxford University Press.

Gylfason, T. (2001). Nature, power and growth. *Scottish Journal of Political Economy*, *48*(5), 558-588.

Haghnazar, H., Sangsefidi, Y., Mehraein, M., & Tavakol-Davani, H. (2020). Evaluation of infilling and replenishment of river sand mining pits. *Environmental Earth Sciences*, *79*(14), 1-18.

Harris, N. (2003). *Atlas of the World's Deserts*. New York: Routledge.

Hausermann, H., & Ferring, D. (2018). Unpacking Land Grabs: Subjects, Performances and the State in Ghana's 'Small-scale'Gold Mining Sector. *Development and Change*, *49*(4), 1010-1033.

Heynen, N. (2006). Green urban political ecologies: toward a better understanding of inner-city environmental change. *Environment and Planning A*, *38*(3), 499-516.

Heynen, N. (2014). Urban political ecology I: The urban century. *Progress in Human Geography*, *38*(4), 598-604.

Heynen, N. (2016). Urban political ecology II: The abolitionist century. *Progress in Human Geography*, *40*(6), 839-845.

Heynen, N., Kaika, M. & Swyngedouw, E. (2006). *In the nature of cities: Urban political ecology and the politics of urban metabolism.* New York: Routledge.

Hilson, G. (2002). Land use competition between small-and large-scale miners: a case study of Ghana. *Land use policy*, *19*(2), 149-156.

Hilson, G., & Banchirigah, S. M. (2009). Are alternative livelihood projects alleviating poverty in mining communities? Experiences from Ghana. *The Journal of Development Studies*, *45*(2), 172-196.

Hilson, G., & Maconachie, R. (2017). Formalising artisanal and small-scale mining: insights, contestations and clarifications. *Area*, *49*(4), 443-451.

Hilson, G., & Maconachie, R. (2020). For the environment: an assessment of recent military intervention in informal gold mining communities in Ghana. *Land Use Policy 96*, 104706.

Hilson, G., Goumandakoye, H., & Diallo, P. (2019). Formalizing artisanal mining 'spaces' in rural sub-Saharan Africa: The case of Niger. *Land Use Policy*, *80*, 259-268.

Hofstrand, D. (2013). *Types and Sources of Financing for Start-up Businesses*. Iowa State University, Extension and Outreach. Retrieved from https://www.extension.iastate.edu/agdm/wholefarm/html/c5-92.html

Holden, M. T., & Lynch, P. (2004). Choosing the appropriate methodology: Understanding research philosophy. *The marketing review*, *4*(4), 397-409.

https://www.oxfordeconomics.com/resource/Future-of-Construction/

Johnbull, S. W., & Brown, I. (2017). Socio-economic consequences of sand mining along the Victory River in Portharcourt, Nigeria. *Asian Journal of Environment and Ecology*, *3*(2), 1-15.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational researcher*, *33*(7), 14-26.

Katega, I. B., & Lifuliro, C. S. (2014). *Rural non-farm activities and poverty alleviation in Tanzania: A case study of two villages in Chamwino and Bahi districts of Dodoma region* (REPOA Research Report No. 14/7). Dares Salaam, Tanzania: Repoa. Retrieved from: https://www.repoa. or.tz/ documents/REPOA_RR_14_7.pdf.

Kelemen, M. L., & Rumens, N. (2008). *An introduction to critical management research*. London, UK: Sage.

Kervankiran, I., Dziwornu, M. G., & Temurçin, K. (2016). Illegal mining as threat to sustainable development in Ghana: A political ecology approach. *ZfWT*, *8*(3), 173-191.

Khan, M. (1995). *State Failure in Weak States*. London: Routledge.

Khan, M. (2010). *Political Settlements and the Governance of Growth-Enhancing Institutions*. London: Mimeo.

Khan, S., & Sugie, A. (2015). Sand mining and its social impacts on local society in rural Bangladesh: A case study of a village in Tangail district. *Journal of Urban and Regional Studies on Contemporary India*, *2*(1), 1-11.

Khatun, D., & Roy, B. C. (2012). Rural livelihood diversification in West Bengal: determinants and constraints. *Agricultural Economics Research Review*, *25*(347), 115-124.

Khogali, H., & Takhar, P. (2001). Empowering women through cash relief in humanitarian contexts. *Gender & Development*, *9*(3), 40-49.

Killebrew, K., & Wolff, H. (2010). *Environmental impacts of agricultural technologies*. Washington: Evans School Policy Analysis and Research (EPAR), University of Washington.

Kleemann, J., Inkoom, J. N., Thiel, M., Shankar, S., Lautenbach, S., & Fürst, C. (2017). Peri-urban land use pattern and its relation to land use planning in Ghana, West Africa. *Landscape and Urban Planning*, *165*, 280-294.

Koehnken, L., & Rintoul, M. (2018). *Impacts of sand mining on ecosystem structure, process and biodiversity in rivers.* Gland, Switzerland: World Wildlife Fund International.

Korah, P. I., Cobbinah, P. B., Nunbogu, A. M., & Gyogluu, S. (2017). Spatial plans and urban development trajectory in Kumasi, Ghana. *GeoJournal*, *82*(6), 1113-1134.

Kothari, C. R. (2004). *Research methodology: Methods and techniques* (2nd ed.). New Delhi, India: New Age International Publishers.

Krantz, L. (2001). The sustainable livelihood approach to poverty reduction. *SIDA. Division for Policy and Socio-Economic Analysis*, *44*, 1-38.

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and psychological measurement*, *30*(3), 607-610.

Krugman, P. (1987). The narrow moving band, the Dutch disease, and the competitive consequences of Mrs. Thatcher: Notes on trade in the presence of dynamic scale economies. *Journal of development Economics*, *27*(1-2), 41-55.

Kumar, R. (2019). *Research methodology: A step-by-step guide for beginners*. New Delhi, India: Sage Publications Limited.

Kuter, N. (2013). *Reclamation of Degraded Landscapes due to Opencast Mining*. Croatia: InTech.

Lamb, V., Marschke, M., & Rigg, J. (2019). Trading Sand, Undermining Lives: Omitted Livelihoods in the Global Trade in Sand. *Annals of the American Association of Geographers*, *109*(5), 1511-1528.

Lane, P. R., & Tornell, A. (1996). Power, growth, and the voracity effect. *Journal of economic growth*, *1*(2), 213-241.

Larson, C. 2018. Asia's hunger for sand takes toll on ecology. *Science 359* (6379), 964–65.

Lawal, P. O. (2011). Effects of sand/gravel mining in Minna Emirate area of Nigeria on stakeholders. *Journal of Sustainable Development*, *4*(1), 193-199.

Leach, M., & Mearns, R. (1991). *Poverty and environment in developing countries: an overview study*. Swindon: Economic and Social Research Council, Global Environmental Change Programme.

Leach, M., Mearns, R., & Scoones, I. (1997). *Environmental entitlements: a framework for understanding the institutional dynamics of environmental change*. Sussex, UK: Institute of Development Studies.

Leach, M., Mearns, R., and Scoones, I. (1999). Environmental entitlements: *dynamics and institutions in community-based natural resource management. World Development 27* (2), 225–247.

Littig, B., & Griessler, E. (2005). Social sustainability: a catchword between political pragmatism and social theory. *International journal of sustainable development*, *8*(1-2), 65-79.

Locke, A., & Henley, G. (2016). Urbanisation, land and property rights. London: Overseas Development Institute.

Loorbach, D., & Shiroyama, H. (2016). The challenge of sustainable urban development and transforming cities. In *Governance of urban sustainability transitions*. Tokyo: Springer.

Lowe, T. (2018). *Understanding the Implications of Sand Mining: A Livelihoods Analysis in Coastal Cambodia*. Published master's thesis, School of international development and global studies, University of Ottawa.

Luse, A., Mennecke, B., & Townsend, A. (2012). Selecting a research topic: A framework for doctoral students. *International Journal of Doctoral Studies*, *7*(1), 143-152.

Lysaght, Z. (2011). *Epistemological and paradigmatic ecumenism in "Pasteur's Quadrant:" Tales from doctoral research.* Official Conference Proceedings of the Third Asian Conference on Education in Osaka, Japan.

Madaki, J. U., & Adefila, J. O. (2014). Contributions of rural non-farm economic activities to household income in Lere Area, Kaduna State of Nigeria. *International Journal of Asian Social Science, 4*(5), 654-663.

Mahadevan, P. (2019). *Sand Mafias in India*. Geneva, Switzerland: Global initiative against transnational organised crime.

