

**ASSESSING THE SOCIAL AND ENVIRONMENTAL IMPACT OF ILLEGAL MINING
OPERATION IN RIVER PRA: A CASE STUDY OF GHANA WATER COMPANY
PROJECTS IN DABOASE**

**BY
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Declaration

I hereby declare that this submission is my work towards the MSc Project Management and that, to the best of my knowledge, it contains no material previously published by another person, nor material which has been accepted for the award of any other degree of this University or elsewhere, except where due acknowledgement has been made in the text.

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Abstract

Illegal mining popularly known as galamsey has caused the people of Daboase, the district capital of Mpohor Wassa East their livelihood and the Ghana Water Company Limited millions of Ghana cedis to treat water for human consumption. This study aimed to assess the social and environmental impact of an illegal mining operation in river Pra and its impacts on water production of Ghana Water Company Limited. Three objectives were set for this work, which are 1.) To determine the effects of illegal mining in the river Pra on water treatment and production at Daboase head works 2.) To assess the impact of illegal mining in the river Pra on the environment 3.) To ascertain the socioeconomic implications of the polluted River Pra on the populace and proffer solutions to curb the galamsey menace in the area. Extensive literature review was done, and a quantitative survey was designed and used in the research. 61 questionnaires out of 66 questionnaires that were distributed were retrieved and wholly completed taking a rate of response of 92%. 7 people targeted for the interview were all interviewed representing a percentage of 100. 93% represented the overall respondent rate. To draw meaningful results, the collected data have been analyzed by using the quantitative data analysis techniques (which include Mean Scores, percentages and frequencies, and others) through the Statistical Package for Social Science (SPSS) IBM version 24. Results of the study show that land, water, air pollution and increased in water production cost are the main environmental impacts and social indicators such as employment, population increase and migration, economic and business development, prostitution, crime, conflict, poverty issues, infrastructural development and prices of goods and services are the social impacts of illegal mining. Regularization of the illegal mining with proper documentation be granted to the miners, attention be paid to the massive unemployment situation are some of the recommendations of this study.

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Dedication

I would want to dedicate this thesis to my wife, Mrs. Faustina Amoah, children; Emmanuel Gyashie Amoah, Evelyn Yarboley Amoah, Mark Adjei Amoah and Joel Gyashie Amoah for their support morally and spiritually. I love you all!

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Illegal mining also known as galamsey activities heavily pollute River Pra which is the basic source of water been treated by the Ghana Water Company to the citizens of Daboose and Sekondi -Takoradi Metropolitan Assembly. The water body is eventually drying up and production cost keeps going high as a result of the illegal mining. According to Karikari, et al., (2009), Ghana is among the countries that the impact of small-scale gold mining to the environment keeps escalating. In Ghana, it has been proved that, human activities are the fundamental source of environmental mercury (Hg) pollution (Hilson & Pardie, 2006). A research conducted by (Oduro et. al., 2012) found out that the main Pra river and its tributaries have $(48.40 \pm 26.08 \text{ ng/ml})$ and $(27.59 \pm 18.23 \text{ ng/ml})$ average dissolved Hg concentration, respectively, which are far above the WHO guideline value of 1.0 ng/ml due to illegal gold mining activities along the stretch of the Pra River.

The Daboose treatment plant which was initially designed to produce six million gallons of water daily currently produces four million gallons of water a day, mainly due to high turbidity (muddy nature) of the River Pra as a result of the activities of illegal miners. The raw water intake point at the Daboose Headworks is covered with sand due to open activities of the illegal miners. This situation has posed a lot of technical problems for the treatment plant and cost of production. Hitherto, 33 bags of aluminum sulfate per day was used. Now, 90 bags of the same is required daily for production. The production capacity of the treatment plant is affected as a result of this galamsey activities. This situation is, therefore, affecting industries, businesses, households and even threatening water security in the region. Environmental degradation is

caused when mining is carried out in the “forest zones.” It is also believed that mining affects approximately 38% of the earth forest (Ricardo & Hersilia, 2004).

1.2 Problem Statement

Illegal mining, popularly known as galamsey has been an issue of concern to most Ghanaians for many years now. The recent ban and the establishment of ‘operation vanguard’ to curb the galamsey menace depict how serious the issue is. Galamsey operators mostly operate close to water bodies which serve as a source of water for their operations. Today, important major rivers such as the Pra, Birim, and the Offin, etc. are heavily polluted due to galamsey activities (Adjei, Oladejo, & Adetunde, 2012). The galamsey operators also create pits that are not filled after use exposing themselves and others (including women and children) to harmful chemicals. In worse cases, we hear that pits of these illegal mines cave in killing several people. Apart from the mining activities, providing jobs and contributing to the economic growth of Ghana, it has its similar challenges which have a negative impact on the environment and the communities at large. Although numerous studies highlight mining impacts, most studies do not discuss how community members cope with the consequences they experience. Current literature on impact studies does not go further to assess the different dynamics that these impacts have on society (Amankwah & Anim-Sackey, 2003); (Harvey, 2014); (Kitula, 2006); (Petkova-Timmer, et al., 2009).

It is therefore essential that this study is conducted on the social and environmental impact of an illegal mining operation in river Pra on the lives of the residents whose communities have been evaded by galamsey operators. This will highlight the effects on the social and economic activities of the people in the study location.

1.3 Aim and Objectives

1.3.1 Aim

This research aimed to *assess the social and environmental impact of an illegal mining operation in river Pra*. In achieving the aim of the study, the following objectives were set:

1.3.2 Objectives

1. To identify the effects of mining illegally in the river Pra on water treatment and production at Daboase head works.
2. To identify the effect of illegal mining in the river Pra on the environment.
3. To identify the socioeconomic effects of the polluted River Pra on the populace and proffer solutions to curb the galamsey menace in the area.

1.3.3 Research Questions

To be able to fully understand and appreciate the extent of social and environmental impacts of illegal mining activities in the community, the following research questions will be answered;

1. What are the effects of illegal mining in river Pra on water treatment and production of Daboase head works?
2. What is the impact of illegal mining in the river Pra on the environment?
3. What is the socioeconomic effect of the polluted river Pra on the populace?

1.4The significance of the study

The study of this nature is very crucial at the time the president of the Republic of Ghana has vowed to deal ruthlessly with the illegal miners in Ghana. Firstly, the information generated from this study will add up to the data already in existence on the water quality in Daboase and its environs. Also, educational institutions, policymakers, environmental experts and stakeholders can use the findings generated from this study as an information source.

1.5 Brief Research Methodology

According to Bryman, (2008) design is a necessity in research conduction. Furthermore, the design provides a framework for the collection and analysis of data. The type of methodology for the collection of data is being determined and influence by the design been applied. Case study, survey research also known as cross-sectional design, longitudinal design, experimental design and similar design are the five notable designs Bryman outlined. For study, a case study design is employed because it involves looking at the social and environmental impacts of illegal mining activities in a specific place which is Daboase (River Pra).

A more qualitative approach and adaptation of semi-structured interviews, observation, focus group discussion and analysis of texts and documents related to illegal mining in the Ghanaian and Daboase, in particular, were the methods used for empirical data collection. My choice of these methods is informed by the fact that “case study designs often favor qualitative methods such as participant observation and interviews” (Bryman, 2008). It will also enable me to generate much-needed information and as well as doing an intensive and detailed examination of the case study. Relevant literature was initiated through secondary data obtained through textbooks, journals, previous research works and the internet.

