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DISSERTATION THESIS

**The Mining Industry in Ghana –
Its Economic, Social Benefits and Environmental Impacts**

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DECLARATION

I hereby declare that this work submission is my own and that, to the best of my knowledge, it contains no materials previously published or written by another person or material which to a substantial extent has been accepted for the ward of any other degree of the University or other Institute of higher learning, expect due acknowledgement has been in the text.

In Prague.....

Signature.....

Ing.Wisdom Erasmus Boatri

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Spiritually, I wish to thank the God almighty for His guidance and protection throughout my life for the knowledge given to me to fulfill this journey and hope for more wisdom and understanding for the life ahead. Amen.

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DEDICATION

I dedicate this work to my Parents, Siblings and Friends.

ABSTRACT

Ghana, a mineral-rich country depends largely on the mining industry and it is a major contributor to the national economy. Introduction of Economic Recovery Program/Structural Adjustment Program in 1983 has seen an increase in minerals production and revenues over the past three decades. Despite significant contributions to the economy, the externalities associated with the industry and effects of illegal mining activity popularly known as *galamsey* have caused significant damage to the environment and a source of great concern to the nation. To analyze impact of the mining industry and its environmental implications as well as *galamsey* operations, data was collected from regulatory institutions and field survey was carried out in mining and non-mining communities (Tarkwa, Obuasi, Prestea, Sunyani, Koforidua, Cape Coast, etc) to administer questionnaires to mining professionals and non-mining professional. We applied direct regression model on production and revenue data of gold, diamond, bauxite and manganese collected from mandated institutions. In addition, empirical data collected on socio-economic benefits, environmental implications and *galamsey* operations were also analyzed based on socio-demographic information of respondents. Outcome of the analysis indicated continuous increase in minerals production and revenues especially gold and manganese whilst bauxite and diamond follows respectively in the next 5 years (2012 – 2016). Participants of the survey perceived contribution of mining industry to nation's development as positive gain of which constitutes 42% of sample size. Furthermore, responses on compensation to farmers and relevant agencies as a result of negative impact of mining activities in relation to socio-demographic information of respondents proved to be poor with 42% of total respondents which indicated insufficient compensation by mining industry to farmers. The statistical analysis of people's interest in *galamsey* proved to be high with 62% of total respondents whilst 49% of respondents agreed illegal mining is lucrateness business that would attract more people. Respondents are disillusioned in governments' effort to effectively deal with environmental issues of the sector as well as curb illegal mining activities.

KEYWORDS: Mining sector in Ghana, *galamsey* operation, environmental effect, ancestral believes, pollutions, employment.

ABBREVIATIONS

ALP	Alternative Livelihood Program
CHF	Community Health Facilitator
CSR	Corporate Social Responsibility
CSIR	Council for Scientific and Industrial Research
EIA	Environmental Impact Assessment
EITI	Extractive Industries Transparency Initiative
EMP	Environmental Management Plans
EPA	Environmental Protection Agency
ERP	Economic Recovery Program
GAG	Ghana Australian Goldfield
GDP	Gross Domestic Product
GEREU	Germany European Trade Fair
GOG	Government of Ghana
GRA	Ghana Revenue Authority
GSS	Ghana Statistical Service
GTZ	Gesellschaft Technische Zusammenarbeit
IMF	International Monetary Fund
IRS	Internal Revenue Service
MDGs	Millennium Development Goals
NEAP	National Environmental Action Plan
NEP	National Environmental Policy
NGO	Non-Governmental Organization
OECD	Organization for Economic Co-operation Development
PMMC	Precious Mineral Marketing Corporation
PNDC	Provisional National Defence Council
PROPER	Pollution Control Evaluation and Rating
SAP	Structural Adjustment Program

SEED	Sustainable Community Empowerment and Economic Development Programme
SSMP	Small-Scale Mining Project
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Organization
WACAM	Wassa Association of Communities Affected by Mining

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1. INTRODUCTION

1.1 Background

Ghana is endowed with lot of natural resources. It is located on the Western corridor of Africa with population of over 25 million (GSS, 2010). Its neighboring countries are Ivory Coast, Togo, Burkina Faso and Gulf of Guinea on the South (Figure 1). It is a democratic country which had its independence on the 6th March, 1957 under the leadership of Dr. Kwame Nkrumah. There was various coups d'état and civilian governments till 1992 when the forth republic started. There has been five successive elections since 1992 constitution came into been. "Ghana is one of the truly stable, peaceful and democratic countries in the region and offers a comfotingly different environment and this is what brings Germany business to the region" this statement was made at Germany European Trade Fair, 2012 (GEREU, 2012) by German Ambassador to Ghana, Mr. Thomas Wimmer at the trade fair. Ghana is rated B+ with long term foreign and local currency issuer default with a stable outlook whiles short-term foreign currency at B which has given investors positive indications of the economy as indicated by Fitch in 2012 (Ghana News Agency, 2012).

Mining in Ghana dated back over 2000 years with the use of local equipment or tools. In fact, this method of mining got the Arab traders into the country and gave Ghana the name Gold Coast as known previously (Botchway, 1995). During the 14th to 19th Centuries, Gold Coast manufactured about 14 million ounces of gold with the use of traditional tools and methods. The British in the 19th Century pave the way for modern technologies after they took over the Ashanti Kingdom (Ayensu, 1997). The introduction of modern methods of extracting minerals made gold mining an important foreign-run enterprise. Ashanti Goldfields Corporation, started operations in 1897, got a concession of about 160 square kilometers to extract gold for local and international industries.

Ghana is the 10th largest gold producer in the world and second in Africa after South Africa. Ghana also produces other minerals as aluminum metal and manganese ore, bauxite, diamond and other minerals as kaolin, limestone, salt, sand, gravel and crude oil. It is estimated in 2009, that gold earned Ghana 2.98 billion US dollars. In terms of taxes, royalties, consumables, workers payment amounted to 668 million dollars which amounted to 22 % of total amount was injected into the economy (UNDP, 2006). In 2011 Ghana was identified as the 13th world diamond producer in terms of volume (George, 2011; Kimberley, 2011). The mining industry in Ghana contributed to gross foreign exchange, especially the gold has been

moving along side with the cocoa sector. There have been intense policy reforms and restructuring of the mining sector in the early 1980s. Aim of economic recovery program of the mining sector was to introduce private participation and generate export revenue. These reforms has seen huge investment from AngloGold Ashanti Limited which is global gold miner, Newmont Ghana Limited a United State of America Company, Australian mining companies, and other huge firms investing huge capital into the sector. This led to increase in new mining companies coming into the country. The mining industries present substantial revenue and employment enough to provide more visible economic benefits to the country and improved the life of the population.

The benefit that a country gets from mining industries depends on the mining laws of the nation. These laws stipulate taxes and incentives packages for investors in the sector as well as nation. The perception of Ghanaians is that host communities and state do not seem to have significant contribution from the sector due to low percentage of 3 to 6 per cent paid as royalties. This looks like the country is not likely to achieve the Millennium Development Goal (MDGs) of reducing poverty by the year 2015. The UN Human Development Index placed the nation very low as 131 out of 171 countries in 2006 (UNDP, 2006). Pollution of river bodies in and around mining companies affected access to safe drinking water and ensure environmental sustainability would affect the MDG of access to safe drinking water. It is a major challenge to the nation in meeting this aim within stipulated period.

In fulfillment of development, the Provisional National Defence Council (PNDC) launched a neo-liberal Economic Recovery Program in 1983 which resulted in increased of gold mining for the nation. The reform of mineral legislatures in 1986 generated benefit to investors, communities and state. The review led to World Bank group in 1990's fighting for Africa's natural resources granted US\$ 2.75 billion loans to private multinational companies for investment into the extractive industry (Pegg, 2003). These mining companies are given some incentives to boost their operations in the sector. Equipment imported by mining companies into the country are all exempted from custom duties to aid their work, non-payment of capital gain taxes, corporate income taxes, value added tax (VAT), dividend withholding taxes and lowest royalties payment of these companies to the state are all having effect on the economic development of mining sector and nation. These modern technologies have its impact on communities and nations at large. Some impacts of mining in the country are pollution of water, air, noise, soil, degradation of agricultural land and other serious environmental implications of mining operations.

The purpose of research is to determine whether it is economically, environmentally and socially beneficial to keep or even to support these mining programs despite their negative impact on the environment and quality of life of local population. Some serious environmental effects of mining companies are; pollution of water bodies with cyanides & other heavy metals, dust & air pollution that prevents communities of potable drinking water based on mercury in our rivers. The introduction of modern technologies apparently led to employment of many expatriates in mining sector with adverse effect on rendering local forces limited employment opportunities. Wassa Association of Communities Affected by Mining (WACAM) a non-governmental organization noted that 250 rivers had been polluted by these mining companies and illegal miners (Owusu-Koranteng, 2005).



Figure 1: Map of Ghana, source (Internet)

1.2 Purpose of research

Based on the presented literature sources the researcher identified the following gaps and practical problems related to the mining industry which has not been answered effectively:

- I. Not clearly defined roles and positions of mining industry in economy of Ghana.
- II. There is not efficiently functioning government and systemic civic society participation is lacking.
- III. Continuous pollution of water bodies in and around communities of mining companies has necessitated need for researcher to study into the topic since this leads to social unrest within and outside communities.
- IV. Persistent criticism of the mining sector in relation to its contribution to national development of the economy by various stakeholders, social commentators, etc.
- V. Increase in illegal mining activities in communities which is seen as disadvantage to companies whose catchment areas are been encroached on and leading to total destruction of environment.
- VI. An adherence to environmental management systems of waste disposal in mining industry which ends up pollution of environment and other related health issues.
- VII. Environmental health problems posed by activities of mining companies in communities and country as a whole especially spillage of cyanides sink rashes, etc.

1.3 Hypotheses

The main purpose is to confirm the role of the mining industries as a significant factor of the country's GDP, as well as the core contributor to the CSR programs. Also, it is needed to find how the population (mostly respondents from the study areas) perceive the role of these industries in the society, particularly, how they perform their corporate social responsibility activities toward nation or local communities. For this we have formulated the following working hypotheses.