Mahama, C., & Dixon, M. (2006). Acquisition and affordability of land for housing in urban Ghana: a study in the formal land market dynamics. *RICS Research paper series*, *6*(10), 4-45.

McAdams, D. C. (1980). A power-conflict approach to urban land use: toward a new human ecology. *Urban Anthropology*, 9(3), 295-318.

McQuilken, J., & Hilson, G. (2016). *Artisanal and small-scale gold mining in Ghana. Background Research to inform an Action Dialogue.* London: IIED.

Mearns, R. (1996). Environmental entitlements: pastoral natural resource management in Mongolia. *Cahiers des Sciences Humaines*, *32*, 105-132.

Mehlum, H., Moene, K., & Torvik, R. (2006). Institutions and the resource curse. *The economic journal*, *116*(508), 1-20.

Mensah, A. E., Justice, A., Osei, O. N., & Henrietta, F. (2020). Does Environmental Laws and Policies Work? A Review of Ghana's Case. *Research in Ecology*, *2*(3), 32-41.

Mensah, J. (2019). Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. *Cogent Social Sciences*, *5*(1), 1-21.

Mensah, J. V. (1997). Causes and effects of coastal sand mining in Ghana. *Singapore Journal of Tropical Geography* 18(1), 69-88.

Mensah, J., & Enu-Kwesi, F. (2019). Implications of environmental sanitation management for sustainable livelihoods in the catchment area of Benya Lagoon in Ghana. *Journal of Integrative Environmental Sciences*, *16*(1), 23-43.

Mesele, B.T. (2016). *Rural Non-Farm Livelihood Diversification among Farming Households in Saharti Samre Woreda, Southeastern Tigray*. MSc. Thesis, School of Graduate Studies, Addis Ababa University, Ethiopia.

Mishra, A.K., Mottaleb K.A., & Mohanty, S. (2015). Impact of off-farm income on food expenditures in rural Bangladesh: An unconditional quantile regression approach. *Agricultural Economics* 46: 139–148.

Misoczky, M. C., & Böhm, S. (2015). *The oppressed organize against mega-mining in Famatina, Argentina: Enrique Dussel's ethics of liberation.* New York: Routledge.

Mngeni, A., Musampa, C. M., & Nakin, M. D. V. (2017). The effects of sand mining on rural communities. *WIT Transactions on Ecology and the Environment*, *210*, 443-453.

Moahid, M., & Maharjan, K. L. (2020). Factors affecting farmers' access to formal and informal credit: Evidence from rural Afghanistan. *Sustainability*, *12*(3), 1-16.

Mogaka, M. M. (2013). *The Effects of cash transfer programmes on orphans and vulnerable children's (OVCs) wellbeing and social relations: A Case*

Study of Nyamira Division, Nyamira County. PhD. thesis, University of Nairobi, Kenya.

Mohapatra, G., & Giri, A. K. (2021). How Farm Household Spends Their Non-farm Incomes in Rural India? Evidence from Longitudinal Data. *The European Journal of Development Research*, 1-30.

Mohapatra, S., Shaikh, A., Nayak, P., & Navada, R. (2017). Hazards and health risks encountered by manual sand dredgers from Udupi, India: A cross-sectional study. *Journal of Clinical and Diagnostic Research, 11*(7), 11-17.

Møller-Jensen, L., Allotey, A. N., Kofie, R. Y., & Yankson, P. W. (2020). A comparison of satellite-based estimates of urban agglomeration size for the Accra area. *ISPRS International Journal of Geo-Information*, *9*(2), 79-94.

Morgan, K. M., & Kench, P. S. (2016). Parrotfish erosion underpins reef growth, sand talus development and island building in the Maldives. *Sedimentary Geology*, *341*, 50-57.

Munyanduki, M. (2017). Aligning the Mining Sector with Sustainable Development in Namibia. In A. Nhemachena & T. V. Waikanadwa (Ed.), *Mining Africa. Law, Environment, Society and Politics in Historical and Multidisciplinary Perspectives*. Bamenda, Cameroon: Langaa Research and Publishing Common Initiative Group.

Musah, J. A. (2009). *Assessment of Sociological and Ecological Impacts of Sand and Gravel Mining: A case Study of East Gonja District (Ghana) and Gunnarsholt (Iceland).* Keldnaholt, Iceland: GRÓ LRT.

Myers, G. A. (1999). Political ecology and urbanisation: Zanzibar's construction materials industry. *The Journal of Modern African Studies*, *37*(1), 83-108.

Myers, G. A. (2008). Peri-urban land reform, political-economic reform, and urban political ecology in Zanzibar. *Urban Geography*, *29*(3), 264-288.

Nagler, P. & Naude, W. (2014). *Non-farm entrepreneurship in rural Africa: patterns and determinants* (IZA Discussion Paper no. 8008). Bonn, Germany: Institute for the Study of Labour.

Neuman, W. L. (2011). *Basics of social research methods: Qualitative and quantitative approaches* (3rd ed.). Boston: Pearson Education, Inc.

Nin-Pratt, A., & McBride, L. (2014). Agricultural intensification in Ghana: Evaluating the optimist's case for a Green Revolution. *Food Policy*, *48*, 153-167.

North, D. C. (1990). *Institutions, institutional change and economic performance.* Cambridge: Cambridge University press.

Nyame, F. K., & Blocher, J. (2010). Influence of land tenure practices on artisanal mining activity in Ghana. *Resources Policy*, *35*(1), 47-53.

Obeng-Odoom, F. (2014). Urban land policies in Ghana: a case of the emperor's new clothes? *The Review of Black Political Economy*, *41*(2), 119-143.

Oduro, C. Y., & Adamtey, R. (2017). The vulnerability of peri-urban farm households with the emergence of land markets in Accra. *Journal of Science and Technology (Ghana)*, *37*(1), 85-100.

Oduro, C. Y., Adamtey, R., & Ocloo, K. (2015). Urban growth and livelihood transformations on the fringes of African cities: A case study of changing livelihoods in peri-urban Accra. *Environment and Natural Resources Research*, *5*(2), 81-98.

Ofosu-Mensah, A. E. (2010). Traditional gold mining in Adanse. *Nordic Journal of African Studies*, *19*(2), 24-24.

Okoh, G., & Hilson, G. (2011). Poverty and livelihood diversification: Exploring the linkages between smallholder farming and artisanal mining in rural Ghana. *Journal of International Development*, *23*(8), 1100-1114.

Oliver-Smith, A. (2006). *Reflections on Nature, Environment and Society in Vulnerability Research*. Bonn, Germany: UNU-EHS.

Onn, A. H., & Woodley, A. (2014). A discourse analysis on how the sustainability agenda is defined within the mining industry. *Journal of Cleaner Production*, *84*, 116-127.

Osmani, S. R. (1993). *Growth and Entitlements: The Analytics of the Green Revolution.* Helsinki: UNU World Institute for Development Economics Research.

Owusu, G., & Yankson, P. W. (2017). *Urbanisation in Ghana. The economy of Ghana Sixty years after independence*. Oxford: Oxford University Press.

Oxford Economics (2021). Future of construction: a global forecast for construction to 2030. Retrieved from http://www.oxfordeconomics.com/resource/Future-of-Construction/

Padmalal, D., & Maya, K. (2014). *Sand mining: the world scenario*. Dordrecht: Springer.

Parker, J. (2000). *Making the town: Ga state and society in early colonial Accra.* Portsmouth, NH: Heinemann.

Peprah, K. (2013). Sand Winning and Land Degradation: Perspective of Indigenous Sand Winners of Wa, Ghana. *Journal of Environment and Earth Science 3* (14), 185-194.

Pereira, K. (2020). *Sand stories: surprising truth about the global sand crisis and the quest for sustainable solutions.* Paul street, London: Rhetority Media.

Piyadasa, R. U. (2011). *River sand mining and associated environmental problems in Sri Lanka. Sediment Problems and Sediment Management in Asian River Basins*. Hyderabad, India: IAHS.

Ponce, A. F., & McClintock, C. (2014). The explosive combination of inefficient local bureaucracies and mining production: Evidence from localized societal protests in Peru. *Latin American Politics and Society*, *56*(3), 118-140.

Pribadi, D. O., Vollmer, D., & Pauleit, S. (2018). Impact of peri-urban agriculture on runoff and soil erosion in the rapidly developing metropolitan area of Jakarta, Indonesia. *Regional Environmental Change*, *18*(7), 2129-2143.