1.6 Scope of work

Geographically, the study is limited to the Daboase District. However; the study will identify and study into details the communities in which the GWCL is operating. Conceptually, however, the study will concentrate on assessing the social and environmental impact of an illegal mining operation in river Pra using Ghana Company Limited Daboase head works as a case study.

1.7 Delimitation

This study is limited to the Ghana Water Company Limited, Daboase head works. Highways. The study investigates the impact of illegal mining on water production and the environment using Daboase a case study. The time within which this study was conducted is a limiting factor. However, the inference drawn from the study is very significant to GWCL.

1.8 Organization of the chapters

The study consists of five chapters and is organized as follows:

Chapter One: Provides the background of the study, problem statement, aims, and objectives together with the research questions, the significance of the research and delimitation.

Chapter Two: This chapter primarily includes water production at the Daboase head works, the environmental impact of illegal mining, social effects of illegal mining and corporate social responsibility of GWCL at Daboase.

Chapter Three: Provides information on the methodology, population and sample size consideration, limitation of the study, data collection procedures, instrumentation, and data analysis procedures. Also, ethical issues were discussed here.

Chapter Four: Provides findings and the discussion of the results of the study.

Chapter Five: Provides a summary of the findings, conclusion, and recommendation to the Ghana Water Company management team and suggestions for further research.

1.9 Chapter Summary

Pollution of the Pra River and its effect on water production and the environment at Daboase was presented in this chapter as a way of background information. The problem statement was discussed, and significance of the study made. Research questions were posed to help achieve the objectives and the aim of the study eventually. The methodology employed and scope within which the study was done was also discussed. Also, the delimitation was mentioned.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

This section reviews prior studies on the subject being researched. A literature review is “a useful methodology to gain an in-depth understanding of a research topic. A systematic examination of existing publications can help researchers in identifying the current body of knowledge and stimulating inspirations for future research” (Mok et al., 2015, p.447). This serves as a guide for the development of a theoretical framework and hypotheses for this study. This will enable the researcher to apply them to the research findings to arrive at justifiable recommendations and conclusions. Illegal mining also known as galamsey activities heavily pollute River Pra which is the basic source of water been treated by the Ghana Water Company to the citizens of Daboa and Sekondi -Takoradi Metropolitan Assembly. The water body is eventually drying up and production cost keeps going high as a result of the illegal mining.

2.2 Project Management

After establishing a need for organizational growth, a company needs to re-evaluate their management style accordingly. Many projects are defined by their result, but managing these projects usually stays the same. Project management, as defined in the Guide to the Project Management Book of Knowledge (from now on referred in the thesis as PMBOK), means “the application of knowledge, skills, tools, and techniques to project activities to meet or exceed stakeholder needs and expectations” (PMBOK Guide, 2013:5).

2.3 Socio- Economic Impacts of Illegal Mining

Several decades ago, socio-economic community prosperity being provided by the assumption of resource extraction has been questioned by researchers according to Freudenburg et al.,(2002). This was first brought to light in 1960s when underdevelopment in Latin America (Frank, 1966) was being researched into. different trade exchanges were emphasized where materials in their raw form were sent from regions where mining was done to other countries at comparatively cheaper prices and products that have been added with value were imported at high value. According to Godoy (1985), a systematic finding of development and mining in cultural and social dimension were organized in 1980 as a response to the boom extraction of mineral. The mining scope was being transformed by the usage of a model produced as a result of a review on research in relation to the industry made by Godoy and this had a huge focus on the communities where mining was predominant especially developing countries with indigenous population as attested by Ballard and Banks (2003).

The impact of socio-economic on the extraction of resources on communities that are adjacent has be highlighted in subsequent research especially ethnic minorities and regions that are remote contexts. The benefits in reduction of poverty, development of infrastructure and creation of jobs in relation to mining was backed by the World Bank (2004), yet a well-supplied literature with studies connecting communities that are dependent on resources with proportions of high poverty and unemployment (Chuhan-Pole et al., 2017, Hilson & Banchirigah, 2009), tensions between locals and mining companies (Hilson, 2002, Bebbington et al., 2008) and increased crime (Garvin, 2009). According to Hatcher (2012), activities involving in mining illegally has been criticized as a disturbing economic endeavor leading to impact on health as well as distress on the environment. Extraction of resource is considered

as the main drive to degradation of the environment especially contamination of water (see fig 2.1), deforestation and acid mine drainage (Bridge,2004).



Figure 2.1 Polluted water at the intake of GWSCL Daboase Plant

The usage of chemical that are harmful in the process of extraction has caused cyanide and mercury to have been connected to the impacts on health level in the community (Tschakert et al., 2016; Aragón & Rud, 2013). The use mercury and cyanide has resulted in GWSCL spending millions of Ghana cedis to treat the water at Daboase treatment plant for human consumption. The result is that production cost is escalated and it is a drain on the company's finances. Figure 2.2 depicts GWSCL production.



Figure 2.2 Sample water taken for treatment

The geographic and corporate features of the operations of mining illegally are the amplifiers for the challenges in association with the dependence of resources. In the case of many, extraction of resources is predominant by a single firm and considering the capital and scale requirements in mining contemporary, this part is mostly dominated by companies that multinational and large as well. Most recently, the Chinese have invaded the illegal mining business in Ghana and are destroying our water bodies. Indeed, communities that are dependent on resource are mostly frontier locations with indigenous population which are large (Kemp, 2010) where there is limitation on control of operation over a company and where livelihood is relied on illegal mining (Randall & Ironside, 1996). Much debate along “unsustainable mining” is centered around the notions of “resource curse” (Auty, 1994), countries with lesser

resources which are natural have comparatively a good economy compared to those with natural resources in abundance. The recent oil find in commercial quantities in Ghana is a typical example.

Corruption, mismanagement of resources and bad performance of the economy is so because of “resource curse” as attested by Hilson and Maconachie (2009). According to Extractive Industries Transparency Initiative (EITI, 2005), corruption and conflict in mining is as a result of poor accountability in relation to revenues and payments as well as lack of transparency as this mostly leads to poor governance and instability in political issues (Weinthal & Luong 2006, NRG, 2015). According to Hilson & Maconachie (2009) regimes in control of regions in sub-Saharan Africa hoard all the wealth of resources and the local population is mostly deprived of any benefits. Bebbington et al., (2008) attested that, the repercussion of this, is failure in growth in relation to sustainability and development in developing nations that are endowed with resources. According to Ballard & Banks (2003) the international community started acknowledging the right of locals in the mining areas in respect to livelihood, access to land and culture by 1980 for the following two reasons: “sustainable development” emergence (WCED, 1987) and rights approval of local people to prior, free and consent informed (FPIC (UN 2007). The FPIC concept, backed by the International Labor Convention (ILO, 1989) and United Nations Declaration on Indigenous People’s right (UNDRIP) (UN, 2007), was used as mechanism for the protection of rights to determining of self (Barrera-Hernández, 2016).

2.4 The Environmental Impact of Illegal Mining

Mining can be described as an activity that requires a very adequate plan and anticipation of possible impacts (Abdus-Saleque, 2008). Gualnam (2008), indicated that, the issue of mining

involves numerous processes which normally starts with the deposit prospecting and exploration stage.

In fact, environmental impacts of mining are well documented, and the literature abound with ecological impacts in the form of waste management, impacts to biodiversity and habitat, deforestation of land with the consequent elimination of the vegetation, pollution (water, air, land, and even noise pollution), etc. In Ghana and many other tropical areas of mining, it is noted that mining is a major cause of deforestation and forest degradation, generating a significant number environmental impacts (World Rainforest Movement, 2004 p.43). The extant study is on the effects of illegal mining and its impact on water quality. In addition to the threat posed by mining to biodiversity, the removal of the forest cover is swiftly drying up rivers and streams, resulting in the extinction of river hosted animal and plant species associated with tropical rainforest. Even, many communities complain that snails, mushrooms, medicinal plants, etc. are no longer available in the areas of mining due partly to mining activities (World Rainforest Movement, 2004 p.44) in addition to the numerous health problems such as malaria, tuberculosis, conjunctivitis and other skin diseases posed by illegal mining activities (World Rainforest Movement, 2004).