1. Mining companies contribute systematically to the nation's macroeconomic development
2. Mining companies contribute directly to the communities' general socio-economic development
3. Galamsey operators will consider alternative livelihood income earning occupations

1.4 Objectives

To deal efficiently with solving the above problems, the main objective of our dissertation project is defined in following form:

- To identify the current position of the mining sector in Ghana, its economic results, social impact of the new socio-economic and environmental goals (or paradigm).

To cope with this objective we formulated the following specific goals:

- I. To assess and evaluate current state of mining industry and its future scenarios of minerals production and revenue to the economic development of Ghana
- II. To analyze management of the mineral industry in Ghana and other resource rich countries
- III. To evaluate perceived standard of living of people in mining communities and positive impact of mining sector
- IV. To analyze opinion of environmental problems associated with mining sector and assess adherence of international environmental standards by companies (i.e. pollution, disposal of waste, etc) as well as performance of environmental management institutions
- V. To evaluate opinion on the extent of environmental damage by illegal mining activities in the industry and perception of miners to opt for alternative livelihood income-earning occupations
- VI. To recommend appropriate strategies of implementing alternative livelihood income-earning projects, effective relationship and communication between mining companies, communities and other related agents

To achieve the research objectives we adopted two – phase approach of data collection and were analyzed separately with different statistical techniques. These approaches to data gathering are described in materials and methodology in chapter three.

1.5 Organization

The structure of the dissertation thesis was outlined based on the following arrangements: Chapter one comprises the introductory background, purpose of research, Hypotheses, objectives and organization. Chapter two presents literature review of the study with critical importance on history of mining industry in Ghana, legal framework, socio-economic

benefits, environmental issues, illegal mining (thus, major threat) and other related issues relevant for the research. Chapter three addresses materials and methods employed to obtain the research outcomes. Chapter four discusses outcomes of the study and chapter five sums up the conclusion and recommendations. References and appendixes conclude the research respectively.

2. LITERATURE REVIEW

2.1 Economic growth and mining industry in general and Ghana

Mining activity as we know is not just for only developing countries but it spans the gamut of the economic development strata and the backbone of the very development process through the production of materials drive faucet of countries' economies (Aryee, 2001). As stated by the US National Mining Association, "The future begins with mining, throughout history, mining products have shaped the course of civilization" (National Association of Mining, 1998). A situation of resource nationalization has been implemented in several countries across the globe. Researchers have done extensive studies on the nationalization of these resources; Richard Poplak (Africa In Fact, 2012) examines the growing trend towards resource nationalization and posted question as to how can governments share this wealth with mining companies while making sure their citizen benefits too?. A report by Goldman Sachs (Africa In Fact, 2012) warns that Nationalization "never works" Except when it works, Norway, Brazil, Botswana and Chile which have effectively nationalized portions of their commodity sector. The Norwegian government which is a benchmark for good governance participates in 50 to 70% of all mining licenses, collects taxes, royalties and dividends, and has put up a petroleum fund which worth over US \$500 billion. There are no hard and fast rules that work in the case of nationalization rather than models that work are exception. In the case of Botswana often cited as the leading light in Africa, the nation has forged a partnership with the private sector and the government owns 50% of a joint venture with DeBeers known as Debswana. This mining company mines the country's richest diamond concessions, generating about two-thirds of gross domestic and more than 70% of export earnings (Africa In Fact, 2012). The mining sector in 2011 contributed US\$ 35.9 billion to South African economy or 9.8% of GDP (Statistics South Africa, 2012). The Democratic Republic of Congo demands 5% free equity and 15% to 51% negotiated equity shares in any mining firm handles through the state minerals companies Gecamines and Sokimo. The state does not invest in prospecting and mine development; they leave critical infrastructure, example roads and hydro dams for mining companies. The government of Botswana is required to invest US \$ 1.5 billion in Jwaneng's Cut 8 diamond mine which leads to matching its investor partner boot for boot. Zambia has doubled its royalty's payment from 3% to 6% in the 2012 budget but they did not reintroduce the 25% windfall tax they abolished in 2009 under the Presidency of Michael Sata (Africa In Fact, 2012).

Ghana is the country which has been in forefront of the nationalization debate since 1957. The country's gold production decreased from 915,317 ounces in 1960 to 282,299 ounce in 1984 as a result of poor state management and a plummet in global prices. A radical liberalization contributed production to increase tenfold to 2.9 million ounce in 1993 of which the country is maintained to stick to its trajectory. The legislation of Ghana is one of the mixed approached which is becoming very common. The state takes 10% free equity in both petroleum and minerals projects while it has an option to acquire further 20% at market price. It imposes tax rate of 35% and further 20% profit or "windfall" tax. Furthermore, a country where gold mining contributes up to 37% of export, the state intends to get as much values as possible from its natural resources. In the short term, taxes and state ownership may increase government revenue but these do not necessarily increase development. Due to this, the African Union Mining Vision demands a "knowledge-driven African mining sector that catalyzes and contributes to the broad-based growth and development of, and is fully integrated into an African market". It is a union-speak from African for the continent-wide commitment to beneficiation. Noticeably without development African countries will forever remain mere exporters of raw materials and when these resources are finished, there will literally be nothing left for these countries (Africa In Fact, 2012). Whiles nationalization debate is critically seen as a tragic handmaiden, in Zimbabwe, the government demands 51% shares of all mining operations which are further scaring off already jittery investors in the country.

One of the most corrupt, dangerous and riskiest place for multinational investment is the Democratic Republic of Congo. It is one of the countries on earth which is most resource-rich and with its water resource alone can solve African's energy challenges through hydroelectric power. Realization of agriculture prospect in DRC could feed the continent and in terms of its potential in mineral development, it is one of the top five areas in the world. However, so many decades of conflicts between government forces and rebels has plunged the country into chaos which has made the country to crouch beside Bolivia and Russia (Africa In Fact, 2012). The negative impact of these conflicts and corruption in most resource-rich countries has really affected livelihood of people. Socio-economic development projects are not fully implemented in communities and countries which mostly lead to social unrest, conflicts, etc.

2.2 Source and economic growth – Natural resource and the Resource Curse

Insufficient economic development, society unrest mostly culminate into conflicts, high levels of inflation, surge in corruption from most sectors especially public officers or government appointed officials, irresponsible fiscal policies, Dutch disease and so on have contributed to few economic growth (Cruz, 2011). This theory is popularly known in the academic circles as resource curses. Natural-resource curse was first mentioned by Richard Auty in 1993 and since then it became popularized among the Economist which also follows a paper written by Jeffrey Sachs and Andrew Warners in 1995. These authors and other have managed to indicate nations rich in natural resources develop slowly than states with fewer natural resources in the 20th century (Cabrales and Hauk, 2011). The Dutch disease is a phenomenon which is plagued by resource-rich countries. The term was invented by the Economist in 1977 to describe the benefit of the natural gas field discovered in Netherlands and its implication on the country's economy. Foreign exchange inflows as a result of the export of natural resource increased the values of the currency. This led to local manufacturing, agriculture and other exports not competitive. The above situation can affect well-governed nations but the tendency of much significant is associated with poorly-governed countries (Africa In Fact, 2012). There are various academic discussions on this resource curse theory. Auty has specified in his resource curse thesis the rate at which some resource-rich countries depend heavily on these minerals and poor-governance of these developing countries which finally leads these nations into civil wars, etc. Based on the significant evidence that has been collected over the years of research and observation, 'resource curses theory' may be observable facts rather than a theory (Cruz, 2011). In the 1980s and early 1990s, Auty was among the first to coin resource curse term. He therefore argues that negative effects are so commonly associated with natural resource extraction companies in developing countries than economic growth, development, etc. Article written in 1993 by Auty and Warhurst titled *Sustainable Development in Mineral Exporting Economies*, both authors argues that “ with reference to the ore exporters that, despite the harsh lessons of the 1970s and 1980s, few governments of mineral economies have learned that the control of Dutch disease is a prerequisite for sustainable development” (Auty and Warhurst, 1993). Different case studies of countries have been examined by Auty as a result of their economies been affected by the mineral sector. In the case of Peru, He therefore concludes that the backbone of developing countries' economies should not be the extraction

industries rather it should be surplus that would help to promote economic diversification (Auty, 1993).

2.2.1 Symptoms of the Resource Curse

Some symptoms associated with resource curse are as follows:

Revenue Volatility: Natural resource extractive nations are consistently at the mercy of the international market's price fluctuations of goods produce by these countries. In case of development, countries that depend on the high prices of their goods might face several negative effects. An example is countries like Angola, where government revenue constitutes 80% of the oil export and 42% of the country's GDP, in a major decline in the price of oil can totally have maximum impact on government planning (Consulate of Angola, 2015) has been witness currently. The same scenario is been observed in the case of Russia due to the fall of the world market price of oil and economic sanctions imposed by Europeans countries and the United State of America has significantly affected government revenue and expenditure. In most developing countries revenue volatility can lead to serious political strife and conflicts when people do not understand the concept of price fluctuation and they do not trust the institutions of the state.

Lack of Diversification: In developing countries where natural resource extractive industry is lucrative, both local and foreign investors do see insignificant motivation to invest in others sectors which are not natural resource related. It is more profitable for investors to divert resources to the extractive industry while agriculture and manufacturing sectors of the economy are abandoned because they are not lucrative. These nations become vulnerable to price fluctuations and depletion of these nations' natural resources in the future which would significantly impede their development and leads to serious problems for the government, examples manufacturing and agriculture products become uncompetitive as the national currency increases (Cruz, 2011).

Excessive Spending/Borrowing, Inflation: Resource-rich nations tend to spend more on different projects and programs because they earn enough of revenues from these resources. These developing countries tend to adopt irresponsible fiscal policies which can lead them to be vulnerable to the resource curse theory. A common phenomenon among these countries is their excessive amount of borrowing and spending that they initiate in various sectors of the economy. These governments bolster infrastructure projects and social programs as a result

of continuous inflow of revenue from the extractive sector which frequently do little to abet diversification and development. The possibility of currency appreciations occurs when governments put more money into the local economy with disproportionate spending. Unsound economic planning by mineral-rich countries happen when these developing nations depend largely on foreign demands for their goods and if the prices of these commodities drops or their resources are exhausted, they lack the financial power to support social programs and projects (Cruz, 2011).