Ramachandra, T. V., Vinay, S., & Chandran, M. S. (2018). Quantification of annual sediment deposits for sustainable sand management in Aghanashini River estuary. *Journal of environmental management*, *206*, 1263-1273.

Rathbone, R. (2000). *Nkrumah & the chiefs: the politics of chieftaincy in Ghana.* Ohio, USA: Ohio State University Press.

Rathoure, K. P., & Rathoure, A. K. (2020). Sand Mining and Biodiversity Decline with Reference to Rajasthan Area: Mining and Biodiversity. In *Current State and Future Impacts of Climate Change on Biodiversity* (pp. 210-224). Hershey, Pennsylvania: IGI Global.

Rege, A. (2016). Not biting the dust: using a tripartite model of organised crime to examine India's Sand Mafia. *International Journal of Comparative and Applied Criminal Justice*, *40*(2), 101-121.

Rege, A., & Lavorgna, A. (2017). Organisation, operations, and success of environmental organised crime in Italy and India: A comparative analysis. *European Journal of Criminology*, *14*(2), 160-182.

Robbins, P., & Sharp, J. (2006). Turfgrass subjects: the political economy of urban monoculture. In *In the nature of cities* (pp. 125-143). New York: Routledge.

Roberts, C. W. J. (2013). Extractive Sector Regulations in Africa: Old Practices and New Models for Change. In *Governing Natural Resources for Africa's Development.* Ottawa: North-South Institute Forum.

Roy, A., & Basu, S. (2020). Determinants of livelihood diversification under environmental change in coastal community of Bangladesh. *Asia-Pacific Journal of Rural Development*, *30*(1-2), 7-26.

Sachs, J. D. (2015). Achieving the sustainable development goals. *Journal of International Business Ethics*, *8*(2), 53-62.

Sachs, J. D., & Reid, W. V. (2006). Investments toward sustainable development. *Science*, *312*(5776), 1002-1002.

Sachs, J. D., & Warner, A. M. (1995). *Natural Resource Abundance and Economic Growth* (HIID Development Discussion Paper No. 517a). Harvard: Institute for International Development, Harvard University.

Sachs, J. D., & Warner, A. M. (1997). Sources of slow growth in African economies. *Journal of African economies*, *6*(3), 335-376.

Saghir, J., & Santoro, J. (2018). Urbanisation in Sub-Saharan Africa. In *Meeting Challenges by Bridging Stakeholders*. Washington, DC, USA: Center for Strategic & International Studies.

Saith, A. (2006). From universal values to millennium development goals: Lost in translation. *Development and change*, *37*(6), 1167-1199.

Sarantakos, S. (2005). *Social research* (3rd ed.). New York: Palgrave Macmillan.

Saviour, N. M. (2012). Environmental impact of soil and sand mining. *International Journal of Science, Environment and Technology*, *3*, 221-216.

Schaetzl, R. (1990). Sand and gravel mining for aggregate. Retrieved from https://www.msu.edu/-soils.

Schrecker, T., Birn, A. E., & Aguilera, M. (2018). How extractive industries affect health: Political economy underpinnings and pathways. *Health & place*, *52*, 135-147.

Scoones, I. (1998). Sustainable *and Rural Livelihoods: A Framework for Analysis* (IDS Working Paper No. 72). Brighton, UK: Institute for Development studies.

Scotland, J. (2012). Exploring the philosophical underpinnings of research: Relating ontology and epistemology to the methodology and methods of the scientific, interpretive, and critical research paradigms. *English language teaching*, *5*(9), 9-16.

Scott, J. C. (1976). *The Moral Economy of the Peasant: Rebellion and Subsistence in Southeast Asia*. New Haven, CT: Yale University Press.

Scrivener, K. L., & Kirkpatrick, R. J. (2008). Innovation in use and research on cementitious material. *Cement and concrete research*, *38*(2), 128-136.

Seccatore, J., Veiga, M., Origliasso, C., Marin, T., & De Tomi, G. (2014). An estimation of the artisanal small-scale production of gold in the world. *Science of the Total Environment*, *496*, 662-667.

Sekaran, U. (2003). *Research methods for business: A skill-building approach* (4th ed.). New York, USA: John Wiley & Sons.

Sekaran, U., Lai, L., Ussiri, D. A., Kumar, S., & Clay, S. (2021). Role of integrated crop-livestock systems in improving agriculture production and addressing food security–A review. *Journal of Agriculture and Food Research*, *5*, 1-10.

Sen, A. (1981). *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford: Oxford University Press.

Sen, A. (1986). *Food, economics and entitlements* (WILDER Working Paper No. 1). Helsinki: World Institute for Development Economics Research (WILDER), United Nations University.

Sen, A. (1987). *Hunger and entitlements*. Helsinki: World Institute for Development Economics Research (WILDER), United Nations University.

Shahzalal, M., & Hassan, A. (2019). Communicating sustainability: Using community media to influence rural people's intention to adopt sustainable behaviour. *Sustainability*, *11*(3), 1-28.

Shanunu, Z., Achanso, A. S., & Mumuni, E. (2022). Connecting Traditional Belief Systems, Natural Resource Conservation and Sustainability in West Gonja Traditional Area of Ghana. *Journal of Energy and Natural Resource Management*, *8*(1), 17-25.

Sharma, K. C. (2009). *The Role of Traditional Leaders (Chiefs) in the Administration of Justice in Africa*: *Customary Courts in Botswana*. Ithaca, New York: Cornell University Press.

Silva, J. P. M. (2019). The Quest for land at Piranema Sand Cluster. Herald of the International Academy of Science. Russian Section, (1). 27-32.

Sørensen, F., & Grindsted, T. S. (2021). Sustainability approaches and nature tourism development. *Annals of Tourism Research*, *91*(C), 1-14.

Suutarinen, T. K. (2015). Local natural resource curse and sustainable socio-economic development in a Russian mining community of Kovdor. *Fennia-international journal of geography*, *193*(1), 99-116.

Swift, J. (1989). Why are rural people vulnerable to famine? *IDS bulletin*, *20*(2), 8-15.

Tadele, E. (2021). Land and heterogeneous constraints nexus income diversification strategies in Ethiopia: systematic review. *Agriculture & Food Security*, *10*(1), 1-14.

Tastet, E. (2019). Stealing beaches: A law and economics policy analysis of sand mining. *LSU J. Energy L. & Resources*, *7*(2), 525-551.

Tenkorang, E. Y. (2016). *Traditional institutions and environmental governance in gold mining areas: the case of Asutifi District Ghana*. Unpublished PhD. thesis, Institute for development studies, University of Cape Coast.

Thomas, K. D. (2015). *Handbook of research on sustainable development and economics*. Pennsylvania, IGI Global.

Thornhill, A., Saunders, M., & Lewis, P. (2009). *Research methods for business students*. Prentice Hall: London.

Tiwari, M. (2007). Chronic poverty and entitlement theory. *Third World Quarterly*, *28*(1), 171-191.

Torres, A., Brandt, J., Lear, K., & Liu, J. (2017). A looming tragedy of the sand commons. *Science*, *357*(6355), 970-971.

Torres, A., Simoni, M.U., Keiding, J.K., Müller, D.B., zu Ermgassen, S.O., Liu, J. (2021). Sustainability of the global sand system in the Anthropocene. *One Earth*, 4 (5), 639–650.

Torvik, R. (2001). Learning by doing and the Dutch disease. *European economic review*, *45*(2), 285-306.

Tuokuu, F. X. D., Kpinpuo, S. D., & Hinson, R. E. (2019). Sustainable development in Ghana's gold mines: Clarifying the stakeholder's perspective. *Journal of Sustainable Mining*, *18*(2), 77-84.

Twum-Baah, K. A. (2000). Population growth of Mega-Accra—Emerging issues. In R. Mills-Tettey, & K. Adi-Dako (Ed.), *Visions of the city: Accra in the 21st century*. Accra: Woeli Publishing Services.

Ubink, J. M., & Quan, J. F. (2008). How to combine tradition and modernity? Regulating customary land management in Ghana. *Land use policy*, *25*(2), 198-213.

UNEP. (2014). *Sand, rarer than one thinks.* Nairobi: United Nations Environment Programme.

UNEP (2019). *Sand and sustainability: Finding new solutions for environmental governance of global sand resources*. GRID-Geneva: United Nations Environment programme.

United Nations (2019). Sustainable development goals. Retrieved from https://www.sdg_goals.png (1920×1080) (embracerelief.org).

Uphoff, N., & Buck, L. (2006). *Strengthening rural local institutional capacities for sustainable livelihoods and equitable development.* Washington, D.C. World Bank.