It has been found out that due to the adverse environmental impacts of illegal mining activities on the Pra River, the health of most of the people in that community is very poor with a high prevalence of upper respiratory tract infection (URTI) in the area which medical experts attributed to the illegal mining activities and its associated pollution, arsenic poisoning (Awudi, 2002). Also, mining impact related diseases such malaria, diarrhea, upper respiratory tract infections, skin disease, acute conjunctivitis, and accidents is noted to be high in Tarkwa, another mining community in Ghana (Awudi, 2002 p.9). According to The World Bank (2006), in Mongolia, the contamination of the quality of water as a result of pollution of water, pollution

of mercury, piles from rock waste, pollution of air and tailings repositories has been a characteristic of mining-induced impacts in places where operations in relation to mining is being performed. Additionally, major problems in relation to the environment have led to majority of the mining communities in Ghana and is largely brought about by the mining boom which requires massive vegetation clearance and land excavation, waste disposal, mineral processing and misuse of mining chemicals leading to decline in safe drinking water for humans, decline in air quality, loss of ecological biodiversity, decreasing forest cover and decreasing space for human waste disposal (Awudi, 2002). Whereas mineral wealth exploitation and resources has become a relevant venture in majority of the countries in buttressing the agenda of the development of the nation. The exploitation of resources is frequently a destructive activity that damages the ecosystem and causes problems for people living nearby the mining operations (Rhett, 2006).

Acid rain is caused as a result of chemicals such as sulfur dioxide been released from mines overtime and this has a toll on the environment when manifested on a global scale. Greenhouse gases is produced as a result of carbon dioxide and methane released by burning fossil fuels from these mines produce and climate change could occur as a result of that. However, what is most worrying is that the damages of the environment as a result of the process of extraction is not uniform either with its severity depending largely upon varying factors such as transportation routes, mine type, ore body characteristics, among others (Gibson and Klinck, 2005). With those communities very close to the mines likely to bear the heavy brunt of the environmental consequences even though other less close communities could also be impacted negatively by the ecological effects of the mining operations.

2.5 Corporate Social Responsibility

Indeed, compliance with FPIC is mostly viewed as a requisite for national level operation but not a right by communities in the local to operate (Barsh, 1994; MMSD, 2002). Therefore, to amass residents' support, corporate social responsibility (CSR) was used as a "social license to operate" (Wheeler et al., 2002). According to Visser (2008), CSR is a concept that is contestable although it was manufactured to enhance the socioeconomic and environmental conditions through ethical, philanthropic, economic and legal responsibility. The cooperation between stakeholders and companies in the mining industry is being enhanced by a framework provided by CSR (Wheeler et al., 2002). Jenkins (2004) attested that, the balance achieved by companies between maximization of profit, various community demands while the environment is being protected is attained by the help of CSR. This can be implied as, more duties are being taken up by the mining companies as well as creation of local job, protection of rights of human, enhancement of welfare and the protection of the environment by inculcating CSR as affirmed by Hamann, (2003). Owen and Kemp (2013) affirms that, the survival and acceptance of the mining companies is being achieved by the help of CSR among the indigenous context., but also the whole industry development in relation to sustainability (MMSD, 2002).

CSR clearly aims at commonplace within the mining companies and organizations that are non-governmental. For instance, Manteaw (2008) queried whether CSR fulfills merely a "social licenses to operate" or if intensions are geared to uplifting the well-being of socioeconomic in mining communities genuinely. Kapelus (2002) also affirmed that, to mitigate pressure from opponents in mining, the usage of CSR is being inculcated by companies as a way to confront the concerns of development of local communities. Nevertheless, inadequate benefits are being brought to residents (Blowfield, 2004; Christian

Aid 2004) and the presence of tension among mining companies and local communities. Bebbington, (2012) attest that, dust, loss of land, contamination of water, noise, unemployment is range of impact that could result in conflicts.

Phelps et al., (2015) affirms that, for developing nations that are dependent on commodity, weak linkages (forward and backward) generated within the mining context is of a major concern. Backward linkages as a result of development of the economy was identified as an identical experience to be insignificant together with the multiplier effect in Tanzania, Mali and Ghana (Chuhan-Pole et al., 2015). In Botswana, Tanzania, Angola and, Ghana where the developmental breadth linkage (forward and backward) was found to be best limited, this was found to be right (Morris et al., 2012). Tonts (2012) attest that, activity of resource supports the economies at the local level and this is considered contingent on specific context of range in relation to policy of government, remoteness, structure of the economy and type of commodity. Mining is disregarded as force to improvement to socioeconomic well-being in the developed countries context. (e.g., (Gaventa, 1980; Deaton & Niman, 2012). A typical instance; In Blackwell—United States, although mining was massive in that community but poverty kept on perpetuating (Duncan & Coles, 2014). Illnesses related to mine, high unemployment rate and rampant inequality according to Gaventa, (1980); Duncan & Coles, (2014) were what the residents of Blackwell have been left with after a decade after the boom an analogy that is ironic to what has been identified in the nations that are developing and practicing mining in their communities including Ghana.

2.6 Theoretical Framework

Mineral resources endowed in communities can be exploited and this could be of benefit or otherwise for the community as deduce from the literature review. The determination of the results is dependent on the mode of excavation or exploration, the institutional framework established in which mining companies operate, reduce measures such as assessment of

environmental impacts, assessment of social impact, degree of local people involvement. If the implementation, design and operation of the effects of illegal Mining is reduced, corrected and avoided, it has a high probability of bringing about sustainable development. This stands to say that, the study is based on the linkages of impacts that exist between the activities of illegal mining and the social, economic and environmental changes of mining to water production at the Daboase water treatment plant as depicted in Figure 2.