Undermine Democratic Institutions: Autocratic governments seem to dominate mineral rich countries and nations that practice democracy suffers from weak institutions as well as corrupt politicians with bureaucrats and faces ethnic strife. A pseudo form of democracy exists in the countries which turn to hide an autocratic leaning ruler who in one way or the other used democratic ways to extend their stay in office an example is Vladimir Putin of Russia. Some form of accountability and transparency is required from democratic government but because of the lucrative revenues provided by the extractive sector these rulers abandon democratic principles because of their corrupt practices (Cruz, 2011).

Corruption: Governments of resource rich countries mostly collect rents in the form of royalties, revenues, corporate taxes, etc from extractive companies operating in their countries. In the case where countries basically depend on foreign corporations, firms and companies for their revenues as a result of their mining operations in these countries rather than they being revenue providers for their citizens tend to cripple democratic institutions in these countries. Loss of trust for governmental institutions and officials comes into place when you undermine these democratic institutions. According to Hardford, “ Economists believe that the difference between countries that leave successfully formalized trust and those that have not is basically the difference between rich countries and poor ones” (Hardford, 2007). Shaxson provided two approaches of assessing corruption. Firstly, “the abuse of wider interests by narrow interest” and secondly, “in terms of the principle that whatever abuses the public good and undermines public faith in the integrity of rules, systems and institutions in corrupting” (Shaxson, 2007). Corruption is very serious symptom of the resource curse that permeates through all dimensions from economic sphere, political and social realms of nations. It is important to pay significant attention to this canker since it is difficult to combat.

2.3 Mining and its policies introduced under the new reform in Ghana.

Mining on small-scale was operating in Ghana long before the arrival of Europeans in the then Gold Coast. In order to control and regulate sources of gold from the 'Gold Coast', the British colonized it in 1900. British large-scale mining companies and foreign investors started late in 19th century. "British mining interest were a significant source of influence on the Colonial Office in London and its representatives in the territory and shaped the formulation and implementation of mineral policy in the colony"(Tsikata,1997). Mining sector of the nation contributes 38 per cent of the total annual foreign exchange earnings to the country's economy, 5 per cent country's population is employed by mining sector and provides 12 per cent of the total revenue collected by the nation's largest tax collector, Internal Revenue Service (IRS) currently known as Ghana Revenue Authority (GRA). Ghana's mineral sector appreciated by 10.4% in 2010 and in the same year it accounted for approximately 11% of fiscal receipts by Ghana Revenue Authority. Gold especially contributed over 80% of value of total revenue from mineral industry. In large-scale mining sector, approximately 20,000 Ghanaians were directly employed with 6,000 providing services to the industry whilst over 500,000 were engaged in small-scale diamond mining, gold and other industrial minerals for construction sector (Ministry of Finance and Economic Planning, 2010:2011 and African Economic Outlook, 2011). Government and communities benefit from royalties paid by these companies and state equity participation of 10 per cent with equity interest. Agricultural sector of Ghana is very large and provides about 60 per cent employment opportunity to nation's population which also accounts for 36 per cent of Gross Domestic Product (GDP). Previously, five (5) mining companies were the only mining companies in the country during the time of implementation of Economic Reform Program/Structural Adjustment Program in 1983. After reform, mining companies opened up thirteen major new surfaces mining in the country. Furthermore, 200 mining leases were granted by the nation resulting into 30 per cent of the nation's lands surface area held as mining concessions by mining companies (Vital Statistics, 1998).

The government took major effort to win foreign investors into the sector in recent years which yielded much interest from these investors. It led to wide range of companies from countries like; Canada, South Africa, Australia, Ireland, the United Kingdom and United State of America which holds large interest in most of the mines in Ghana. These countries belong to Organization for Economic Co-operation and Development and they are guided by OECD Guidelines for Multinational Enterprises. The issue is if all these mining companies

attract inflow of FDI into the economy, provides 38% of foreign exchange and only contributes 5 % to GDP, are these companies actually aiding and developing the nation (Hannah, 2005).

Fui Tsikata, in 1997 stated that, "An Environmental Protection Agency has been established in December 1994 (Environmental Protection Agency Act 490, 1994) with powers to promulgate and enforce standards. Neither precise standards nor detailed regulation have as yet been enacted, though impact assessments are now required and guidelines for mineral operations have been formulated" (Tsikata, 1997). Environmental Protection Agency (EPA) was established by law to regulate operations of these companies to protect the environment and various mining communities from these miners. In 2002, Sarpong and Illinois respectfully identified gaps in the Ghanaian environmental laws as "As regards standards, to be enforced, however, there are gaps in the Ghanaian environmental legal regime. There is no legislating regulating the discharge of waste into water, riverine systems or the marine environment"(Sarpong, 2002).

Governments need political will to deal decisively with these issues in order to provide clean water to communities and protect them from related diseases. Taking stock of all these pollutions in the sector, one will like to know if these mining industries are adhering to international standards or just taking advantage of the loop holes in the country to pollute the environment. Globally, social and environmental responsibilities have been addressed by mining industries recently. Lots of factors have contributed to address the extractive industry on key issues to debate on social and environmental sustainability (Cowell et al., 1999). In Ghana, gold is the most important mineral currently being exploited. This mineral accounts for, 90% on the average of total value of minerals won (Akabzaa and Darimani, 2001). Since the commencement of reforms, the mining industry on a whole provides 50% of foreign direct investment flows into Ghanaian economy. These statistics of the sector changes from year to year. Its contribution to state tax revenue is around 4% while labor employment accounts for 0.7% of working age force (UNCTAD, 2005; Baah, 2005).

The Recovery Program policies and institutional reforms of the mining industry have resulted and renewed confidence in investors which contributed to increase in exploration and mining boom in the last two decades in the country (Coakley, 1999; Akabzaa, 2000; Aryee, 2001). Ghana adopted the World Bank and IMF prescribed structural adjustment package and other African countries in the 1980s to eradicate decline in the economic performance of the nation. The main objective of the reform sought to improve the competitiveness of extractive

industry and make it attractive to private foreign investors, modernize and provide resources to important mining sector governmental institutions to help mining companies and aid with information to assist investor's demand. Mineral Commission was established with the purpose of achieving this means. The promulgation of the country's first independent mining code was initiated in this era. The Minerals and Mining Law, PNDCL 153, of 1986. During 2006, this law was revised as Mineral and Mining Act, A703. This law stipulates and streamlines all mineral rights licensing procedures, encouraging competitive fiscal regime and the establishment of quota for minerals sales to be maintained by companies in offshore account. The extractive sector generated US\$ 6 billion dollars' in 2005 which worth Direct Foreign Investment (DFI) of almost 60% of the country's annual budget. In 1984, annual gold production increased from 282,299 ounces to 2,143,000 ounces in 2005 and later increased to 2,629,290 ounces in 2007. Bauxite from 44,169 tons to 606,700 tons in 2005 to 1,033,368 tons in 2007, manganese from 341,978 tons to 1,719,589 tons later to 1,305,809 tons and diamond from 341,978 carats to 1,065,923 carats and 839,235 carats during the same period. There was an increased in mineral exportation from US\$115.3million in 1984 to US\$ 995.2million in 2005 and further to US\$1,793,343,307 in 2007. The most identified mineral exported was Gold which recorded over 90% of total value (Hannah, 2005). In 2011, major minerals appreciated, Gold was 3,604,498 Oz, Diamond 283,369 carats, Bauxite 407,918 MT and Manganese 1,705,314 MT (Mineral Commission, 2012).

The contribution of the extractive sector to the economy of Ghana is very important in terms of revenue, infrastructure, cooperative social responsibilities, employment and other related aspects and activities. Mr. Agbeko Azumah, Communication Manager of Newmont Ghana informed the media that out of the company's employees of 4, 706; 96% of them are Ghanaians. Detailed information however indicated 52.25% are not from communities in which company has its concessions, 38.01% are employees from the various concessional communities and only 4.74% are expatriates. This an effort adopted by Newmont Ghana Ltd to fulfill its' cooperate social responsibility to indigenes and non-indigenes of communities and also adhere to Government principles of giving opportunities to its citizenries. Newmont Ghana indicated that since its operation from 2006 to date, it has created 48,000 jobs for the nation which is said to be direct, indirect and induced jobs created by the company (Ghana Business News, 2011). The sector needs to assess its environmental policies to protect communities in which they mined. It's very important to notice the contribution of the sector as well as monitoring the environmental implications. Environmental Impact Assessment

needs to be carried on regular basis to inform, educate and make sure they adhere to international standard of disposing of waste and mining. Effective monitoring of situations will aid the country to achieve some of the Millennium Development Goals as clean drinking water, etc.

The sector became attractive after Economic Recovery program and Structural Adjustment Program policies was introduced into the sector when it was liberalized. Sectors of economy which can generate export revenue were major priority of the reform. The biggest gross foreign exchange earners are mining and cocoa sector which got immediate attention with the aim of boosting investor's desire. ERP/SAP aimed to restore production incentives and prices, solve inflation problems, aid to reduce budget deficit, realign interest rates, , set proper priorities for the allocation of scarce foreign exchange, rehabilitate economic and social infrastructure, improve government finances and getting states currency with major currencies of the world and eradicate black marketing and smuggling (Nyanteng,1997). The SAP also aimed at issues of considering a feeble financial system which prevented private investment and savings mobilization, declining exports, ineffective public administration and unproductive industry, etc.

Main targets of Structural Adjustment Program aimed at (Akabzaa and Darimani, 2001);

1. Improve resource use, with particular reference to public sector.
2. Ensure fiscal money stability.
3. Establish an incentive framework to strengthen the balance of payments, encourage savings and investment and stimulate growth.

The Economic Recovery Program has major components which can be identified as;

1. Eliminating or reducing budget deficit.
2. Gradual eliminating of price and distribution controls.
3. Flexible exchange rate policy.
4. Introduction of sector specific rehabilitation and infrastructure programs to increase management and restore the potential for growth.
5. Intensive policies for the export sector, especially cocoa and mining.
6. Immediate adjustment of administered prices to reflect changes in the exchange rates and other cost, inclusion of prices of energy.

The restructuring of key export sectors with emphasis on mining by the structural adjustment program included need for a coordinated program of rehabilitation of state controlled mines, an acceptable degree of management autonomy, combine with monetary assistance with view

to solve the downward trend of production and gradual process to divestiture these mines to private investors were recommendation of World Bank policy. Some of these policies include;

1. Reconstruction of country's social infrastructure and economic.
2. Encouragement of private sector development.
3. Readjustment of price and incentives system in favor of the production sector, with keen interest in the export sector.
4. Gradual liberalization of the economy and reduction in government intervention in the economy.
5. Reformation of monetary and fiscal discipline.