Van Der Ploeg, F. (2011). Natural resources: curse or blessing? *Journal of Economic literature*, *49*(2), 366-420.

Van Leeuwen, M., & Van Der Haar, G. (2016). Theorizing the land–violent conflict nexus. *World Development*, *78*, 94-104.

Verstegen, S. (2001). *Poverty and conflict: An entitlement perspective* (CPN Entitlement Briefing Paper). Retrieved from https://www.clingendael.org/sites/default/files/201602/20010900cru_other_verstegen.pdf.

Vincent, K., Wanjiru, L., Aubry, A., Mershon, A., Nyandiga, C., Cull, T., Banda, K. (2011). Gender, climate change and community-based adaptation. Quat. Int. *184*(1), 202–204.

Vintró, C., Sanmiquel, L., & Freijo, M. (2014). Environmental sustainability in the mining sector: evidence from Catalan companies. *Journal of cleaner production*, *84*, 155-163.

Vizard, P. (2001). *Conceptualising poverty in a human rights framework: foundational issues in ethics, economics and international law*. PhD. thesis, London School of Economics and Political Science, University of London.

Voigt, S., & Kiwit, D. (1998). The role and evolution of beliefs, habits, moral norms, and institutions. In *Merits and limits of markets*. Berlin, Heidelberg: Springer.

Von Braun, J., & Lohlein, D. (2003). Policy options to overcome subsistenceagriculture in the CEECs. In S. Abele, & K. Frohberg (Ed.), *Subsistence agriculture in Central and Eastern Europe: How to break the vicious circle?* (pp. 46-69). Halle, Germany: Institute of Agricultural Development in Central and Eastern Europe.

Walliman, N. (2011). *Research methods the basics*. New York: Routledge.

Wanamaker, C. (2018). *The environmental, economic, and social components of sustainability*. Retrieved from https://soapboxie.com/social-issues/The Environmental-Economic-and-Social-Components-of-Sustainability-Soapboxie.

Wexler, L. (2009). Regulating resource curses: institutional design and evolution of the blood diamond regime. *Cardozo Law Review*, *31*(5), 1717-1780.

Williams, R. (1973). *The Country and the City*. London: Hogarth Press.

Wireko-Gyebi, R. S., Asibey, M. O., Amponsah, O., King, R. S., Braimah, I., Darko, G., & Lykke, A. M. (2020). Perception of small-scale miners on interventions to eradicate illegal small-scale mining in Ghana. *SAGE Open*, *10*(4), 1-11.

World Bank (2002). *World development report, 2002: Building institutional markets.* Washington, DC: World Bank

World Economic Forum. (2016). Mapping mining to the sustainable empowered lives. *Resilient nations. Development goals: An Atlas*. Retrieved from file:///C:/Users/SOUTH%20SUB-METROCCMA/D ownloads/Mapping_Mining_SDGs_An_Atlas_Executive_Summary_FINAL.pdf.

Yaro, J. A. (2004). Theorizing food insecurity: building a livelihood vulnerability framework for researching food insecurity. *Norwegian Journal of Geography*, *58*(1), 23-37.

Zhai, T., & Chang, Y. C. (2018). Standing of Environmental Public-Interest Litigants in China: Evolution, Obstacles and Solutions. *Journal of Environmental Law*, *30*(3), 369-397.

Zhai, W., Ding, J., An, X., & Wang, Z. (2020). An optimization model of sand and gravel mining quantity considering healthy ecosystem in Yangtze River, China. *Journal of Cleaner Production*, *242*, 118385.

Ziblim, I. A., Timothy, K. A., & Deo-Anyi, E. J. (2013). Exploitation and use of medicinal plants, Northern Region, Ghana. *Journal of Medicinal Plants Research*, *7*(27), 1984-1993.

Zimmer, A. (2010). Urban political ecology: Theoretical concepts, challenges, and suggested future directions. *Erdkunde*, *64*(4), 343-354.

Zohrabi, M. (2013). Mixed Method Research: Instruments, Validity, Reliability and Reporting Findings. *Theory & practice in language studies*, *3*(2), 254-262.

APPENDIX A

INTERVIEW SCHEDULE FOR HOUSEHOLD HEADS

Dear valued participant,
The study is on "sand mining and local household livelihoods in Ga South and the Gomoa East local government areas." The research serves as a learning exercise that partially satisfies the criteria of the University of Cape Coast's Doctor of Philosophy programme. Please be aware that any information you supply will be treated privately and used solely for the intended purpose. Your voluntary participation is appreciated. Participating in this study has no associated risks. As a voluntary participant, you are not obligated to respond to any questions you do not wish to, and you are free to leave at any point in the process. Your response to the questions on this interview schedule will serve as your agreement to take part in the study.

Instruction

Please choose the most relevant answer or answers for each question in the various sections, and then fill in the blanks as needed.

Identification

District……………………………………………………………………………….

Community…………………………………………………………………………….

House Number…………………………………………………………………………

Section 1: Background data

1. Sex [1] Female [2] Male
2. Age…………………………………………………………………………...
3. Highest level of education attained?
   [1] None [2] Some primary education [3] Junior High School
   [4] Secondary School [5] Tertiary level

4. Primary occupation?

[1] Farming [2] Trading [3] Sand mining [4] Transport

[5] Craft [6] Formal sector [7] Remittances [8] Forest gathering

[9] Other (specify)…………………………………………………………

5. How long have you practiced this activity?.................................………

6. What is your household size?..

7. Who own the land in this community? [1] family/clan heads [2] chiefs [3] private persons [4] real estate companies [5] others (specify)………………..

Section 2: Organisation of sand mining

8. How long has sand been mined from this community?......................

9. How widespread is sand mining activities in this community?

[1] Widespread [2] not widespread

10. Where is the sand mined from in this community?

[1] farmland [2] river/stream [3] other (specify)…………………..

11. Have you given any portion of your land for sand mining?

[1] No [2] Yes

If yes, why did you give it out?..

……………………………………………………………………………..

12. How is the sand mined? [1] Manually [2] Machinery [3] Both

13. Who are the sand miners? [1] Ghanaians in this community [2] Ghanaians from outside this community [3] Foreigner [4] others (specify)………………………………………………………………

14. From whom do the sand miners acquire land?

[1] Individuals [2] Family heads [3] Chiefs [4] Clan heads

[5] Lands Commission [6] other (specify)…………………………..

15. What is nature of the agreement between the landowners and sand miners?

[1] written [2] verbal [3] Not sure

16. Do the parties adhere to the agreement? [1] No [2] Yes

Explain your answer…………………………………………………….

17. Do the landowners leave in this community?

[1] No [2] Yes [3] Not sure

18. Are the community members informed about the decision to mine sand in this community? [1] No [2] Yes [3] Not sure

Explain your answer………………………………………………….........

19. Rank the interest of the actors in sand mining in respect the following: monetary, employment, agriculture/food security, social cohesion, environment and aesthetics from 1 to 4. Where 1=low, 2=medium, 3=high and 4=very high.

A. MONETARY INTEREST

Actors	**Interest**				**Reasons/explanations**
	1	**2**	**3**	**4**	
Landowners					
Sand contractors					
MMDA					
Community members					
EPA					
Minerals Commission					
Truck drivers					
Community development committee					

B. ENVIRONMENTAL INTEREST

Actors	**Interest**				**Reasons/explanations**
	1	**2**	**3**	**4**	
Landowners					
Sand contractors					
MMDA					
Community members					
EPA					
Minerals Commission					
Truck drivers					
Community development committee					

C. SOCIAL COHESION INTEREST

Actors	Interest				Reasons/explanations
	1	2	3	4	
Landowners					
Sand contractors					
MMDA					
Community members					
EPA					
Minerals Commission					
Truck drivers					
Community development committee					

D. AGRICULTURE/FOOD SECURITY INTEREST

Actors	Interest				Reasons/explanations
	1	2	3	4	
Landowners					
Sand contractors					
MMDA					
Community members					
EPA					
Minerals Commission					
Truck drivers					
Community development committee					

E. EMPLOYMENT INTEREST

Actors	Interest				Reasons/explanations
	1	2	3	4	
Landowners					
Sand contractors					
MMDA					
Community members					
EPA					
Minerals Commission					
Truck drivers					
Community development committee					

F. AESTHETICS INTEREST

Actors	Interest				Reasons/explanations
	1	2	3	4	
Landowners					
Sand contractors					
MMDA					
Community members					
EPA					
Minerals Commission					
Truck drivers					
Community development committee					

G. OTHER INTEREST

Actors	Interest				Reasons/explanations
	1	2	3	4	
Landowners					
Sand contractors					
MMDA					
Community members					
EPA					
Minerals Commission					
Truck drivers					
Community development committee					

20. In your opinion, are the sand mining activities legal or illegal?

[1] Legal [2] Illegal [3] Both

Explain your answer…………………………………………………….........