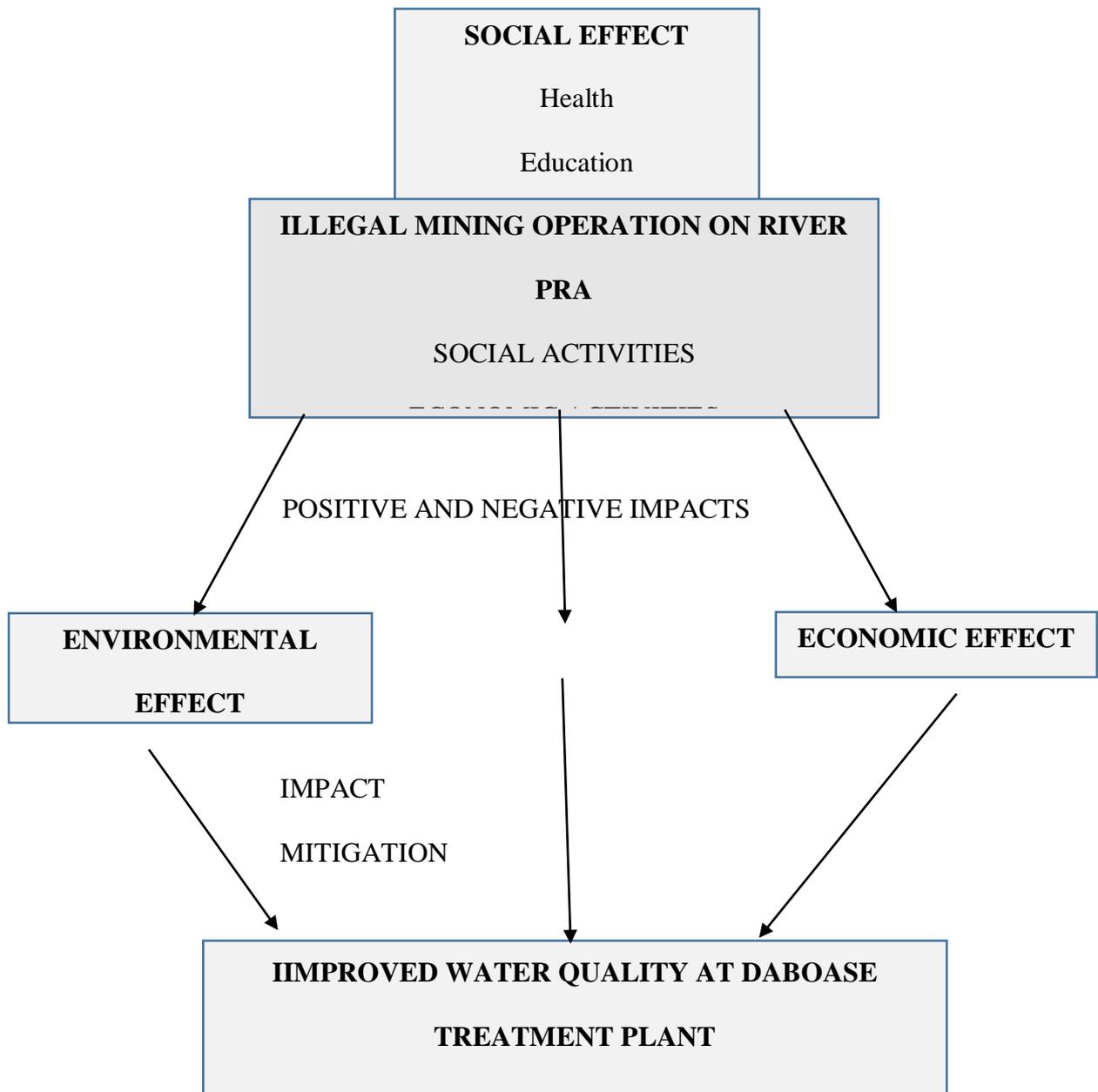


Figure 2.3 Theoretical Framework

2.7 Summary of Literature Review

The literature on mining abounds very well, and review indicates a trend towards the environmental impact assessment rather than social impacts assessments. Though we cannot delink environmental impacts of illegal mining from social impacts to a larger extent, it is equally important that social impacts of mining activities are also given the necessary attention if the real benefits from mining are to be derived by the indigenous communities where mining takes place. Useless would it be if mining activities rather make indigenous people drug addicts or prostitutes which in the long run predispose them to a lot of health problem in addition to that health problems created by mining activities itself. Management and corporate policy measures could help solve problems associated with mining holistically if policy measures on impact assessment consider both environmental and social impact mitigation in totality. As Clark & Clark (1997 p.17) notes „failure to deal with social and environmental issues can result in the closure of even the largest mines.

Debates about inappropriate industrialization, conservation, and securing natural resources will continue to rage. Unless we address the need for stakeholders to mediate environmental conflicts, the potential disputes will continue to deepen economic uncertainty at a moment in our national development when we can least afford it. There are few agreed-on mechanisms for resolving environmental strife. Sustainable development is a desired goal and to reach it, stakeholders must be willing to work with government to implement the principle of co-operative decision-making and share responsibility for the implementation and management of social and environmental issues. The setting up of operation vanguard to curb the menace of illegal mining activities has achieved very little since its inception. This is primarily due to the fact the, some big politician is behind this illicit business. The water quality at the Dabase treatment plants get worse each passing day. The ripple effect is that GWSCL is financially

burned and hence water production to the Sekondi-Takoradi metropolis is not regular. It is a common knowledge that, if the illegal mining activities is not curb completely, Ghana will begin to import water some years to come.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the methodological approaches adopted for the study. This chapter discusses the research design, population, sample size and sampling technique and method of the data collection. This chapter also discusses the analytical tools adopted for the research.

3.2 Research Design

According to Spencer-Oatey (1993), research design is a plan created to answer a research question or test a research hypothesis and to control variance. Social researchers ask two (2) basic types of research questions. Descriptive research answers the question “What is going on?” (De-Vaus, 2001). This involves the systematic and accurate description of facts and characteristics of a given population or area of interest. It can also be defined as the provision of an accurate account of characteristics of a particular individual, situation or group as a way of discovering new meanings, describing what exists, determining frequency and categorizing information (Kerlinger, 1986; Weekes, 1992).

These are;

1. What is going on?
2. Why is it going on?

These questions give rise to the two (2) types of research design which the descriptive research design and the explanatory research design are. This section discusses the two (2) research designs and selects the most suitable for this dissertation.

Explanatory research answers the question “why is it going on?” (De-Vaus, 2001). This involves the development of causal explanations which hinges on the fact that, one phenomenon is affected by various factors. Explaining causality is sometimes simple and other

times very complex. Explanatory research can also be referred to as causal research as it is conducted in order to identify the extent and nature of cause-and-effect relationships (Zikmund et al., 2012).

3.3 Research method

Research method indicates how the data was collected. In social research, there are three (3) basic research methods. These are quantitative, qualitative and the mixed method. The type of research method adopted depends on the type of data utilized for the study (Carrie, 2007). There are basically, two (2) types of data. These are the numerical data and textual data Both the numerical and textual data was utilized for this study.

The quantitative research method utilizes numerical data while the qualitative research method utilizes the textual data. The mixed method combines the strengths of both the quantitative and qualitative research method. Therefore, the mixed research method was the most suitable for this study. The mixed research method collects information to describe a concept involving a larger number of participants (Fellows and Liu, 2008). This data is normally used to study relationships between facts and how they align to theories and findings of past researches. Also, the mixed research method aids researchers to translate data to numbers and analyze textual data.