To achieve these targets under the ERP, certain measures were adopted under three major broad headings as;

1. Institutional/sectorial restructuring, example as divestiture of state-owned companies, financial sector reform.
2. Physical rehabilitation programs and development of the economic and social infrastructure as schools, hospitals, public buildings and roads.
3. Reform in policies such as foreign exchange regime, the external value of the cedi, public sector management, import trade, budgetary policy on deficit financial sector reforms and external distribution (Akabzaa and Darimani, 2001).

The contribution of the mining sector brought about these SAP since it's the major contributor to gross foreign exchange, therefore priority attention was focused on it with purpose to increase production and productivity of the sector. It's been identified that it led to two various policies as macroeconomic and sector reforms were identified. (Songsore et al., 1994). Typical reforms in the mining sector pointed to;

1. Privatization of state mining assets.
2. Legislation of environmental laws and other mining sector legislative changes.
3. Changes in mining laws to make the sector attractive to international or overseas investments.
4. Appreciating fiscal liberation of the mining sector.
5. Reorientation of strengthening of government support institutions for the mining sector.

The macro level of the policy focused on reform of state-owned companies and management of public sector, promotion of export policies, trade policy liberalizations and import

liberalization were serious issues in transforming mining sector. The structural adjustment program was introduced over the years slowly. The mining sector policies targeted at increasing the worth of existing mines through rehabilitation. The policy made mines to acquire loans from bilateral and multilateral financial companies and these were guaranteed by the state for expansion and rehabilitation whilst other enjoyed management contracts to improve their efficiency. All mining enterprise had substantial financial support for expansion, rehabilitation and various groups of investors under management contact agreements. The privatization exercise which was the second stage took place in various forms as; commitments of state to systematically sell its shares in these mines owned by the state to private investors (Songsore et al., 1994). The shares of the state was 55% originally but reduced to 19% in 1998 and currently with AngloGold Ashanti is the majority share owner of the mine, state shares reduced to 2.95% as been held by Government of Ghana. In Ghana, Bauxite Company Limited, Bosia Minerals Group Co. Limited in these companies, the Government reduced its shareholding to 20%, Newmont Ghana Gold Limited is a sole Private Corporation with 100% ownership, etc (Bermúdez-Lugo, 2010).

Under the policy, government wants to maintain a statutory of 10% and completely divestiture 90% of its shares in mining firms to private firms but initial arrangement were involving these foreign companies in management contracts. Some were bought after they realized it's viable. Tarkwa mine which was managed by Goldfields South Africa from 1993 to 1994 finally bought it in 1995 due to viability of the mine; Prestea mine managed by another firm from South Africa called Johannesburg Consolidated Investment from 1995 to 1996 also purchased it in 1997 whilst Ghana National Manganese Corporation and Dunkwa Goldfields were sold outright to private investors with Ghana Consolidated Diamond given to De Beers for management but were unable to purchase it (Akabzaa and Darimani, 2001).

2.4 Major minerals structure, legal reforms and fiscal liberalization of the sector.

There are various minerals mined in Ghana which dated back to several years ago and currently the exploration of crude oil in large quantities. Some of these minerals are mined on large scale whilst others in small quantities such as; Salt, Limestone and Lime. Aluminum is mined but not on large scale like Gold, Diamond, Bauxite and Manganese. Major players in the mining sector are AngloGold Ashanti with its base in South Africa and owns 100% shares of the mine, Newmont Ghana Limited owns 100% shares which is a USA company, Golden

Star Resource Limited (Bogoso/Prestea) has 90% shares and Government of Ghana 10% also an American company, Chirano Gold Mine Limited with 90% and 10% for GOG, Ghana Australian Goldfields (GAG) an Australian company, etc. There are some huge investors in gold mining sector whilst diamond sector, the state is the sole owner of Ghana Consolidated Diamonds Ltd. Ghana Manganese Company Ltd (Ghana International Manganese) mining can boost of 10% shares for GOG and 90% for private investor (Akabzaa and Darimani, 2001; Bermúdez-Lugo, 2010). Large artisanal miners are into various mineral mining which is solely owned by indigenes and reserved purposely for Ghanaian citizens with leases granted for a period not to exceed 5 years after expiration of the license. The license may be renewed by Mineral Commission upon determination of another period (Parliament of the Republic of Ghana, 2006).

The 1992 constitution of Ghana entreats the country to adopt appropriate steps to promulgate regulatory instruments or laws to protect the national environment for posterity and to cooperate with other nations and institutions to safeguard the international environment for the purpose of protecting the broader international environments for mankind (Constitution of Ghana, 1992). In order to regulate and manage the sector effectively and efficiently several laws or legal instruments have been promulgated or reviewed to aid this process after the liberalization and reform of the sector in 1983. Based on the provision of 1992 Constitution, Parliament of Ghana passed the Environmental Protection Agency Act in 1994 (Environmental Protection Agency Act 490, 1994) to regulate the sector. This agency has basic task to perform in line of its duties as; to ensure environmental permits and pollution abatement notice in compliance with any laid down environmental impact assessment procedures in the planning and execution of development projects and existing project compliance. Various auxiliary legislations on the environment have been issued by the body as Environmental Impact Assessment, Environmental Audit and Management Plans based on the Act 490 of Environmental Protection Agency (Environmental Protection Agency Act 490, 1994).

Pursuant to the 1994 National Environmental Policy (NEP) the Agency came out with Mining and Environmental Guidelines with the purpose of aiding mining firms to mine in acceptable manner. Under the guidance, it's compulsory for new mining companies to prepare Environmental Impact Assessment (EIA). Companies which are already in existence must prepare Environmental Management Plan. Intension of these is to adopt modern and precautionary controls into the design of new mining projects and to ensure self-assessments

of industries. During 2006, Mineral and Mining Act 703, entreat holders of mineral right to have due regard to the effect of mining operations on the environment and to adopt good steps which may be necessary to mitigate pollution of environment due to result of such mineral operations in the country (Mineral and Mining Act, 1994). The legal framework for the sector can be identified in;

1. Constitution of Ghana, 1992
2. Mineral and Mining Law,1986,PNDC 153
3. Establishment of Mineral Commission,1986,PNDC 154
4. Regulations for Mineral and Royalty,1987, L.I.1349
5. Enactment of Small-Scale Mining Law,1989,PNDC 218
6. Precious Marketing Corporation Law,1989,PNDC 219
7. Environmental Protection Agency Act,1994,490
8. Mining and Environmental Guidelines,1994
9. Minerals and Mining (Amendment) Act 1994
10. Establishment of Environmental Impact Assessment Procedure,1995
11. Ghana Environmental Assessment Regulations,1996, L .I.1652
12. Revise of mining and environmental guidelines,1999

The overall objective of the World Bank to reform the economy is to develop governmental agencies in the mining area with the purpose of supporting sustainable development of mining sector on environmental friendly bases through application of strengthened mining bodies and well improved technology. The targets were to increase the capacity of mining industry bodies to perform their objectives of encouraging and regulating investments in the mining area in an environmentally friendly manner and develop tactics and mechanisms that will increase financial viability, environmental impact of small-scale mining operations and improve productivity (Minerals Commission, 2010).

2.5 Incentives granted to mining companies and forms of ownership in the sector.

Liberalization of the economy came with new initiatives to encourage private entities to invest into the country's economy to increase export, foreign trade, etc. To lure major investors especially into mining sector, various forms of incentives or concessions granted to investors which on one way or the other would not increase their cost to invest in the country or mining sector. These concessions are granted in the PNDC 153 with additional

amendments, in PNDC 122 and L.I. 349. These incentives are granted in Minerals and Mining Law for investors and are identified as (Biney, 1998);

1. Exclusion from payment of customs import duties of plant, machinery, equipment and accessories imported specially and purposely for mineral operations and may after establishment of the company receive more relief from payment of customs and excise duties as stipulated in the Mining documents;
2. Exclusion from selective alien employment tax under the Selective Alien Employment Tax Decree, 1973 (N.R.C.D.201);
3. Deferment of payment of registration and stamp duties for a period not exceeding five years, to be granted by the Minister for Finance in consultation with the Minister for Mines and Energy, where they are satisfied that the circumstances prevailing at the time of the application for the benefit, justify such deferment.
4. Personal remittance quota for foreign employees free from any tax compelled by any enactment for the transfer of any external currency out of the country;
5. Exclusion of staff from payment of income tax relating to furnish accommodation at the mine site;

Minerals and Mining Law identified one most important feature of sizing down corporate income tax liability and the provision of more specific allowances that targeted eliminating the general tax liability of mining sector operations. Corporate tax in 1975 was 50-55% decreased to 45% in the year 1986 further minimized in 1994 to 35%. To allow investors to regain their initial capital investment, capital expenditure was appreciated from 20% in the first year of production and 15% for sub-sequential annual allowance in 1975 to 75% in operation of the first year later 50% for sub-sequential annual allowance in 1986. In 1975, when the royalty rate was 6% of the total value of minerals, it was reduced in 1987 to 3% to boost the interest of investors in mining (Songsore et al., 1994). In 2006, the Mineral and Mining Act (703) was amended (section 25) with the aim of pegging a fixed 5 % of royalty rate on overall income from minerals by all firms with mining license in the country by Government of Ghana which is the legal framework for the sector (Republic of Ghana Constitution, 2006; Ministry of Finance and Economics Planning, 2010). This percentage still falls within the previous one in the law, thus 3% to 6%. The objective of establishing fixed rate is to prevent industries preferring the lowest instead of highest. Some custom duties which were there before the reform took place were all scrapped to boost the sector.

In 1986, Mineral Commission was established with the purpose of eliminating bureaucracy and providing all services for investors under one roof. The Commission is to formulate regulations, amend and modify existing laws necessary to set up a sound regulatory framework for the industry, standards and guidelines for monitoring of mining activities of the environments developed by the commission. The Minerals Commission recommends mineral policies, promotes, develops mining industry procedures, and advises government on mineral matters and reviews issues (Akabzaa and Darimani, 2001). Mineral operations in Ghana are in two folds as large-scale and small-scale mining industries. Large-scale is very capital intensive with concession exceeding 25 acres while small-scale mining concession does not exceed 25 acres and is less capital intensive. Newmont Ghana Ltd, AngloGold Ghana, Ghana Australian Goldfield, Golden Star Resource Limited (Bogoso/Prestea), etc. are examples of some large-scale mining operations. Small-scale mining operators must register with Mineral Commission to undertake artisanal mining, with an average land size of 25 acres. Activities at the mining site are supervised by the mines inspectorate department of Ghana Mineral Commission. Small-scale sector comprises of individual, small and medium size mining companies (Mineral Commission, 2012).