21. Are the illegal sand miners adequately sanctioned?

[1] Yes [2] No [3] Not sure

If no, why are the not sanctioned?..

[1] bribery of the regulators [2] they are not noticed [3] miners backed by big men supporting [4] other (specify)………………………………

22. Do the miners reclaim the land after mining?[1] No [2] Yes

[3] Not sure

23. Who is the most powerful actor in sand mining based on incentive power, coercive power and trust power? [1] sand contractor [2] truck drivers [3] MMDAs [4] landowners [5] community members [6] EPA [7] Minerals Commission [8] community development committee

[9] other (specify)……………………………………………………….

Explain your answer…………………………………………………….

24. Indicate by ticking the types of power each of the actors in sand mining use in your community.

Actors	**Types of power**		
	Trust	Coercive	Incentive
Landowners			
Sand contractors			
MMDA			
Community members			
EPA			
Minerals Commission			
Truck drivers			
Community development committee			
Other			

Section 3: Effects of sand mining

Economic effect

25. What is the main economic activity in this area?

[1] farming [2] sand mining [3] hunting [4] fishing
[5] trading [6] artisanal [7] other (specify)………………

26. What is the overall effects of sand mining on local household livelihoods in this community?

[1] Positive [2] Negative [3] Not sure

Explain your choice of answer…………………………………………..

27. Tick the positive economic impacts of sand mining on household livelihoods in this community.

[1] direct employment [2] high income [3] increase construction activities [4] Infrastructure development [5] increase in indirect employment [6] market/trading [7] other (specify)………………

28. Tick the negative economic impacts sand mining on household livelihood in this community?

[1] destruction of farmland [2] low crop yields [3] reduced farm size [4] destruction of forest-base livelihoods [5] high cost of living [6] low income [7] low purchasing power [8] other (specify)……………………………………..........

29. How do you evaluate the level of access to land in this community?

[1] Easy [2] moderate [3] difficult

Explain your answer…………………………………………………….

30. Have you lost any portion of your farmland to sand miner in the past five years? [1] No [2] Yes

31. What was the size of your household farmland in 2015 and 2020? 2015……………… 2020………………………………………………

32. What is the level of your crop yields over the last five years?

[1] Reduced [2] similar [3] increased

If reduced, what caused the reduction?……………………….............

33. Has any of your crops/farmland being destroyed by sand miners?

[1] No [2] Yes

34. What types of property was lost? [1] Cash crops [2] staple crops [3] farmland [4] farmhouse [5] other (specify)…………………………

35. What did you receive in return as compensation?

[1] cash [2] another land [3] nothing [4] other (specify)………..

36. What did you use the compensation for?...

37. What is the state of your annual income from your primary occupation over the last five years? [1] Reduced [2] similar [3] increased

If reduced, what caused it?..

38. How much income did you earn annually in 2015 and 2020?

2015 = GHS……………p……………………………………………

2020 = GHS……………p……………………………………………

Explain what caused the reduction in your annual income?..................................

Environmental Effects

39. Tick the negative environmental impacts of sand mining in this community?

[1] Flooding [2] Erosion [3] reduced vegetation [4] change of river course [5] damage to aesthetic beauty [6] deforestation [7] increased depth of water table [8] ponds on land [9] destruction of water bodies [10] destruction of roads [11] pollution (dust and noise) [12] other (specify)……………………………………………………………………

Explain how each of your chosen answers affects your household livelihoods.

a..

b………………………………………………………………………………

c………………………………………………………..........................

40. What are the positive environmental impacts of sand mining on your household livelihoods? ………………………………………………………

……………………………………………………………………………..

……………………………………………………………………………..

Social effects

41. What are the negative social impacts of sand mining in this community?

[1] smoking [2] land disputes [3] prostitution

[4] crime [5] drug abuse [6] destruction of medicinal plants

[7] child labour [8] school dropout [9] ailments

[10] teenage pregnancy [11] reduced meals per day

[12] relocation of families [13] other (specify)………………………

42. What are the positive social impacts of sand mining to household livelihoods in this community?..

43. What common disease household members frequently report at the health centre/clinic? [1] malaria [2] diarrhoea [3] respiratory infection [4] skin disease [5] worn infestation [6] depression

[7] other (specify)…………………………………………………......

44. What is the likely cause of sickness?...

45. When was the last time a household fell sick?

[1] within last two weeks [2] a month ago [3] quarter ago [4] half year [4] about a year

46. Did household member miss work/school due to the last ailment?

[1] No [2] Yes

If yes, how many days did the household member miss work?

[1] Below 7 days [2] Between 7 to 14 days [3] above 14 days

47. Provide the average number of meals per day for your household for 2015 and 2020? [2015] = …………. [2020] =………………………

What account for the change?...

48. Do you have plans to relocate from this community in the near future?

[1] No [2] Yes

Give reasons for your answer……………………………………………

……………………………………………………………………………..

49. Do you have any platform to channel complaints regarding the negative effects of sand mining on your livelihoods? [1] No [2] Yes

If **yes**, what channel do you use? [1] MMDAs [2] local police

[3] Assembly member [4] chiefs/landowners [5] EPA [6] Minerals Commission [7] other (specify)…………………………………………

50. Is the complaint channel you mention effective? [1] No [2] Yes

Explain your answer ……………………………………………………….

51. What support do you require from the MMDAs to enhance your livelihoods?……………………………………………………..

52. What support do you require from the EPA and Minerals Commission?

……………………………………………………………………………..

53. Do the sand miners contribute towards development of this community?

[1] No [2] Yes [3] Not sure

If yes, mention some of the major contributions…………………………

……………………………………………………………………………..

54. What support do you expect from the sand miner? ……………………..

……………………………………………………………………………..

55. Should sand mining be banned in this community? [1] No [2] Yes

Explain…………………………………………………………………..

Section 4: Adoption of alternative livelihood strategies

56. What livelihood assets do you have?

[1] natural asset [2] physical asset [3] financial asset [4] human asset [5] social asset

57. Has the household adopted any alternative livelihood strategies?

[1] No [2] Yes

If yes, what strategy?

[1] transport [2] petty trading [3] construction labour [4] block making [5] firewood/charcoal [6] lotto writing [7] mobile money [8] alcohol brewing [9] glasscutter rearing [11] mushroom production [12] other (specify)…………………………………………………………………

58. Why did you adopt the alternative livelihood strategy?

[1] investment opportunity [2] landlessness [3] low crop yields

[4] other (specify)…………………………………………………........

59. If household had not adopted alternative livelihood, provide the reasons.

[1] old age [2] lack of start-up capital [3] lack of skills [4] limited time [5] no opportunities [7] other (specify)………………………………….

60. What short time coping strategy do you use in the absence of alternative strategies? [1] reduced consumption [3] support from family/friends [3] borrow farm produce [4] buying on credit [5] other (specify)…………………………………………………………………

61. What was your source of startup capital for the alterative livelihood strategy? [1] personal savings [2] loan [3] NGO [4] family/friends

[5] other (specify)………………………………………………………….

62. Do you have access to credit? [1] No [2] Yes

If **yes,** from which source?..

If **no,** why?...

63. Tick the outcomes of your alternative livelihood strategy.

Outcome	Parameter		
	Reduced	Similar	Increased
Income			
Food security			
Employment			
Resilience			
Effective use of resources			

64. What is your annually from the alternative livelihood activity? GHS………………..p………………………………………..

Indicate what you use the income for?..

…………………………………………………………………………..

65. What is state of your household living condition after adopting the alternative livelihood strategy? [1] improved [2] worsened [3] not sure

Explain your answer…………………………………………………........

66. How do you compare your primary and alternative livelihood strategies in terms of sustainable employment? [1] old strategy more sustainable [2] new strategy more sustainable [3] Not sure

67. What problems do you encounter in your alternative livelihood strategy?...

68. What support do you need to enhance or enable you to adopt alternative livelihood strategy?...

Section 6: Institutional framework governing sand mining

69. Indicate the rules that govern sand mining in this community. For each one, mention who set and enforce the rule? Provide as many as applicable.