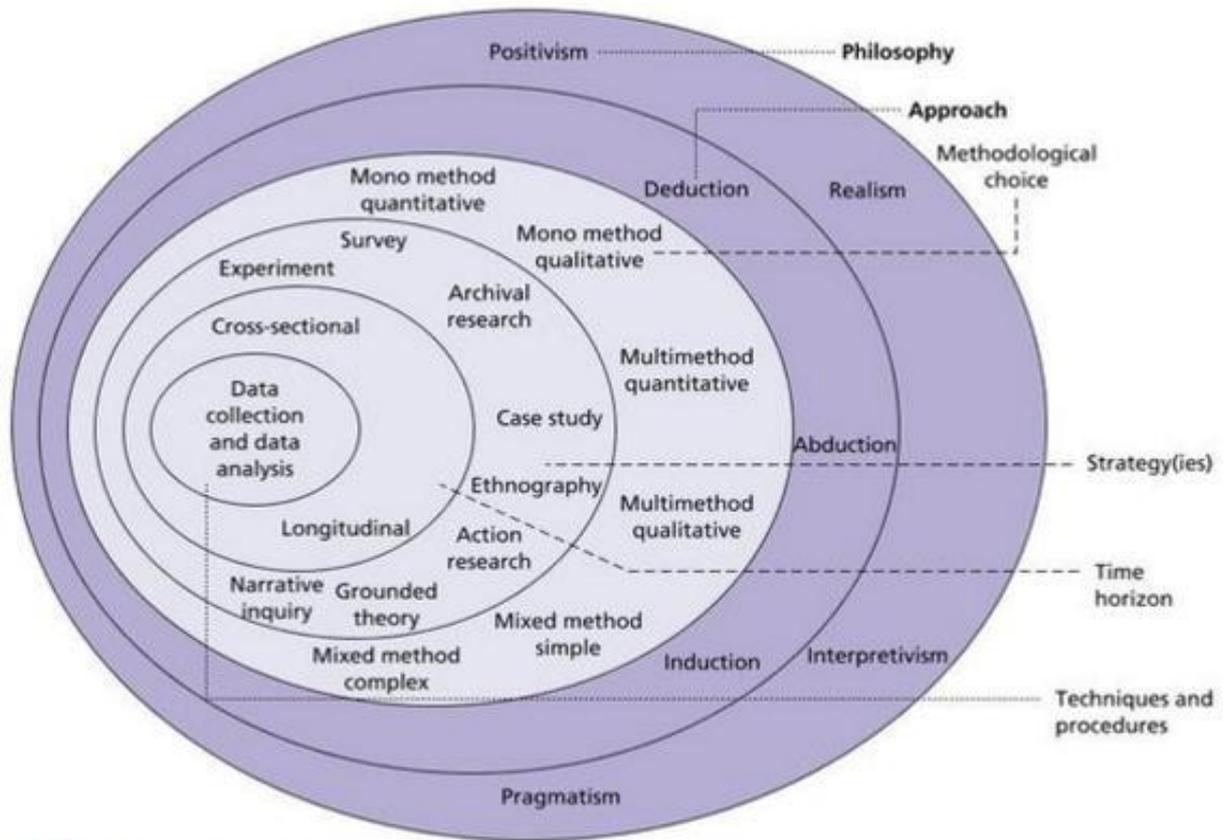


Figure 3.1: The Research “Onion Model”; (Source Saunders *et al.* 2012).

3.3 Study and Target Population

Population can be described as the complete compilation of elements that are of interest to the researcher. They are important in obtaining a specified information from them. Salkind (2008), postulated that, a population comprises of an entire group. Also, Sekaran and Bougie (2010), described a population as a whole group of people that a researcher wants to investigate. The population of the study comprised of employees and stakeholders of illegal mining in the Pra River. The targeted population was deemed most suitable for the study. The three (3) groups in the population included the community members, government employees and the mining company employees.

3.4 Sample Size and Sample Technique

According to Kothari (2014), a sample of about 10% of a population can often give a reliable data. However, a more scientific way of sample size determination was used in this study. Sampling is very vital in research because an entire population is almost impossible to examine (Fellows & Liu, 2003). The unit for sampling in the study was community members, government employees and mining company employees. Questionnaires totaling up to 73 in number were sent out amongst the entire target sample. The distribution and the response order will be represented in the subsequent chapter. Using this method for the research was chosen because it offers a good representation of the people involved actively in illegal mining activities on the Pra River. Further, purposive sampling was the sampling technique used.

3.4.1 Sample Size Calculation

To determine the sample size of the population of the study, Krejcie and Morgan (1970) formula which gives a procedure for the calculating sample size was applied. The formula is stated below:

$$S = \frac{X^2 NP(1-P)}{d^2(N-1)+X^2P(1-P)} \text{ ----- (1)}$$

Where,

S = required sample size

N = the given population size

P = population proportion assumed to be 0.5

d = degree of accuracy

$X^2 = 3.841$ for the 0.95 confidence level

Now, the given values are:

S =?

N =90

P =0.5

$$D^2 = d^2 = 0.0025 \text{ (5\%)}$$

$$X^2 = 3.841$$

Substituting this into the general formula, equation (1) yield;

$$S = \frac{3.841 \times 90 \times 0.5(1-0.5)}{(0.0025 \times 89) + 3.841 \times 0.5(1-0.5)}$$

$$S = \frac{3.841 \times 90 \times 0.5 \times 0.5}{(0.0025 \times 89) + 3.841 \times 0.5 \times 0.5}$$

$$S = \frac{86.4225}{0.2225 + 0.96025}$$

$$S = \frac{86.4225}{1.18275}$$

S = 73, hence the sample size for this study is 73.

3.5 Methods and Instruments of Data Collection

For the purpose of this study, the researcher used questionnaires, as the main tools in collecting data from the respondents. Questionnaires are easy to administer and also very convenient in collecting a large amount of data. Furthermore, questionnaires are economical and also preserves the anonymity of the respondents. In all, seventy-three (73) questionnaires were administered. Interviews were also utilized to collect information from the top management of various MDAs in the Daboase district assembly.

3.6 Data analysis

The data collected was subsequently analyzed to make inferences on the analyzed data. The data were analyzed using the mean score ranking. The mean scores were calculated based on the formula $M = \frac{\sum s}{n}$ (Cheung and Chan, 2011). Where “M”, depicts the mean score, “s” is the respondents’ score based on a five-point Likert scale, and “n” is the total number of respondents. The data was discussed with the aid of text and tables. The study also made use of document analysis and content analysis in analyzing the data collected from the respondents.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION OF FINDINGS

4.1 Introduction

This chapter presents the empirical data and findings from the field of study as given by the community respondents, key informants and employees of the Ghana Water Company Limited, Daboase Treatment Plant in the various interviews and the focus group discussion made in the field. The findings of the research are discussed with regards to the research questions and objectives. The findings are discussed with regards to the following objectives; to identify the effects of mining illegally in the river Pra on water treatment and production at Daboase head works; to identify the effect of illegal mining in the river Pra on the environment and to identify the socioeconomic effects of the polluted River Pra on the populace and proffer solutions to curb the galamsey menace in the area. This chapter begins with a description of the background of the respondents which included their gender, age, educational level and years of experience. This was followed by a discussion of the findings surrounding the objectives of the study,

4.2 Response Rate of Respondents

This section presents the response rates from the various categories of respondents. The response rate gives an indication of the effectiveness of the data collection method used for the study. Table 4.1 depicts the response rate of the distribution.

Table 4.1: Presents the response rates to the study

Category of Respondents	Sample Size	Actual Response	Percentage
Daboase Residents	46	41	89%
Government Employees	20	20	100%
Interviewees	7	7	100%
Total	73	68	93%

Source: **Field Survey (2018)**

From table 4.1, it can be realized that, the respondents from the Daboase residents had a response rate of 89% while the respondents from the government employees had a 100% respondents' rate. The interviews conducted had a 100% response rate. Sekaran (2003), deemed it as satisfactory for the a scientific research.

4.3 Background Information of the Respondents

Table 4.2 shows the background information of the respondents. The respondents were asked to indicate their gender, age, level of education and years of experience. From Table 4.2, there was a gender balance in the respondents as 50.8% represent males and 49.2% represent female. Also, from the results in Table 4.2, the majority 33(54%) of the respondents were educated up to Diploma level, 14(22.9%) were educated up to Bachelor's degree level, and 7 (11.7%) were educated up to JHS level. This shows that the majority of the study respondents were adequately educated. This practically implies that the respondents have adequate knowledge of the gamamsey menace in the district. The results in Table 4.2 also show that the most significant proportion 35(57.4%) of the study respondents had worked for less than five years, followed by those who had worked for 5-10 years 14(22.9%). Those who had worked for 10-15 years were 6(9.8%) while those who had worked for more than 20 years were 2(3.3%). The results show that the respondents were experienced enough to make informed decisions.