There are over 200,000 informal illegal gold winners in the country which are all spread throughout the country. The Precious Minerals Marketing Company (PMMC) purchased minerals especially gold and diamond from these small-scale and *galamsey* operators and ship outside on behalf of miners or dealers and other individuals in the sector. Gold purchased increased from 1989 to 2010 from these operators amounted to over 851,030 ounces approximate worth of US\$ 467 Million (PMMC, 2012). The *galamsey* operators contribute significantly into the economy in terms of gold and diamond production.

The production of Gold which does not include metals from small-scale and artisanal mining in 2010 reduced by 4% to 76,332 kilograms (kg) compared with previous quantity of 79,883 kilograms extracted in 2009. Manganese production increased by 20% and diamond reduced by 11% thus 420,000 metric tons and 334,000 carats respectively (Bermúdez-Lugo, 2010). Production of Bauxite in 2010 was reported as 512,000 tons. Exploration work at Awaso is to be carried out with purpose of increasing production in conjunction with Sichuan Metallurgical Geology Bureau. Government of Ghana still has 20% interest in the Awaso Mine (Bosai Minerals Group Co. Ltd, 2010; Mingle, 2010; Rio Tinto Alcan Inc, 2010).

2.6 Support schemes by Government of Ghana to grow small-scale mining.

To legalize mining activities of artisanal and monitor their operations, the Small-Scale Mining Project (SSMP) was launched in 1989 to formalize their operations and follow international or acceptable standards in the course of their work. The Minerals Commission, Mines Department, Geological Survey and Precious Minerals and Marketing Company were institutional bodies tasked to provide a helping hand for the project. These main institutions were identified as main pillars of the project initially. They have specific role to play in the success of small-scale mining in Ghana. Firstly, Mineral Commission was tasked to employ district officers for the project; mine wardens to be employed by the Mines Department; mineralization and identification of suitable locations for small-scale mining was given to the Geological Survey and finally, PMMC duty was to take record and buy these products from the miners through licensing agents that the body has licensed (Minerals Commission, 2012). The Minerals Commission controls all small-scale responsibilities after these sectors finalized their task.

To formalize and regularize small-scale mining operations in Ghana, the country adopted most important step towards the sector sustainability. “Legalization, intervention and control are keys to eliminating unacceptable work practices and the illicit marketing of minerals and are a necessary prerequisite for removing operational constraints limiting productivity and competitiveness” (Noetstaller, 1994). These means led to creation of legal framework for use of state but have not materialized to the benefits of artisanal who had used illegal methods of mining before enactment of pertinent legislation. There have been several educations to promote environmental improvements in communities with small-scale mines such as climate and air quality, water bodies, geology, soil, ecology and sensitive environmental issues. From 1990s, Minerals Commission sponsor lot of research work on mining related issues but recommendations are yet to be put into practice since lack of resources and manpower have hindered implementation of these research. The Government of Ghana did mandated PMMC to be competitive by providing a rate for mined gold and diamonds to meet world market price as identified in World Bank technical paper titled, *Staff Appraisal Report, Republic of Ghana, Mining Sector Development and Environment Project* (World Bank, 1995), Before 1993, gold-buying price at PMMC was at world market price minus 3 per cent as its commission and Land Rehabilitation Fund. This price was not competitive to that of unauthorized dealers and for that matter strategic decision was taken in 1993 to reform the

sector and fix prices weekly with guaranteed rate of 98 per cent world market price. The strategy affected purchases of small-scale mining positively in that particular year.

In the 1990s, World Bank did lot of research in the small-scale mining industry in Ghana through its Mining Sector Developing and Environment Project launched earlier in that period. Objectives of World Bank project 'is to support the sustainable development of country's mining sector on and environmentally sound basis through application of improved technology and strengthened artisanal bodies '.The project of World Bank was to provide testing of artisanal mining equipment to aid yields and productivity; provide information on geology to small-scale miners; improve legal or regulatory framework of artisanal and to reclaim abandoned land (Hilson, 2001). The World Bank provided some ingredients into initiatives of the Bank but lot of these additional services and tactics have declined especially environmental-related activities. The establishment of district support centers initially was seen as most important decision to provide registration of small-scale miners locally and buying of precious metals from miners. Additional services are needed as locations of centers are centralized within prospective mining communities. Some of these services range from management of environment through education to training of staffs. Initially, eight (8) small-scale mining district centers were constructed in the southern Ghana. These offices has mine engineer and mine supervisors each with purpose of providing technical advice, registration of claims and productive operations of mines and encouraging of safety (Davidso,1993). These offices draw site plans, meet with the public and provide basic equipment to artisanal such as compactors, etc.

The Mineral Commission introduced three horsepower water pumps (to be used for alluvial mining), sluice boxes and pick axes under the sponsorship of Gesellschaft Technische Zusammenarbeit (GTZ) an NGO from Germany. It was an initial step to improve the technological aspect of small-scale mining in the country. This equipment were stored by Mineral Commission and sold by district officers to miners at higher prices and later were too much above small-scale miners financial targets. Majority of equipment were not bought or finally sold off at a loss as a move of disappointment and income from these sales went back into the project (Hilson, 2001). The Commission later consulted Central Regional Development Commission on recommendation of provision of equipment which later could not work out due to knowledge transferred from fishery industry to mining sector do not correspond.

2.7 Large-scale and small-scale miners' dispute over land with proposed measures adopted to resolve them.

In mineral-rich developing countries, companies operating there faced peculiar problems of equitable resolution of disputes between small-scale and large-scale mining. Operations of large-scale mining are hugely mechanized with lot of small-scale activities as well (UN, 1996; Kambani, 2000; Hilson, 2002). Dispute between artisanal and large-scale miners in Ghana resumed alarming proportion while they have all contributed significantly to the economy due to ERP/SAP introduced by the government in the sector. Ghana produced 70 tons of gold in 2003 and Africa's second largest gold producer (MBendi, 2004). The formalization of the sector in 1989 by legalizing of small-scale mining for indigenes under supervision of the World Bank brought modification of tax codes; non-performing state enterprises have been privatized, etc. Moreover, some illegal miners (*galamsey*) mined without license and mining beside these registered miners create many problems within almost all mining communities in the country. The increase in demand of mineral lands by large-scale miners in the country led to much disaffection between mining parties since these *galamsey* operators do not have license and when these concession are given to multinationals it creates tension between local people and foreign nationals. Mining affected communities different ways and it led to Coalition of Civil Society Groups Against Mining indicated that; "Ghana's growing foreign investment and production in the mining sector has been destroying the national economy, the environment, community livelihoods and human rights over the last twenty years" (Crop Watch, 2003). Over 30 000 people were displaced in Tarkwa District in Ghana between 1990 and 1998 with forest lands destroyed, contamination of rivers and farms destruction (Earthworks and Oxfam America, 2004). In the year 1997, Ayling and Kelly reasoned that artisanal has high influence of land dispute because different interest group compete for scarce amount of resources and are lacking legitimate, clear rights of access (Ayling and Kelly, 1997).

The misunderstanding between small-scale and large-scale miners is very high since indigenous people believes they hold cultural ties with land while large-scale miners also claimed appropriate procedures were adopted to acquire concessions therefore they are legal owners. Mining institutions have been blamed due to procedure adopted for granting concessions to large-scale miners by NGO and representatives indigenes on exceedingly- and often unnecessarily-large concessions given out for longer periods (ILO, 1999). Small-scale miners experience hiccups in getting appreciated land for mining due to these large plots

given to large-scale miners that further increase hostility between them. The government contributed to these hostility because they have made it a hobby of given unproductive lands to small-scale miners which contributed to these artisans trespassing on concessions of large-scale miners (Hilson and Potter, 2005). Significant revenue maybe generated by small-scale miners since its very labor intensive most importantly rural communities where alternative job opportunities are less paid and limited to find. Indirect employments in other parts of economy are created with direct employment contributions of artisans (Amankwah and Anim-Sackey, 2003). The real intension by the GOG is to promote large-scale mining for its recognition and illegal small-scale mining public negative perception of their operations. These illegal miners are often blamed in the country both in audio and print media for their social vices such as child labor, mining on legal miners concessions and damaging of environment, etc.

The Western Region in Ghana has 50% of total gold in the country and in 2005, the GOG announced to eliminate these *galamsey* operators in the region and it's a place which is prone to land dispute. These announcement actually increased commotion and conflicts in greater mining areas in the country. Currently studies has actually indicated that policies of small-scale mining has marginalized prospective indigenous mining groups which further increased illegal mining in communities (Nyame, 2002; Amankwah and Anim-Sackey, 2003; Hilson and Potter, 2003). Bureaucratic procedures and financial cost of acquiring concession for small-scale mining actually contributed to these illegal operations in the country in addition to few lands available for indigenous miners since most land are allocated to large-scale miner. Looking at numerous disputes in the sector between small-scale, large-scale and illegal miners in the country, various strategies have been adopted or proposed to solve them in other to bring understanding to these mining communities and achieve maximum revenue for the state.

Registration

The GOG adopted correct approach by registering small-scale mining in Ghana; therefore there is need to ensure everybody in the industry is registered to bring sanity into the sector, with respect for everyone's concession allocated plot of prospecting. The activities of small-scale miners maybe illegal if processes of acquiring permit become difficult and unbearable for prospective small-scale miners or indigenes to venture into (Andrew, 2003). In Ghana, these illegal mining increased due to bureaucratic nature of obtaining permit, in addition to

the cost attached. Many *galamsey* operations have been abolished yet lot are still in the system without been registered (Hilson and Potter, 2003) which means that registration process is not effective therefore additional problems in the system must be eradicated to make it effective. A comprehensive review by Hilson and Potter has underpinned certain criticisms leveled against the registration process and these are outlined below; (Hilson and Potter, 2003; 2005).