Formal institutions			
No	Institutions (Rules)	Who set it	Who enforce
Informal institutions			

70. Are the rules related to sand mining?

Formal: [1] No [2] Yes[3] Not sure

Informal: [1] No [2] Yes[3] Not sure

71. Are the rules effective in regulating sand mining?

[1] No [2] Yes [3] Not sure

Explain your choice of answer…………………………………………

…………………………………………………………………………..

72. Which of the following organisations regulate sand mining in this community? Tick as many as applicable

[1] EPA [2] Minerals Commission [3] Chiefs/landowners

[4] NGOs [5] District Assembly [6] Youth group

[7] other (specify)……………………………………………………........

73. Is enforcement done to ensure compliance? [1] No [2] Yes

Explain your answer…………………………………………………........

74. Is there a non-compliance penalty for illegal sand miners who break the rules? [1] No [2] Yes [3] Not sure

Explain your answer…………………………………………………….

75. Do the EPA embark on environmental education in this community?
[1] No [2] Yes [3] Not sure

76. Are the community leaders effective in regulating sand mining?

[1] No [2] Yes

Explain your answer…………………………………………………….

APPENDIX B

INTERVIEW GUIDE FOR LANDOWNERS

Identification

Name of district:…………………………………………………………..

Name of community:…………………………………………………….

1. Characteristics of respondent:

- Sex
- Age
- Highest level of education
- Occupation

Organisation of sand mining

2. How many years have sand been mined from this community?

3. How much land do you own? (Number of acres plot)

4. How much do you charge for the parcels that are lend to farmers? (Price per acre)

5. Did you give out land to sand miners? If yes:

- How did the sand miners acquire the land from you?
- How many acres?
- What was it used before sand mining?
- What factors did you consider before giving out the land for sand mining?

6. What is the level of involvement of the community members in the decision to mine your land? Were the farmers involved in your decision making?

7. How much do you charge the sand miners?

- Do you pay taxes (royalties, rates) to any person or institutions from the money you get from sand mining?
- Did you give any kind of compensation to the farmers?

8. What is the nature of the agreement between you and the sand miners?

9. What happened to the land after sand mining? Is it sold for building, farming or any other land use

- How much do you sell the land after sand mining?

- Who did you sell it to?

10. Did you encounter any costs or problems because of sand winning?
11. Rank the interest of the sand mining actors from 1 to 4 with 1=low, 2=medium, 3=high and 4=very high interest on the following parameters: monetary, environment, aesthetics, social cohesion, employment and agriculture and food security.
12. Who are the most powerful stakeholders in sand mining? Rank them with coercive, incentive and trust power

Institutional framework

13. What rules regulate sand mining activities in this community?
14. Do land owners comply to the rules regulating sand mining?
15. Which organisation monitor sand miners' operations?
16. How do you rate the performance of state regulatory organisations in sand mining?
17. How do the Traditional Council rules affect sand mining operations?
18. How can landowners collaborate with the other stakeholders to ensure effective regulation of sand mining? Explain

Effects of sand mining

19. What benefits do you get from sand mining?
20. Which livelihood activities are mostly affected by sand mining?
21. Did the allocation of your land for sand mining affect any household livelihood?
22. How were those affected compensated?
23. How does sand winning affect the livelihoods of the local residents both positively and negatively.
24. How can sand be mined sustainably?
25. If you have another opportunity, what will you use your land for?

INTERVIEW GUIDE FOR TRUCK DRIVERS

Identification

Name of district:…………………………………………………………..

Name of community:……………………………………………………

1. Characteristics of respondent:
   - Sex
   - Age
   - Highest level of education
   - How long have you been a truck driver?
   - Did you have another job before? If yes, which job?
   - Why did you decide to become a truck driver?

Organisation of sand mining

2. From which areas do you get the sand?
3. How do you identify mining sites?
4. How do you get customers?
5. How many of your customers are individuals, block manufacturing companies, other companies and public agencies.
6. How many trucks of sand do you sell daily?
7. When do you start and close work? Start ……… Close………
8. How many days per week do you work?
9. How many sand contractors do you work with?
10. How much do you buy the sand on site?
11. How much do you sell the sand to customers? (Price per truckload)
12. Have the prices changed over time?
13. Do you own or hire the truck? How much is the daily rent?
14. How much do you spend per trip delivered? (Fuel, toll, sand conveyance receipt)
15. Do you pay taxes (royalties, rates) to any person or institutions? Please explain.
16. What other moneys do you pay and to whom?
17. How much do you earn as salary?

18. What benefits do you get from sand mining aside your salary?
19. What problems do you face in your work?
20. How many truck drivers work from this station? Do they have a similar workload?
21. Who protects the work of the truck driver?
22. Rank the interest of the sand mining actors from 1 to 4 with 1=low, 2=medium, 3=high and 4=very high interest on the following parameters: monetary, environment, aesthetics, social cohesion, employment and agriculture and food security.
23. Who are the most powerful stakeholders in sand mining? Rank them with coercive, incentive and trust power

Institutional framework

24. What rules regulate sand mining activities in this community?
25. Do you belong to an association?
26. How long has the association existed?
27. How does one become a member of the association?
28. Do the truck drivers have a constitution or rules governing your operations?
29. How does it affect sand mining?
30. Do your rules help the community at large? Please explain
31. What are the sanctions for noncompliance with the truck driver's rules?
32. How do you rate the performance of state agencies in sand mining?
33. How do the Traditional Council rules affect your operations?
34. How can the truck drivers collaborate with the other stakeholders to ensure effective regulation of sand mining? Explain

Effect of sand mining

35. Which issues do you face and how could they be solved?
36. How does sand winning affect the livelihoods of the local residents both positively and negatively?
37. How can sand be mined sustainably?

INTERVIEW GUIDE FOR SAND CONTRACTOR

Identification

Name of region:……………………………………………………………

Name of district:…………………………………………………………...

Name of community:………………………………………………………

1. Characteristics of respondent:

- Sex
- Age
- Highest level of education
- How long have you been a sand mining contractor?
- Did you have another job before? If yes, which job?
- Why did you decide to become a sand mining contractor?
- Is your business registered with the Registrar General's Department?

Organisation of sand mining

2. How do you acquire land for sand mining and from who?
3. How many trucks of sand do you mine in a day?
4. How many trucks do you get per acre (range, average)? Which depths?
5. What is the size of your current concession?
6. At what price do you sell the sand to the truck drivers? How often does the price change?
7. How do you get truck drivers to buy sand from your site?
8. What are your costs?

- To the landowner
- Farmers
- EPA / Minerals Commission
- Local government authority
- Police
- Community (chief royalties)
- Taxes
- Reclamation bond
- Others

9. Please describe the licensing process from start to end?
10. Do you have a permit for this site?
    - Who issued you the permit, if any?
    - How much does it cost to get a permit?
    - How long does it take to get a permit?
    - How long are you expected to operate with the permit?
    - Where does your permit allow you to work?
11. Do you reclaim the land after mining?
12. How much do you earn by the end of the day (profit)?
13. Rank the interest of the sand mining actors from 1 to 4 with 1=low, 2=medium, 3=high and 4=very high interest on the following parameters: monetary, environment, aesthetics, social cohesion, employment and agriculture and food security.
14. Who are the most powerful stakeholders in sand mining? Rank them with coercive, incentive and trust power

Illegal sand mining

15. Why are some miners engaged in illegal extraction?
16. What are the means of illegal sand mining? How is it done?
17. What are the issues with it?
18. How can it be solved?

Institutional Framework

19. What rules regulate sand mining activities in this community?
20. Do you belong to an association?
    - How long has the association existed?
    - How does one become a member of the association?
    - Do the contractors have a constitution or rules governing your operations?
    - How does it affect sand mining?
    - Do your rules help the community at large? Please explain
    - How are the rules enforced?
    - Are the rules complied with? Explain your answer
    - What are the sanctions for noncompliance?

21. How do you rate the performance of state agencies in sand mining?

- Which organisation monitors your operations?

22. How do the Traditional Council rules affect your operations?

23. What is the level of involvement of the community members in decisions to grant mining permits to contractors?

24. How can the sand contractors collaborate with the other stakeholders to ensure effective regulation of sand mining? Please explain

25. Which of the actors are the most powerful in sand mining? Explain

26. Who supports your activities?

Effect of sand mining

27. Which issues do you face and how could they be solved?

28. How does sand winning affect the livelihoods of the local residents both positively and negatively?

29. How can sand be mined sustainably?

INTERVIEW GUIDE FOR THE EPA

Place of interview:………………………………………………………………

Interviewees Position/Title:…………………………………………………..