Table 4.2: Showing the background information of the respondents

Characteristics	Category	Frequency	Percentage
1. Gender	Male	31	50.8%
	Female	30	49.2%
2. Age	25-30	10	16.4%
	30-35	28	45.9%
	35-40	5	8.2%
	45-50	13	21.3%
	55-60	3	4.9%
	Above 60	2	3.3%
3. Education	PhD	1	1.6%
	Masters	5	8.2%
	Bachelors	14	22.9%
	Diploma	33	54%
	JHS	7	11.7%
	Others	1	1.6%
4. Years of Experience	Less than 5 years	35	57.4%
	5-10 years	14	22.9%
	10-15 years	6	9.8%
	15-20 years	4	6.6%
	Above 20 years	2	3.3%

Source: **Field Survey (2018)**

The results in the table also show that majority 28 (45.9%) of the study respondents were below 30-35 years of age, while only two were above 60 years of age. This indicates that the majority

of staff respondents are in their most productive age group. Such respondents are likely to give the true picture of what is on the ground.

4.4 Findings of the Main Objectives

In this section, descriptive statistics were presented. The descriptive statistics used were frequencies and percentages, while the inferential statistics used were Pearson correlation and coefficient of determination.

4.4.1 Objective One: To determine the effects of illegal mining in the river Pra on water treatment and production at Daboase head works

The first objective of the study was to determine the impact of illegal mining in the river Pra on water treatment and production at Daboase head works. The respondents were requested to respond to a number of statements regarding the effects of illegal mining in river Pra on water treatment, and production of Daboase head works by indicating their agreement using a five-point Likert scale of SD=Strongly Disagreed, D=Disagreed, N – Not decided, A=Agreed and SA = Strongly Agreed as shown in Table 4.3. The responses are summarized in the table 4.3;

Table 4.3: Showing the results of the effects of illegal mining in the river Pra

Item	M	SD	D	N	A	SA
Increased in cost of production	3.7	4 (6.6%)	3 (4.9%)	1 (1.6%)	11 (18%)	42 (68.9%)
Malnutrition	3.5	10 (16.4%)	11 (18%)	2 (3.3%)	15 (24.6%)	23 (37.7%)
Unsafe drinking water	4.1	1 (1.6%)	3 (4.9%)	1 (1.6%)	37 (60.6%)	19 (31.1%)
Importation of drinking water	3.5	10 (16.4%)	2 (3.3%)	3 (4.9%)	42 (68.9%)	4 (6.6%)
Frequent water shortage	3.9	5 (8.2%)	7 (11.5%)	2 (3.3%)	21 (34.4%)	26 (42.6%)
Mechanical Damage to equipment	3.3	12 (19.7%)	6 (9.8%)	5 (8.2%)	25 (40.9%)	13 (21.3%)
Frequent part replacement	3.0	15 (24.6%)	9 (14.8%)	2 (3.3%)	30 (49.2%)	5 (8.2%)

Source: Author 2018

The results in Table 4.3 indicate that the respondents strongly agreed to increase in cost of production (Mean = 3.7); malnutrition as a result of polluted water for the local communities (mean = 3.5); Unsafe drinking water (Mean = 4.1); Importation of drinking water in the next few years to come if something is not done to curb the situation immediately (Mean = 3.5); Frequent water shortage as a result lack of chemicals to treat the polluted water for human consumption (Mean = 3.9); Mechanical Damage to equipment due to corrosion (Mean = 3.3); and Frequent part replacement (Mean = 3.0). The findings show majority of the respondents

strongly agree that the effects of illegal mining in the river Pra is very high on the operations of Ghana Water Company Limited at the Daboase head works.

4.4.2 Objective two: impact of illegal mining in the river Pra on the environment

The second objective of this study was to find out the impact of illegal mining in the river Pra on the environment. The respondents were asked to respond to some statements regarding impact of illegal mining in the river Pra on the environment. The findings are summarized in

Table 4.4

Table 4.4: Impact of illegal mining in the river Pra on the environment

Impact of illegal mining in the river Pra on the environment		1	2	3	4	5
	M	SD	D	N	A	SA
1. Endangers the biotic and abiotic surrounding of an organism.	3.76	5 (8.2%)	2 (3.28%)	7 (11.5%)	34 (55.74%)	13 (21.3%)
2. Climatic change	3.82	8 (13.114%)	5 (8.5%)	1 (1.6%)	23 (37.71%)	24 (39.34)
3. Degradation of the natural resources	4.2	3 (4.2%)	6 (9.84%)	3 (4.92%)	7 (11.5)	42 (68.83%)
4. Slating of rivers	2.95	11 (18%)	15 (24.6%)	13 (12.3%)	10 (16.4%)	12 (19.67)
5. Deforestation	3.13	3 (4.92%)	5 (8.2%)	2 (3.2%)	33 (54.1%)	18 (29.5%)
6. Mercury contamination of soils and water	4.38	2 (2.3%)	1 (1.6%)	1 (1.6%)	25 (41.0%)	32 (52.5)

Source: Author 2018

The results in Table 4.4 show that illegal mining endangers the biotic and abiotic surrounding of an organism (mean= 3.76). This means that impact of illegal mining in the river Pra on the environment is neither high nor low. The study respondents noted that climatic change is a major concern with regards to illegal mining (mean= 3.82). Mercury contamination of soils and water was found to be very dangerous to the environment (mean= 4.38). The above

findings show some level of impact of illegal mining on the environment. This is likely to affect the cost of production for GWSCL operations.

4.4.3 Objective three: socioeconomic impact of the polluted River Pra on the populace

The third objective of this study was to find out the socioeconomic implications of the polluted river Pra on the masses. The respondents were asked to respond to some statements regarding socioeconomic impact of the polluted River Pra on the populace. The findings are summarized in Table 4.5

Table 4.5: Socioeconomic impact of the polluted River Pra on the populace

Socioeconomic impact of the polluted river Pra		1	2	3	4	5
	M	NI	SI	SHI	MI	VI
1. Breakdown of central nervous system	3.34	17 (27.67%)	4 (6.57%)	3 (4.9%)	15 (24.6%)	22 (36.0)
2. Drinking and inhaling of gaseous mercury	4.46	1 (1.6%)	1 (1.6%)	2 (2.3%)	27 (44%)	31 (50.5%)
3. Destruction of water bodies	3.59	3 (4.92%)	6 (9.84%)	11 (18%)	19 (31.15%)	22 (36%)
4. Sanitation issues	3.85	5 (11.5%)	7 (11.5%)	4 (6.6%)	21 (34.4%)	24 (39.3%)
5. High Crime rate	3.61	12 (19.7%)	1 (1.6%)	3 (4.9%)	28 (45.9%)	17 (27.9%)
6. Prostitution	1.6	13 (21.31%)	6 (9.64%)	3 (4.92%)	19 (31.2%)	20(32.8%)
7. Unemployment	4.26	2 (3.2%)	1 (1.6%)	4 (6.6%)	26 (42.6%)	28 (46%)
8. Teenage Pregnancy	3.85	3 (4.2%)	9 (14.2%)	5 (8.5%)	21 (34.4%)	23 (37.71%)

Source: Author 2018

According to the results in Table 4.5, the study respondents noted that breakdown of central nervous system (mean=3.50); they worked overtime to complete tasks (mean= 3.34); drinking and inhaling of gaseous mercury (mean= 4.46); and, destruction of water bodies mean= 3.59).