1. Lack of insufficient institutional support from departments set up specifically to help registration processes. An example is insufficient staffs; funds and lack of basic facilities have affected effective operations of these departments.
2. The numerous hindrances of licensing process acts as disincentive for artisanal in the sector to legalize their operations which compound complex legislation and procedures for acquiring licenses; the long duration of the process; difficulty in documentations; disproportionate cost of registering and inadequate life-span of permit once awarded.

Many remedies to the difficulties underline in the process have been identified as:

1. There should be introduction of re-skilling program for artisanal operators in alternative and sustainable employment.
2. The state should strengthen and reiterate its interest to registration process and think more tactically about the status of the small-scale mining industry with the economy of Ghana (Hilson and Potter,2005).
3. There is the need to restore the confidence in registration process and legalized artisanal with procedures fast and simple in addition to increasing the land tenure to 10years whiles support services being improve effectively.
4. Effective deliberation between all stakeholders like illegal miners, small and large scale miners, local and external communities, etc. to work in unity towards improving the process.

Sustainable and alternative livelihoods

To address illegal mining and conflict on land use dispute between operators in the sector, sustainable and alternative livelihood program have come up for consideration to mitigate these menace in the sector. In recent years, the approached has received much attention since the inauguration of the United Nation's Development Program Sustainable Livelihoods Projects (UNDP, 2005). The concept of sustainable livelihoods approach is very broad but it refers to; "the creation of conditions that are (self-) supportive of sustainable development

(...) which, whilst safeguarding resources and opportunities for future generations, provides individuals with means to provide themselves with food, shelter and an acceptable quality of life ” (Stockholm Environment, 2006). Alternative and sustainable livelihood program are adopted in developing countries to solve and eliminate poverty in communities and Ghana. Mostly *galamsey* operation is seen basically as poverty-driven activity; therefore these programs are adapted to re-skill these operators in alternative and sustainable livelihoods (Hilson and Mohammed, 2006). In view of mining companies, these programs were adopted with intention of reducing communities’ economic dependence on mines in other to help mining communities to be self-sufficient after mines are closed.

There are some potential difficulties of livelihoods programs since *galamsey* operators would be doubtful of moving from known sector which they know very well to working within complex employee set-up (Hilson and Potter, 2003). These operators can be assured that alternative employment can better their living standard and quality of life which led to re-training and then illegal small-scale miners would not daunt the program (Ibid, 265).

2.8 Different perspectives of economic and social interventions implemented by mining industry.

Historically, five (5) mining companies were the only mining companies in the country during the time of implementation of Economic Reform Program in 1983. After reform in 1990s, mining companies opened up thirteen major new surfaces mining in the country. Furthermore, 200 mining leases were granted by the nation resulting into 30 per cent of the nation's lands surface area held as mining concessions by mining companies (Vital Statistic, 1998). There has been effort to win foreign investors into the sector recent years which yielded much interest from these investors. It led to wide range of companies from countries like; Canada, South Africa, Australia, Ireland, the United Kingdom and United State of America which holds large interest in most of the mines in Ghana. These countries belong to OECD and they are guided by their guidelines for Multinational Enterprises. The issue is if all these mining companies attract inflow of FDI into the economy, provides 38% of foreign exchange and only contributes 5 % to GDP are these companies actually aiding and developing the nation (Hannah, 2005).

Contributions or Corporate Social Responsibilities are essential ingredient in companies’ success especially in mining industries considering public outcry about their operations in communities. There have been questions about their effectiveness of Corporate Social

Responsibilities initiatives in the mining, oil and gas sector (Frynas, 2005). Moreover, in recent times global extractive industry has addressed its corporate and environmental responsibilities; lot of factors have led to this with the extractive industry keen in debates about social and environmental sustainability (Cowell et al., 1999). Several reasons have been identified by Walker and Howard (2002) why contributions or corporate social responsibilities which are voluntary initiatives are essential for mining companies. These are due to consistent pressure from target groups towards the sector at local and international levels, challenging the industry's legitimacy. A typical example is the opposition of development of a uranium mine at Jabiluka in the Kakadu National Park in Australia by numerous environmental, community and indigenous groups. Campaign targeted at mining industries by large NGOs, such as Oxfam's Mining Campaign and Friends of the Earth International's Mining Campaign (resisting economic globalization). Keeping a license to operate is a constant challenge in the sector. Example is continuous resistance by numerous social organizations to the expansion of gold mining at Mount Quilish Peru that has contributed to Newmont postponement of its activities there (Walker and Howard, 2002).

On the part of industries, it has corporate reasons of contributing to both communities and the state. These are obtaining a competitive advantage, maintaining and receiving stable working environment, maintaining good reputations and managing external ideas which is basically used for interaction with the public and making employees happy in the sense of good staffs for the company, feels positive about the company because they are working with the communities together, good motivation and efficiency (Frynas, 2005). There are pros and cons associated with everything and the mining sector is not an exception to this rule. Mining positively impact to communities such as creation of new communities and wealth, income from export revenues and royalties, technology transfer, skilled employment and training for local populations and improvements in infrastructure like roads, schools, health clinics (MMSD, 2002; CAFOD, 2006).

Several economics and social interventions been accrued to Ghana in different ways. Ghana has allured over US\$ 5billion of direct investment since 1986 into mineral exploration, establishment of new mines, rehabilitation and expansion of old ones (Barning n.d). In other to motivate these companies to contribute to the development of communities and the state, some tax exemptions were granted to the sector. An example is custom duty exclusion of excavator which in effect reduces the cost of acquiring this equipment for smooth mining operations. Total royalty paid to government by mining companies in 2005 stood at US \$

26.76 million and later went up to US \$ 38.46 million and US \$53.80 in 2006 and 2007 respectively. They contributed 6.44 per cent of the state's Gross Domestic Product with labor force of 17,500 (Boon and Ababio, 2009). These companies understand their roles in communities and countries in which they operate.

In effect, they put up sustainable developmental projects to contribute and reduce poverty in those locations that they mine and nation at large. Ghana Statistical Service established that since the poverty rate is said to be reducing, the level of poverty for those who are still poor has not transformed (GSS, 2007). Progress can be made in sustainable development in three dimensions as economic, environmental and social which could be gained through economic development and investment of revenue got from mining operations to ensure communities future development and long-term livelihood of them (Epps, 1996). To achieve these goals of poverty reduction and increase standard of living in communities, several strategic decisions have been adopted by mining companies in the country.

Goldfield Ghana decided to contribute one US dollar (US \$ 1) for every ounce of gold produced in addition to 0.5 per cent of pre-tax profits. AngloGold Ashanti began fighting malaria with its program namely Obuasi Malaria Control Program (Anaman, 2008). In 2010, Yankson identified total employment level of Wassa West District in 1960s as 12 per cent within Tarkwa Township but appreciated to 14 per cent in 2000 as a result of these sustainable developmental contributions of mining companies (Yankson, 2010). However, in order to have well skilled labors for the sector, mining companies financed some local people who are seeking for employment to attend higher institutions to acquire skills which would be important for industries and onward employment. Mining companies in Ghana, normally in their contribution to both communities and state partly can be noticed as provision of manpower training and medical care to employees and households (Figures 2 and 3). There are direct contributions from these companies to various communities in which they are situated for various reason as additional form of good gesture between themselves (Yankson, 2010).

These royalty payments are mandatory by the laws of the land and are paid by them. Mining companies provide social interventions in the country in different ways. These companies provides schools, electricity for communities, Information Technologies for schools and communities, potable drinking water since their operation in one way or the affects pollutes rivers including some economic projects to better livelihood of the people. These projects are aquaculture, production of batik tie-and-dye, rearing of animals and crop cultivation.

(Mitchell, 1999; Cottrell and Rankin, 2000; Hilson and Murck, 2001). Gold Field Ghana Limited foundation also instituted program called Sustainable Community Empowerment and Economic Development Program (SEED) in 2005 at a cost of US\$ 5 million within Tarkwa and Abooso mining leases of the company which consist of 16 villages around its operation as five years program.

The purpose of SEED is "to be a high impact, result focused sustainable and integrated community development program that focuses on economic growth, wealth creation, quality of line improvement, and empowerment through education, capacity building and infrastructure development which can be replicated in mine affected communities all over the world"(Gold Field Ghana, 2005). The purpose of the program is to better the livelihoods and quality of life of poor people numbering 30,000 and vulnerable men, women and children in these communities who are main stakeholders by 2010 (Gold Field Ghana, 2005). Projects initiated during this program are Vegetable cultivation, Livestock rearing, Batik production, Bakeries, Soap production and food processing ,training of volunteers as Community Health Facilitators (CHFs) in collaboration with Ghana Health Service, improving education and livelihood skills of the 16 communities (Gold Field Ghana, 2005). Improving the livelihoods of mining communities, Ghana Chamber of Mines has commission a study on the adoption of common framework which would provide sustainable source to eradicate poverty and create wealth in them. The purpose of this is to look at the Alternative Livelihood Program (ALP) in the long term perspective rather than short term.

Newmont Ghana Gold Limited paid little more than US \$ 47million to the government as her last quarter payment in 2011.This amount consists of US \$ 39million for Corporate Income Tax, National Fiscal Stabilization Levy of US \$ 6million and US \$ 2 million of Mineral Royalties for September in that year since these royalties are paid monthly (Business and Financial Times, 2011). The Ghana Chamber of Mines implemented lot of projects and programs in 2011 with the purpose of improving the socio-economic lives of people in mining communities. These programs implemented are Sustainable Livelihood, Educational Bursary Scheme, Infrastructure projects and Donations.

Youths in these communities had a pilot apprenticeship training skills in Heavy Duty Machine Operations, Welding and Fabrication, Auto Mechanics and Hairdressing were some of sustainable livelihood programs (Yankson, 2010). Total contributions towards these communities in the past year by Ghana Chamber of mines amounted to US \$ 177,117. Gold Fields Ghana Limited, one of the biggest mining company in the country through its

foundation in collaboration with Ghana Health Service constructed a community clinic and nurses quarters for the people of Damang and its neighboring communities which was commissioned in 2012. An amount of US \$ 190,822.94 was invested in the project via Gold Field Ghana Sustainable Community Empowerment and Economic Development Program. Total amount of US \$ 2.8 million has been invested in Damang Community development since the establishment of the Gold Fields Ghana Foundation in 2005 (Ghana Chamber of Mines, 2012). The sector has been doing its best to support various communities in which they operate and the entire nation. Sustainable development is the core aim of the sector and a lot of programs and projects are leading to achieve that goal and eliminate poverty in those areas and Ghana.