Institutional framework

1. Summarize briefly the responsibility assigned to your organisation for sand mining.
2. What rules/ laws of your organisation prescribe how sand mining should be done and how do you apply the rules?
3. How long has your organisation been assigned this role?
4. Do you have enough resources to effectively perform this role?
5. How does the license procedures work?
6. What is the level of enforcement of the rules?
7. What is the level of compliance to the rule?
8. How much of your resources do you use for sand mining, compared to gold mining and others?
9. How often does the EPA monitor the activities of sand miners? Do you undertake monitoring exercises at night?
10. How are the host communities involved in the allocation of environmental permits? Do you educate the actors on how to preserve the environment?
11. What challenges do the EPA have in regulating sand mining?
12. What are the sanctions for noncompliance to the sand mining rules?
13. Which other organisation are involved in regulating sand mining?
14. What is the nature of collaboration between the EPA, these organisations and traditional leaders?
15. How can the collaboration be enhanced?

Organisation of sand mining

16. What processes are involved before someone can be given a concession?
    - How much do sand contractors pay for a permit?
    - How long does it take to get a permit?
    - Do you think the effort to get the license is reasonable?
17. What considerations do you make before granting sand mining

permit? (Impact on water bodies, aquatic organisms, vegetation, terrestrial organisms, human activities)

18. How many permits have you issued for the study areas?
   - This year
   - Previous years (how has it developed?)
19. What is illegal sand mining?
20. Are sand miners operating legally or illegally?
21. Is sand mining one of the sources of revenue for the EPA?
22. Rank the interest of the sand mining actors from 1 to 4 with 1=low, 2=medium, 3=high and 4=very high interest on the following parameters: monetary, environment, aesthetics, social cohesion, employment and agriculture and food security.
23. Who are the most powerful stakeholders in sand mining? Rank them with coercive, incentive and trust power
24. How does the power of the other stakeholders affect your work?

Effects of sand mining

25. What are negative effects of sand mining to the mining communities?
26. What are positive effects of sand mining to the mining communities?
27. What are the major environmental problems caused by sand mining?
28. How does sand mining positively affect the environment?
29. What does reclaiming mean to the EPA? Do sand miners comply to that? What percentage of mined land is reclaimed?
30. Do sand miners pay any reclamation bond before starting to operate?
   - How much do they pay and is it adequate?
31. Do you think the number of your concessions given out leads to farmers being pushed further out?
32. What strategies have you adopted to address illegal sand miners on agriculture land?
33. How can sand mining be done sustainably with other livelihoods?

INTERVIEW GUIDE FOR THE MINERALS COMMISSION

Place of interview:……………………………………………………………

Interviewees Position/Title:……………………………………………………..

Institutional framework

1. Summarize briefly the responsibility assigned to your organisation for sand mining activities.
2. What rules/ laws of your organisation prescribe how sand mining should be done and how do you apply the rules?
3. How long has your organization implemented this role?
4. Do you have enough resources to effectively perform this role?
5. How does the license procedures work?
6. What is the level of enforcement of the rules?
7. What is the level of compliance to the rule?
8. How much of your resources do you use for sand mining, compared to gold mining and others?
9. How often does the Minerals Commission monitor the activities of sand miners? Do you undertake monitoring exercises at night?
10. How are the host communities involved in the allocation of mining concessions?
11. What challenges do the Minerals Commission have in regulating sand mining?
12. What are the sanctions for noncompliance to the sand mining rules?
13. Which other organisation are involved in regulating sand mining?
14. What is the nature of collaboration between the Minerals Commission, these organisations and traditional leaders?
15. How can the collaboration be enhanced?

Organisation of sand mining

16. What is the normal size of concession you give to contractors? Size of a block?
17. What processes are involved before someone can be given a concession?

- How much do sand contractors pay for a concession?

- How long does it take to get a concession?
- Do you think the effort to get the license is reasonable?

18. What considerations do you make before granting sand mining concessions? (Impact on water bodies, aquatic organisms, vegetation, terrestrial organisms, human activities)
19. How many permits have you issued for the study areas?
    - This year and the previous years
20. What is illegal sand mining?
21. Do sand miners operate legally or illegally?
22. Is sand mining one of the sources of revenue for the Minerals Commission? Kindly give reasons for your response
23. Rank the interest of the sand mining actors from 1 to 4 with 1=low, 2=medium, 3=high and 4=very high interest on the following parameters: monetary, environment, aesthetics, social cohesion, employment and agriculture and food security.
24. Who are the most powerful stakeholders in sand mining? Rank them with coercive, incentive and trust power
25. How does the power of the other stakeholders affect your work?

Effects of sand mining

26. What are negative effects of sand mining to the mining communities?
27. What are positive effects of sand mining to the mining communities?
28. What are the major environmental problems caused by sand mining?
29. How does sand mining positively affect the environment?
30. What does reclaiming mean to the Minerals Commission? Do sand miners comply to that? What percentage of mined land is reclaimed?
31. Do sand miners provide any reclamation bond before starting to operate?
    - If yes, how much do they pay? Is the amount adequate for the cost of rehabilitation?
32. Do you think the number of your concessions given out leads to farmers being pushed further out?

33. What strategies have you put in place to address illegal sand miners on agriculture land?
34. How can sand mining be done sustainably with other livelihoods?

INTERVIEW GUIDE FOR THE MMDAs

District……………………………………………………………………………

Date of interview:…………………………………………………………………

Place of interview:…………………………………………………………………

Interviewees Position/Tittle:…………………………………………………………

Organisation of sand mining

1. What are some of the major uses of land in this community?
2. What is the dominant occupation for the community?
3. What is the level of sand mining in this community? (Widespread, moderate, low)
4. How many active sand mining areas are in the community?
5. How many years have sand been mined from the communities?
6. What processes are involved before someone can mine sand?
7. Are you part of the permit allocation process?
8. What considerations do you make before allowing sand miners to operate in the district? (Impact on water bodies, aquatic organisms, vegetation, terrestrial organisms, human activities)
9. Which other agency are responsible for granting permit or license to the sand miners?
10. I what ways do you involve the locals in the allocation of mining concession?
11. How many trips of sand leave the communities daily?
12. Do the sand miners operate legally or not? Explain:
13. Is sand mining one of the major sources of revenue for the Assembly? Kindly explain
14. How much has the Assembly estimated to generate from the sand mining this year?

Institutional framework

15. What rules etermine how sand mining should be done in this district? Indicate both Formal and Informal rules.
16. Does the Assembly have bye-laws guiding sand mining?

Explain section of the bye-law……………………………………

17. Are the rules enforced?
18. Do the sand miners comply with the rules? What in your opinion could account for that?
19. What are the sanctions for noncompliance to the Assembly's rules?
20. How does your office monitor the activities of the sand miners?
21. How often do the other regulatory organisations monitor sand mining operations?
22. What challenges does the Assembly have in monitoring sand mining?
23. Does the Assembly collaborate with other regulatory organisations?
24. What is the nature of collaboration?
25. How can the collaboration be enhanced? Explain
26. Rank the interest of the sand mining actors from 1 to 4 with 1=low, 2=medium, 3=high and 4=very high interest on the following parameters: monetary, environment, aesthetics, social cohesion, employment and agriculture and food security.
27. Who are the most powerful stakeholders in sand mining? Rank them with coercive, incentive and trust power

Effects of sand mining

28. What is the general contribution of sand mining to development of the district?
29. How would you rate the contribution of sand mining to development of the sand mining communities?
30. Which livelihood activities are mostly affected by sand mining?
31. How has sand mining affected local household livelihoods in the host communities?
32. How were those affected negatively compensated?
33. Is the District Assembly involved in the determination of compensation?
34. Mention the positive and negative effects of sand mining on the locals' livelihoods.

35. How does the Assembly address the negative effects of sand mining?
36. Do you undertake measure to rehabilitate the sand mining sites?
   - Yes [ ] (How do you do that?)
   - No [ ] (Why don't you?)
37. Are the sand miners required to pay reclamation bond before starting to operate?
38. How much do they pay? Is it adequate for the cost of rehabilitation?
39. What is the total size of land the Assembly had supervised for its rehabilitation?
40. Would you recommend that sand mining is banned in the district?

Alternative livelihood strategies

41. What strategies have been put in place to ensure that households have sustainable livelihoods?
42. What strategies do families who lose their livelihoods to sand mining adopt?
43. How are the strategies supported by the MMDA?
44. Are the strategies viable compared to their previous occupations?
45. Does your office allocate part of the revenue generated from sand mining to support the development of the mining communities? Mention some of the support
46. Do the sand miners support the livelihood of the affected households?
47. How can sand mining activities be done sustainably alongside other livelihoods?