This means that the impact on the populace is moderate.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter discusses and analyses the empirical findings and data critically as presented in chapter four. The section is divided into two sections. The first part explains the empirical results on the water production at the Daboase treatment plant, environmental impacts of illegal mining activities in the Daboase District and social with regards to water production and water quality of Ghana Water Company Limited. The second section deals with the conclusions from the findings and the third session gives a general recommendation for government and GWCL management to implement to help curb the accelerating rate of water pollution on the river Pra.

Although there has been a few significant changes and alteration in the natural resources particularly land, forest cover and water bodies in Daboase since mining activities by illegal miners started, there is no doubt that mining in the community is severely impacting the people of Daboase District in one way or the other. These impacts are social and environmental and therefore affect the very lives and livelihood of the people and their surrounding environs.

5.2 Effects of Illegal Mining in River Pra on Water Treatment and Production of Daboase Head Works

Water has been an essential resource in the lives of people in Daboase because it is used for their domestic activities as well as their agricultural activities. It should be stated that ever since illegal mining started in the Daboase District, the water bodies around the surrounding environs have been rendered unusable because they have been polluted by illegal mining activities. Earlier warnings by the governments have compelled the residents to avoid using them for any purpose because they fear to die or contract diseases. Although most of these water bodies can

still be seen as it used to be, they are not used by the people. The greatest challenge of this water pollution is the cost of production on GWCL activities at the Daboase head works. Production cost has increase drastically forcing the company to buy more chemicals to improve upon the water quality to Sekondi-Takoradi and its environs. Fetching water from a nearby stream confirms the extent to which water bodies have been polluted as it can be seen on face value, these water bodies have change in their natural outlook. Access to portable water now comes at a considerable cost to all residents of Daboase District.

5.3 The Impact of Illegal Mining in the River Pra on the Environment

The environment and its resources remain a significant asset to humans because it is the very source where we derive our very livelihood. Even more so for the people of Daboase, as the very nature of their occupation involves a constant and direct interaction with the environment, it constitutes their primary source of livelihood. The environmental impacts and natural resources considered in this study for assessing the effects of mining activities in Daboase focuses are land, water, and air pollution. Impacts on these natural and environmental resources to a more significant extent influence the quality of life of the people in the community in one way or the other.

Land is a vital resource for the people of Daboase. Predominantly a farming community, land serves as the main conduit for their livelihood because they cultivate the land for their basic sustenance. However, mining in any form or scale appropriates the land and can cause serious devastation and degradation of it. Daboase is no exception. The impacts of illegal mining activities by Newmont especially through excavation in Daboase has affected the land and degraded it to some extent. The same situation can be found in Tarkwa where “the huge scale of excavation has led to a complete change of landform suitable for agricultural and any other livelihood activity” (Awudi, 2002: 7).

Clean air is vital because its lack thereof can have dire consequences on the health of the people. In many countries, quality air is non-existent because of the increased air pollution through the release of harmful chemical gases and dust particles as a result of a variety of human activities. Air pollution in the Daboase community mainly comes from the dusty untarred roads that are continually used by heavy-duty vehicles belonging to these illegal miners for transporting machines and other equipment to the mine sites. It is difficult to visibly see chemical gases, fumes, and smoke from the mining site. Chemicals that are used in the blasting process are also released into the atmosphere and explain why people in the community have been barred from using rainwater for any activity.

Considering the extent of the environmental impacts, most people in the community have tried to draw a link between these impact and some health conditions currently experienced in the community. Although residents are not able to draw a direct linkage because of the lack of clinical data to buttress their thinking, there is a high tendency that some of the health conditions are directly and indirectly related to some of the environmental impacts.

5.4 The Socioeconomic Impact of the Polluted River Pra on the Populace

The social impacts of the mining activities in Daboase are mixed regarding its positivity or negativity. With the implications spanning through social indicators such as employment, population increase and migration, economic and business development, prostitution, crime, conflict, poverty issues, infrastructural development and prices of goods and services, there is the general acceptance in the community on the impacts of illegal mining activities in the community in any of these ways. After all, majority of the respondents indicated that they have been affected by major social and structural changes in the community since illegal mining began.

On employment, the situation is very unique in Daboase because contrary to popular opinions of job creation and massive business development in illegal mining areas due to mining activities, the situation as it persists in Daboase is far from such reality. Moreover, workers in the illegal mining firms are mostly outsiders and non- indigenes of Daboase community who have worked in mining firms in Ghana such as those of Obuasi, Prestea, and Tarkwa mines.

Concerning poverty in the community, one would have thought that the significant presence of migrants and newcomers in the community resulted in increased demands for goods and services, the growth of other petty businesses as well as the flow and circulation of cash in the rural economy would reduce poverty of the people. However, the livelihood of the people has been worst off with the start of illegal mining activities. A report by National Strategic Environmental Impact Assessment (NSEIA) in Ghana notes that poverty is more endemic in communities directly impacted by illegal mining activities with communities proximate to mining projects being generally poorer than those further away from mining (NSEIA, 2007 cited in Akabzaa, 2009). Because most of the people in the community previously were and continue to be farmers and live very simple lives, the destruction of their farms for mining activities and the general lack of alternative employment for most of the people have brought untold hardships to the people. Most of the people have had their major source of livelihood curtailed with illegal mining activities. This case of illegal mining induced poverty largely results from displacement.

5.5 Conclusions

The impacts of mining in Daboase district are many. The increase in production cost of GWCL operations, social and environmental effects are very glaring. However, the environmental impacts resulting from illegal mining activities in the Daboase District is pervasive and severe in comparison to the social impacts although both situations interact and it is challenging to

delink the environmental impacts from the social impacts because of their linkage. The settlements at the new site are designed in such a way that residents would have to stay in the area with entirely new people who are mainly unrelated by any ties.

Increased frustration among the people especially the youth is another outcome of illegal mining activities in the Daboase district. Primarily this resulted from the disappointment of Newmont to provide the people with employment and jobs and overall development of the community on the reason that they are unskilled and uneducated to work in mining set up like Newmont. This has indeed increased unemployment situation in the community since those whose farms have been taken by these illegal miners had the hope that they would get jobs in return and continue to have a source of livelihood.

The empirical findings points to the fact that an increasing trend that has emerged and developed in Daboase in response to their lack of jobs and employment is the large-scale involvement of the youth in illegal mining in the district. Illegal mining employs about 70% of the youth and people in Daboase now even though other people continue to farm. Migrants into Daboase particularly people from Northern Ghana are mostly engaged in the illegal mining business with local and indigenous Daboase district residents providing auxiliary services and small businesses such as selling sachet water in support of the people in the illegal mining sites. A number of attempt by the government of Ghana and the local authorities to quell this practice have proved futile. Most of the people in the community working in the illegal mining fields have vowed to resist fiercely any attempt by authorities to curtail their source of livelihood now which is illegal mining or galamsey. The illegal mining is now the livewire of most people in Daboase district even though some of the residents continue to engage in agriculture or engage in both illegal and farming.

Although health implications of illegal mining activities can be severe and great in most communities affected by mining. The current situation in the Daboase district demonstrates that illegal mining activities have not had much health consequence on the Daboase district residents even though some people believe that some sicknesses being experienced in the community could be traced to the illegal mining activities.

Finally, it is revealed through the study that even though large parcels of land and other environmental or natural resources have been affected with the onset of illegal mining nothing is being done to ensure the long-term environmental sustainability to reclaiming natural themselves in the future when illegal mining ends in the community.