Figure 2: Graduate Apprenticeship sponsored by Newmont Ghana, Source: (Newmont, 2013)



Figure 3: Insecticide – treated bed nets sponsored by Newmont, Source: (Myjoyonline.com, 2013)

2.9 Consequences of (small-scale) mining on the environment.

Environmental impacts of small-scale mining operations in Ghana have been grouped into one of three categories by Aryee et al (Aryee et al., 2003). All damage to the lithosphere or land degradation was identified by Aryee as first which was seen as how resident operators leave behind “moon-scraped” surfaces, tracts of agricultural land destroyed and soil erosion inducement. Land degradation on the wider scale has been caused by unplanned prospecting and processing techniques and application of rudimentary mineral extraction. Health and safety is major problems since most of these mine pits are dug closer to communities which is a major challenge and hazard issue (Ofei-Aboagye et al., 2004). Secondly, problems of the environment encircle all impacts against the hydrosphere. River and stream pollutions have seen report and publication (Dankwa et al., 1996 and Akabzaa, 2000) etc. Excessive siltation and discharge of mercury have hindered water sources as result of their usage in the industry. Most of research which aimed at environmental pollution induced by small-scale mining operations in the country targeted on aquatic-toxicological issues (NRS, 1994; Ntibrey, 2001; Lundberg et al., 2002; Bonzongo et al., 2003; Bannerman et al., 2003). Finally, the last one comprises all atmospheric impacts. The release of mercury vapor (methyl) is the basic concern in this context. Extenuation steps have been taken to minimize pollution of methyl compounded with educating miners on its usage and mercury retorts been introduced at

cheaper rates to miners and available at district offices. The UNIDO TherMex retort was advocated by Babut et al., in 2003 after a research he conducted in Dumasi which enable miners to understand the process of amalgamation. The adoption of the retort was also called by Hilson in 2002. Two phase mercury abatement project was implemented by UNIDO in small-scale gold mining industry in Ghana with intention of minimizing mercury emissions. Assessing the environmental and health-related impacts of mercury was the first phase related to small-scale gold mining regions in Ghana which was assessed in 1999. The last phase included the retort usage promotion, primarily, the TherMex model. In 2002, 40 million euros was granted for the mining support under the EU-SYSMIN facility and part of that fund will be channeled to research for further management of mercury (Ofei-Aboagye et al., 2004).

Migrations of people from villages with the intention of searching for employment, resting in the importation of varied, local populations grow which also affects customs and traditions. Prostitutions and sexual promiscuity are on the increase with appreciation of communicable diseases like gonorrhoea, AIDS and syphilis (Akabzaa, 1997; MIME, 2002). Rudimentary operational practices are mostly used by small-scale miners with little respect for the physical environment since they lack the awareness. Furthermore, lots of these ponds of water which persist throughout the raining period turns to be a fertile breeding places for mosquitoes with malaria parasites. A number of publications in Ghana have taken a look at land degradation by small-scale mining operation that has been a major problem of the sector (Hilson 2002a; Hilson 2002b; Action Aid Ghana 2003; Aryee 2003; Aryee et al., 2003).

There was an initiative by the government in early 1990s to post a reclamation bond for small-scale mining that is retaining 3 per cent of gains from mineral sales to PMMC that will lead to land restoration purposes. The initiative generated about US \$ 17,000 during its initial years of introduction. The resulting uncompetitive price led some miners to sell their gold to unauthorized dealers or buyers which affected government to stop the Land Reclamation Bond immediately. The unauthorized market for minerals appreciated when difference in market and buying prices passes 5 per cent (Noetstaller, 1994). In order to eliminate the illegal market activity in the sector, the government agreed to pay 98 per cent of the market price for minerals. Some environmental problems facing the mining industry either small-scale or large-scale are air pollution, water pollution; farmland destruction, etc (Figures 4 – 6).



Figure 4: Pollution of air (toxic vapor and dust from mining operations), (Al-Hassan, 2012)



Figure 5: Polluted Bonsa River, Tarkwa, Source; Field survey, 2013.



Figure 6: Farmlands destruction, (Al-Hassan, 2012)

2.10 Sources of Government revenue

The mining sector generates revenue to the Government of Ghana in various forms. Some internal generated revenues were identified by Akabzaa T and Darimani A in a draft report for SAPRI, 2001 as;

1. Purchase tax and import duty on vehicles
2. Dividends to shareholders
3. Utility bills(electricity and water)
4. Taxes of employees' salaries and social security contributions from employers and employees
5. Locally purchased consumables and equipment
6. Wages, salaries and other emoluments payment to contractors and employees
7. Divestiture of state mining companies and sales of government shares
8. Royalties, concession rents, services, customs and harbor duties
9. Corporate income tax (SAPRI, 2001).

2.11 Challenges of mining industries

Small-scale mining is primarily identified as poverty-related activity which can mostly be found in remote villages of developing countries, where there are less employment

opportunities with less education levels. Simple tools are used in this mining with no or less mechanization and which lack formal business arrangements or legal ownership to sites mined (UN, 1996; Kambani, 2000; Hilson, 2002). There is great potential for land dispute since different groups compete for a limited amount of resources and clear legitimate ownership of access is often lacking (Ayling and Kelly, 1997). Apart from numerous benefits by the country, there are cons of the sector as limited wage-employment opportunities from current mechanized-intensive mining operations, surface mining leading to loss of farmlands, refusal of mining communities with its associated clashes between communities and mining companies as result of environmental issues (Akabzaa and Darimani, 2001), thousands of small-scale subsistence or artisanal gold miners which were not disturbed but now totally displaced (Hilson and Potter, 2005), and with associated disputes with large-scale mining organizations (Aubynn, 2009). Several allegations have been leveled against the sector about its contribution to these communities.

It's been identified by Swift and Zadek (2002) that "while there is a strong potential for Corporate Social Responsibility to make a positive contribution to addressing the needs of disadvantaged communities, there are ways in Corporate Social Responsibility could, whether by mistake or by design, damage such communities" (Jenkins and Obara, 2006). Companies need to include stakeholders in their decision making process to be able to identify their needs and come out with sustainable developmental projects which will involve communities to be part of the project rather than acceptance of something which has been designed by external bodies. However, lack of transparency in the sector based on flow of revenue to communities, the sector formed the Extractive Industries Transparency Initiative (EITI) to tackle these issues and aims at ensuring revenues from the extractive industries contribute to sustainable development and poverty reduction. Non-governmental organization by name WACAM established that 250 river bodies had been polluted by these mining companies and illegal miners in Ghana. This organization identified operations of Golden Star Resources (Bogoso/Prestea) Mine polluted and destroyed six rivers around Dumase namely Aprepre; Wurawura; Akyesu; Pram; Nana Nyabaa and Nsu Abena and two more rivers in Twigyaa. Other companies like AngloGold Ashanti Obuasi Mine also polluted about 12 rivers in Sanso and its surrounding communities in Obuasi leading to places like Odumase and Fenaso lacking good clean water for livelihood (Hannah, 2005). The fact that the law has not stipulated how waste should be discharged specifically, the miners choose to adopt their method to the disadvantage of communities by depriving them of potable drinking

water. Political will is needed to deal decisively with these issues in order to provide clean water to communities and protect them from related diseases. Taking stock of all these pollutions in the sector, one would like to know if these mining industries are adhering to international standards or just taking advantage of the loopholes in the country to pollute the environment. Farmlands are being destroyed by these large-scale and small-scale “galamsey” operators. Environmental pollution comes from these operations which impact negatively on communities by depriving them of the basic necessities, example destruction of their homes, noise pollution, spillage of cyanide, etc. (Hannah, 2005).

2.12 Genesis or development of environmental policies and effect of Environmental Impact Assessment in Ghana.

Mining communities benefit some physical and social infrastructure facilities from mining companies which are established in these areas. Infrastructure is provided in various forms as roads, schools, health posts or hospitals, water and electricity. Most beneficiaries of these social amenities have been communities directly affected with mining operations. These communities are directly affected negatively by mining operations in terms of water and air pollution as well as some forms of environmental degradation. A considerable degree of land alienation is often required by mining. These mining companies can have decisive influence on the areas in which mines are situated while generally mining projects have feeble links with rest of host national economy (Anyemedu, 1992). Introduction of the SAP in 1983 actually affected mining industry in Ghana positively which led to massive increase in production of minerals since introduction of the policy. National environmental regulatory policies have not been put in place to guard increase of minerals as well as the environment and protect mining communities from these negative impacts of mining activities. The absence of guarding environment from mining operations has deepened poverty levels of people in mining communities.

Ghana participated in 1972 conference by the United Nations General Assembly held on the Human Environment in Stockholm, Sweden with objective to give all type of development a human face. Environmental Protection Council (EPC) was created in 1974 by NRC 239 in Ghana with purpose of commitment to global efforts aimed at protection and management of the environment. The introduction of EPC was the beginning of national recognition for environmental issues in Ghana and its inclusion into development main stream. Controlling of chemicals in the country was primary target of Decree 239. This is manifested by the

appointment of 18-member Toxic Chemical Committee by Environmental Protection Council (EPC) with purpose of advice on matters of chemicals on institutions which are involved in mineral explorations (Laura, 1991). Environmental Protection Council (EPC) though established in 1974, it was an advisory body till 1994 when had full agency ship with all powers to regulate environment. The Council began as department under Finance Ministry, later reshuffled under various Ministries until 1992 when it had its own Ministry of Environment before been transformed into Ministry of Environment, Science and Technology (Akabzaa and Darimani, 2001). The existing mineral law has no provision to protect the environment from operations of mining companies.