INTERVIEW GUIDE FOR THE DISTRICT DEPARTMENT OF AGRICULTURE

Date of interview:……………………………………………………………

Place of interview:……………………………………………………………

Interviewees Position/Title:………………………………………......................

Institutional framework

1. What rules or rules prescribe how sand mining should be done in this district? Formal and Informal.
2. Does the Department have rules on sand mining?
3. What is the level of enforcement of the rules regulating sand mining? What in your opinion could account for that?
4. How often do the regulatory organisations monitor sand mining operations?
5. Which department or agency do you collaborate with?
6. What is the nature of collaboration?
7. How can the collaboration be enhanced? Explain
8. Which powerful groups affect your departments attempt to stop illegal sand mining?

Effects of sand mining (start from here)

9. Which livelihood activities are mostly affected by sand mining?
10. What is the effect of sand mining on agriculture in the district?
   - Farmers
   - Yield
   - Type of crop cultivated
   - Farm size
   - Farmers income
11. How many hectares of farmland have been negatively affected by sand mining?
12. What are the effects of sand mining on food prices?
13. Expalin how the Department participate in the determination of compensation to negatively affected farmers?

14. How were those affected compensated?
15. Mention the positive and negative effects of sand mining on the environment.
16. Mention the negative and positive social effects of sand mining
17. How does the department address the negative effects of sand mining?
18. How many farmers have been displaced from their farms by sand miners?
19. What measures do you implement to rehabilitate the degraded agriculture land?

- Yes [ ] (How do you do that?)
- No [ ] (Why don't you rehabilitate the land?)

20. How many acres have been rehabilitated?
21. Would you recommend that sand mining is banned in the district?

Alternative livelihood strategies

22. What measures have you put in place to restore the livelihoods of people who have been negatively affected by sand mining?
23. What alternative strategies do the negatively affected households adopt?
24. How are the strategies supported by your department?
25. In your own view what challenges do the households face in adopting new livelihood strategies?
26. Are the alternative strategies viable compared to their previous occupations?
27. Which of the following would you recommend for affected farm households and why?

- Concentrate only on food crop production
- Concentrate only on the alternative livelihoods
- Combine both (food crop and alternative livelihoods)

28. How can sand mining activities be done sustainably alongside other livelihoods?

INTERVIEW GUIDE FOR THE COMMUNITY DEVELOPMENT COMMITTEE

Name of community…………………………………………………………..

Date of interview:…………………………………………………………

Place of interview:…………………………………………………………

Interviewees Position/Tittle:………………………………………………….

Organisation of sand mining

1. What are some of the major uses of land in this community?
2. What is the dominant occupation in the community?
3. What is the level of sand mining in this community? (Widespread, moderate, low)
4. How many active sand mining sites are in this community?
5. How many years have sand been mined from this communities?
6. What processes are involved before someone can mine sand?
7. Are you involved in the permit allocation process?
8. What considerations do you make before allowing sand miners to operate in the community?
9. How are the community members involved in the allocation of land for sand mining?
10. How many trips of sand leave this community daily?
11. Do the sand miners operate legally or not?
12. Is sand mining one of the major sources of revenue for the community development committee?
13. Rank the interest of the sand mining actors from 1 to 4 with 1=low, 2=medium, 3=high and 4=very high interest on the following parameters: monetary, environment, aesthetics, social cohesion, employment and agriculture and food security.
14. Who are the most powerful stakeholders in sand mining? Rank them with coercive, incentive and trust power

Institutional framework

15. What rules prescribe how sand mining should be done in this community? Explain both Formal and Informal

16. Are the rules enforced?
17. What are the sanctions for noncompliance to the rules?
18. What challenges does the community development committee have in monitoring sand mining?

Effects of sand mining

19. How would you rate the general contribution of sand mining to development of this community?
20. Which livelihood activities are mostly affected by sand mining?
21. How are those affected negatively compensated?
22. Mention the negative and positive effects of sand mining on the environment.
23. Mention the negative and positive social effects of sand mining you know.
24. What measures have you put in place to rehabilitate the degraded sand mining sites?
25. Would you recommend that sand mining is banned in the community?

Alternative livelihood strategies

26. How do you ensure that households have sustainable livelihoods?
27. What strategies do families who lose their livelihoods to sand mining adopt?
28. Are the strategies viable compared to their previous occupations?
29. Do the sand miners support the livelihood of the affected households?
30. How can sand mining activities be done sustainably alongside other livelihoods?

APPENDIX C

FGD GUIDE FOR THE YOUTH AND WOMEN'S ASSOCIATIONS IN THE COMMUNITY

Organisation of sand mining

1. Major uses of land in this community: probe who own the land (Individuals, family, chiefs, clan head), level of sand mining in the community, number of years' sand has been mined, who gave the land out for sand mining, number of trips per day and how land is acquired for sand mining.
2. Processes involved before someone can mine sand in the community and level of involvement of the community members in the process.
3. The actors in the sand mining business: probe their individual interest and source of power

Institutional framework

4. Rules and laws that govern sand mining in this community: Probe for formal and informal and who set them including taboos
5. Enforcement of the rules: level of effectiveness, mention effective rules and ineffective rules, why they are effective or ineffective.
6. Which organisations control sand mining in this community.
7. What sanctions are for noncompliance to the mining rules?
8. How can the rules be made effective?

Effects of sand mining

9. Livelihood activities affected by sand mining: probe for both negative and positive effects (income, yield, consumption, number of people displace)
10. Compensation for affected persons
11. Environmental effects
12. Social effects (food prices, crime, conflict, ailment)
13. Rehabilitation of the degraded sand mining sites.
14. Contribution to the community development.

15. Measures put in place to stop illegal sand mining.
16. Sanctions for sand mining.

Alternative livelihood strategies

17. Alternative livelihood strategies the affected households pursue: probe if is agriculture, alternative livelihood or both, how it is financed, support from sand miners, are they viable compared to original livelihood.
18. What are the outcomes of these strategies?
19. Challenges in pursuing new livelihood strategies.
20. How can sand mining activities be done sustainably alongside other livelihoods?

APPENDIX D

OBSERVATIONAL GUIDE

The following subthemes in the study communities served as the foundation for this observational guide.

1. Number of trucks carrying sand that leaves the community daily
2. The available livelihood assets of the people.
3. The existing livelihood activities in the study communities.
4. Evidences of land dilapidation as a result of of sand mining.
5. Damages of farms by sand miners.
6. Damages of the vegetation by sand miners.
7. Damages of water bodies by sand miner.
8. Community members' social lives.
9. Available infrastructure built by the sand miners for the community members.
10. places of reclamation after mining and the use made of those areas.
11. Environmental management strategies employed by either the community members or the sand miners.
12. The presence of representaives of the regulatory agencies in the sand mining communities.

APPENDIX E

ETHICAL CLEARANCE

UNIVERSITY OF CAPE COAST

INSTITUTIONAL REVIEW BOARD SECRETARIAT

TEL: 0558093143 / 0508878309
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OUR REF: UCC/IRB/A/2016/883
YOUR REF:
OMB NO: 0990-0279
IORG #: IORG0009096

22ND JANUARY, 2021

Mr. Kofi Yeboah Asare
Department of Integrated Development Studies
University of Cape Coast

Dear Mr. Asare,

ETHICAL CLEARANCE – ID (UCCIRB/CHLS/2020/48)

The University of Cape Coast Institutional Review Board (UCCIRB) has granted **Provisional Approval** for the implementation of your research titled **Sand Mining and Sustainability: Finding Solutions for Household Livelihoods in the Gomoa East District and Ga South Municipality, Ghana**. This approval is valid from 22ND January, 2021 to 21ST January, 2022. You may apply for a renewal subject to submission of all the required documents that will be prescribed by the UCCIRB.

Please note that any modification to the project must be submitted to the UCCIRB for review and approval before its implementation. You are required to submit periodic review of the protocol to the Board and a final full review to the UCCIRB on completion of the research. The UCCIRB may observe or cause to be observed procedures and records of the research during and after implementation.

You are also required to report all serious adverse events related to this study to the UCCIRB within seven days verbally and fourteen days in writing.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours faithfully,

Samuel Asiedu Owusu, PhD
UCCIRB Administrator

ADMINISTRATOR
INSTITUTIONAL REVIEW BOARD
UNIVERSITY OF CAPE COAST