5.6 Recommendations

Although the study was faced significant challenges regarding time and resources, it should be stated that the overall findings and analysis given in this studying justify and represent the true situation as it persists in the illegal mining communities of the Daboase district. The findings are therefore valid in the context for which the study was conducted although regarding generalizability to all other illegal mining communities and context is doubtful considering the qualitative nature of this study which only favors generalization in the context of the study. By the findings, I provide the following recommendations which I believe will be useful for the Government of Ghana, GWCL Management, and the local and national authorities in general in managing the impacts of illegal mining on the community as well as other illegal mining communities in Ghana. The recommendations I believe can also stimulate future research and investigations into illegal mining in other areas of Ghana.

Regarding promises of development and other social benefits made by social commentators to the people of illegal mining communities, the findings from the study to a more considerable extent, this has not been met by the communities. It is therefore recommended that the

regularization of the illegal mining with proper documentation be granted to the miners to take steps in fulfilling its promise of infrastructural development and investment particularly water, electricity, hospital and other social amenities at little or no cost to the community residents. In addition, the few existing ones can be expanded to provide and cater for the needs of the teeming number of community residents especially when migrants' settlers into the Daboase district has increased tremendously with the start of mining in the community, thereby putting more pressure on the existing facilities and infrastructure resulting in its destruction and demise. Adding more facilities and expanding the existing one would in the great ease the pressure on the few ones and prolong its lifespan in the long run.

In line with unfulfilled promises to the people, it is recommended that great attention be paid to the massive unemployment situation primarily caused as a result of the displacement of the people from the farms which mainly served as the major source of employment and livelihood for the people because they are predominantly farmers. The disappointment that has greeted the Daboase district residents particularly the youth due to the failure of the government to employ the majority of the residents is a source of great worry, and it is gradually turning the people in the community destitute and hopeless. Such a situation poses a high risk to the operations of the mining company itself since the trend if not halted could cause resentment and feud between the mining company and the community.

Regarding illegal mining or galamsey which is illegal in Ghana by the country's mining laws, the current measures adopted by operation vanguard by using national security operatives and soldiers to swoop and brutalize the youth at illegal the mining site is hazardous especially for the stability and peace of the community. It should be realized that the lack of employment caused largely as a result of the displacement of people from their farmlands and the subsequent failure to get jobs have invariably given rise to practice of illegal mining in the community in

the desperate quest of the people to survive and make a living. Since it is said that ‘a hungry man is an angry man’, the people would largely resist any attempt again to deprive them of their livelihood especially when they are jobless, and their lives have been lost. It is recommendable that instead of haunting the people from the illegal mine sites, the local authorities can regularize their activities by putting in place measures to monitor and streamline their activities to conform to standards. To maximize benefits, the people can be made to pay taxes monthly to the government whiles they are made to operate in line with various environmental and mining standards. In this way, the people’s livelihood would in one way or the other be restored whiles the state also reaps benefits from their activities in a more regularized manner. This would ensure a peaceful co-existence between illegal miners and the community in particular.

Finally, it is recommended that government of Ghana and GWCL management becomes more accountable to the people by making known to the community various development initiatives and programmes that are rolled out by the government. As it stands currently, most of the residents are not aware of programmes and initiatives that is undertaken by the government to solve the youth employment issues in the country to which the residents can benefit. It is not in anybody’s interest to keep such programmes in the dark from community access. The district assembly should take a conscious effort to market their developmental programmes, initiatives, and investments in the community. The use of media like brochures and leaflets is not adequate since the illiteracy rate is very high. However, the use of radio programmes, information vans to announce such programmes in the community, community durbars are the very few useful means that can be employed by the district assembly to market their programmes and to educate and inform the community about them. In this way, the government of the day would achieve acceptance by the people since most of them would appreciate the efforts the government is making to improve their lives and increase community awareness.

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APPENDIX 1

**KWAME NKURUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF ART AND BUILT ENVIRONMENT
DEPARTMENT OF BUILDING TECHNOLOGY**

QUESTIONNAIRE

RESEARCH TOPIC: *ASSESSING THE SOCIAL AND ENVIRONMENTAL IMPACT OF ILLEGAL MINING OPERATION IN RIVER PRA: A CASE STUDY OF GHANA WATER COMPANY LIMITED TREATMENT PLANT AT DABOASE*

Dear Respondent,

I am a student of Kwame Nkrumah University of Science and Technology pursuing a Master of Science degree in Project Management. The questionnaire is intended to help the researcher get information on the effects of illegal mining in the river Pra on water treatment and production at Daboase head works, assess the impact of illegal mining in the river Pra on the environment and to ascertain the socioeconomic impact of the polluted River Pra on the populace and proffer solutions to curb the galamsey menace in the area. The purpose of the study is purely academic and information given will be treated with the highest degree of confidence. You have been selected as a key respondent for this study. Kindly, complete the questionnaire to enable the researcher complete the study. The research is under the supervision of Dr. Kofi Agyekum. Please tick the answer which represents your opinion on the subject. I appreciate your participation in this effort. Thank you.

Yours Sincerely,

James Amoah, MSc. Student, KNUST

Dr. Kofi Agyekum, Project Supervisor, (KNUST)

SECTION ONE: DEMOGRAPHIC BACKGROUND OF RESPONDENTS

Please, kindly respond to the questions by ticking (✓) the appropriate box for each item.

1. Gender: Male Female
2. Age: 25-30 30-35 35-40 45-50 55-60 Above 60
3. Qualification: JHS/HND BSc MSc PhD Other
4. Years of experience: Less than 5 years 5-10 years 10-15 years 15-20 years
 Above 20 years
5. Source of livelihood Farmer Illegal Miner Government Employee other.....

SECTION TWO: EFFECTS OF ILLEGAL MINING IN RIVER PRA ON WATER TREATMENT AND PRODUCTION OF DABOASE HEAD WORKS

Kindly, indicate your level of the agreement or disagreement with the following statement on the effects of illegal mining in river Pra on water treatment and production of Daboase head works. [1= Strongly disagree; 2= Disagree; 3= Neither agree nor disagree; 4= Agree; 5= Strongly agree]. Please tick (✓) in the space provided.

Effects of illegal mining on water treatment	1	2	3	4	5
1. Increased in cost of production					
2. Malnutrition					
3. Unsafe drinking water					
4. Importation of drinking water					
5. Frequent water shortage					
6. Mechanical Damage to equipment					
7. Frequent part replacement					
Others (please identify any not in list)					

SECTION THREE: IMPACT OF ILLEGAL MINING IN THE RIVER PRA ON THE ENVIRONMENT

Kindly, indicate your level of the agreement or disagreement with the following statement on the impact of illegal mining in the river Pra on the environment. [1= Strongly disagree; 2= Disagree; 3= Neither agree nor disagree; 4= Agree; 5= Strongly agree]. Please tick (✓) in the space provided.

Impact of illegal mining in the river Pra on the environment	1	2	3	4	5
7. Endangers the biotic and abiotic					

surrounding of an organism.					
8. Climatic change					
9. Degradation of the natural resources					
10. Slating of rivers					
11. Deforestation					
12. Mercury contamination of soils and water					
Others (please identify any not in list)					

SECTION FOUR: SOCIOECONOMIC IMPACT OF THE POLLUTED RIVER PRA ON THE POPULACE
 Kindly, indicate the level of important of socioeconomic impact of the polluted river Pra on the populace.
[1= Not Important; 2=Slightly Important; 3=Somewhat important; 4=Moderately important; 5= Very Important]. Please tick (√) in the space provided.

Socioeconomic impact of the polluted river Pra	1	2	3	4	5
9. Breakdown of central nervous system					
10. Drinking and inhaling of gaseous mercury					
11. Destruction of water bodies					
12. Sanitation issues					
13. High Crime rate					
14. Prostitution					
15. Unemployment					
16. Teenage Pregnancy					
Others (please identify any not in list)					