In 1983, the ERP/SAP was introduced with main target of transforming various sectors of the economy to gain an increased yearly growth rate of at least 5%. The policy introduction seen major reforms in the economic and minerals sector but not much was put in place to combat environmental impacts that may come with reform of mining industries in terms of laws to accept destructions that would come from growth of mining sector. Annual losses to the economy was estimated in 1988 by quantifying it as to the environmental degradation and conservative estimate amounted to 41.7 billion Ghana cedis which represents equivalent of 4% of country's overall GDPs (Coakley, 1999). Environmental Impact Assessment (EIP) was implemented the following year by EPC as form of environmental management tool and requirement for all developmental projects with emphasis on industrial ones. The legal backing was not available for the council to see to the full implementation or enforcing this requirement on mining companies as well as industries. In 1991, National Environmental Action Plan and National Environmental Policy were given the support with their preparation and adoption. The larger framework which was provided by NEP for implementation of the NEAP, to examine all undertakings involving mining that might have a potentially negative influence on the environment and to set put into motion acceptable quality guidelines and standards to be acceptable to public health and safety of environment. Mining and Environmental Guidelines which was published in 1994, has contributed with NEP to address the environmental impact of mining industries with its aim of helping mining companies to perform in a manner that is seen as environmentally sustainable (Feeney, 1998). The EPC was transformed to Environmental Protection Agency in 1994 by an act of Parliament (Environmental Protection Agency Act, 1994) and NEAP and NEP had all the legal support in December, 1994. Environmental Impact Assessment was made a mandatory in the Act 490 for all mining and developmental projects which made it compulsory for new mining

industries to prepare EIA with Environmental Management Plans (EMP) prepared and submitted by existing mines.

The mining industries are compelled to prepare and submit to EPA their environmental report, environmental audit reports and environmental action plans with procedures identified for development projects and mining in the EIA documents. The effect is to ensure periodic assessment of environmental performance of existing mines and to combat any environmental issues that might happen as a result of mining activities in timely manner. The Act 490 gave passage to an Executive Instrument 9, 1999 which was regulation to support issue specifically under areas of NEP and the Act. These regulations are;

- I. Legislative instrument 1652
- II. Environmental Assessment Regulations, 1999

The appointment of certain categories of staffs to EPA as public prosecutors when offences are committed under the Act 490 and Pesticides Control and Management Act 528, 1996 was provision in the Executive Instrument 9, 1999 which provided licenses and permit based on standards for granting it.

The Environmental Impact Assessment is developed to guide and protect the mining environment with use of well-developed laid out procedures in EIA which properly designed as an environmental management tool. The guidelines has some practical negative aspects which do not give room for stakeholders in mining industries inputs to be part of the process even those local affected directly. Main principle of EIA process is that, notice is required from the proponent to be advertised and noticed proposed of project in presses which must be accessible to all or state presses that would allow the public to express their interest or concerns or to comment on the project. After the EIA draft report received, is then published by Environmental Protection Agency for specific interest people or group of people to look at the report and bring out issues in it within 21 days starting from the first day of publication (Tsikata, 1997). The communities which are directly impacted by mining project does not have level playing field in terms of channel for notifying and soliciting information from them as direct input.

The state-owned newspapers or offices of District Assemblies being the primary source of information to the communities are even not accessible to them. In addition, the EIA report prepared in technical language and these local communities do not have the skilled knowledge to read and understand issues identified in the EIA reports which makes the local communities contribution lost or not considered. The Environmental Audit Reports are

handled confidentially and not available to be accessed. A company is not compelled to accept recommendations proposed by an audit report, it's to minimize the negative aspect of mining on the environment due to its confidentiality of the report. This is due to provision in the guidelines that “a company is not obliged to accept all the recommendations of an audit, especially if it considers some of them in practical, too costly or that recommendations do not fit in the operating or management structure of the company” (Graham, 1992). It actually reduced the report to mere submission to EPA. Environmental Impact Assessment does not guarantee effective community participation which is another problem of the report. Information from miners indicated that, involvement of communities in their assessment was agreed upon and implemented but sympathizers argue that community directly impacted are informed appropriately during environmental effect hearings, it is carried out to listen to their concerns regarding the project.

Public relations forums are most of the hearing which are organized by mining firms where discussion based on expected positive economic gains to state as well as local population with little or total downplaying the negative effect of mining (Bird, 1994). The authorities in charge lack the ability to follow up on issues where some objections have been raised about an Environment Impact Assessment. An example is, Mempeasem a mining community with mining company C4 that presented its EIA that was not able to convince local people as to how that would deal with expected social problems and environmental impacts of the project. Social impacts of mining projects are not dealt with EIA adequately when social issue are based on just payment of money as form of royalties and compensations (Kesse, 1985). Considering these, Mineral Commission proceeded to issue company with mining lease whilst feedback is still expected by Kyekyewere community on public forum held in September, 2000; resettlement action of the community began by Abosso Goldfields.

2.13 Initiatives of EPA to control mining industries and social, health & environmental impact of mining in Ghana.

For the Environmental Protection Agency to control the mining companies effectively, AKOBEN system was design with more than one hundred performance indicators which has qualitative and quantitative data as well as visual information assigned to rate, monitor, assess and disclose environmental performance of mining companies in the sector to conform to international standard. Based on the objectives of Ghana National Environmental Policy to find and implement an appropriate incentives and sanctions to enforce and ensure compliance

regulations in the industry (Allotey et al., 2011). The responsibility of National Environmental Policy stated that there should be need to adopt most cost effective means to achieve environmental aims, use of incentives in addition to regulatory measures and take part in public participation in environmental decision-making. To carry out these duties and implement mandate of Ghana Environmental Protection Agency to be in line with principles of the National Environmental Policy. Environmental Protection Agency known of the use of old ways of doing things, that's "carrot and stick" approach decided to adopt a modern program named **AKOBEN** approached after the use of several programs over the pass decades to regulate the sector. AKOBEN program is an Environmental Performance Rating and Disclosure System adopted for manufacturing and mining companies (Allotey et al., 2011).

The name AKOBEN is a symbol adopted from Ghana's traditional Adinkra symbols and signifies Vigilance and Wariness that is a "set of behaviors which is pertinent for issue of environmental and conservation." or represents alertness and readiness to serve a good cause (Figure 7). The method used to rate AKOBEN program forged to reflect environmental values of Ghana. Physical and human environment are included in the rating method of the program due to the environmental values of Ghana. Indonesia was the first to introduce environmental rating and disclosure initiative in 1995 (Afsah et al., 1997). Pollution Control Evaluation and Rating (**PROPER**) by Indonesia cannot be compared with AKOBEN because there are important differences between them. Most importantly, PROPER program rating criteria for assessing the mining sector is yet to be published whilst AKOBEN is the first kind in the universe with detailed rating environmental methodology for mining sector. In the mining industry specifically, AKOBEN is an important contributor to the current global attempt in the rating of environment and public disclosure (Sekyi, 2011).



Figure 7: AKOBEN SYMBOL, Source: ADINKRA.ORG

The rating method adopted by AKOBEN in the mining sector considers environmental performance of a company into five (5) code colors which can be communicated easily to the public at large. These colors can be identified as GOLD; GREEN, BLUE, ORANGE and RED (Table 1). Quantitative, qualitative and visual information rating methodology is used to comprehensively evaluate the performance of environment of mines. It is practical approached designed to measure environmental performance also targets minimizing the use of vague or problematic indicators in the mining sector. It nailed its indicators down to those that can be validated by a third party, verified and measured. These categories of colors represent five (5) environmental performance levels specifically. Explanation of these colors can be found in the table below;

Table 1: Meaning of AKOBEN Colors

Rating Level	Performance	General Description
RED	Poor	Failed to follow environmental law(LI 1652),shows pattern of chronic exceedances and creates risks from toxic and hazardous waste mismanagement and discharges
ORANGE	Unsatisfactory	Exceedance of regulatory standards for non-toxic, weak environmental monitoring and incomplete fulfillment of reclamation bond criteria
BLUE	Good	Adequate compliance with environmental standards and reclamation bond criteria
GREEN	Very Good	Blue + adopts voluntary initiatives and is responsive to public complaints
GOLD	Excellent	Green + mine site follows its corporate social responsibility policies.

Source: Environmental Protection Agency, Government of Ghana, 2012.

Social criteria of AKOBEN, comprises two main factors as Responsiveness to Communities Complaints which is in relation to the environment and Corporate Social Responsibility Programs which is commitment by your own institution. Environmental complaints as identified by the AKOBEN program include some complaints as identified as (Sekyi, 2011);

- I. Affect noise and ambient air quality due to dust
- II. Related operation and do have effect on the welfare of the communities which are closer to mining project, and

III. Water resources been affected by concessional areas of the project.

Mining sector contributes significantly to Gross Domestic Product or the economy in Ghana but with its shortfall in terms of impact on environment and society as a whole. Lot of challenges facing the industry in one way or the other is affecting developments both in mining communities and nation at large. Some of these adverse impacts on the cultural values of people and social organization are identified as follows; (Akabzaa and Darimani, 2001).

➤ Youth unemployment

Activities of mining companies have resulted in unemployment either directly or indirectly. Large-scale surface mining resulted in large tracts of land taken from farmers and rendering them jobless since they cannot be employed in mining companies because they lack the skills needed.

➤ Family disorganization

There are serious problems with relocation and settlement packages implemented in mining communities due to resettlement accommodation of families have hugely affected their long establishment family network. Sometimes house provided as resettlement places are not up to standard to be occupied by family since their sizes are too small for household which were previously living in 5 or more bedrooms house.

➤ Prostitutions

This is a major negative social impact identified in large highly populated towns. It has been identified as major reason for loss of social values in the communities and confirmed by over 70% communities approached for their opinion on the subject.

➤ Chemical pollution

Chemicals like mercury and cyanide used to process ore account for major pollutants of our water bodies and the surface (Figure 8). Mishandling, poor storage of explosive and misuse of chemicals could also lead to pollution of the environment and killing of species in water bodies. Other related problems are; airborne particulate matter, accidents as result from *galamsey* operations, eye diseases especially acute conjunctivitis, vector-borne adverse diseases like malaria, schistomiasis and onchocerciasis, respiratory tract diseases, especially pulmonary tuberculosis and silicosis, mental issues, vegetation and degradation of land, high cost of living, drug abuse, etc (Akabzaa and Darimani, 2001).



Figure 8: Chemical /Mercury pollution, (Al-Hassan, 2012)

Samples of water were obtained in some mining communities in Tarkwa which was analyzed by Environmental Chemistry Division of the Water Research Institute of the Council for Scientific and Industrial Research (CSIR) in December, 1998 (Tables 2 - 4).

Table 2. Samples of water obtained and assessed communities around Tarkwa

PARAMETER	Guide Value for Maximum Concentration in Drinking Water			Sampling Stations			
	EU	WHO	USA	NKWANTA KROM (streams)	DAMANG NKRAKRA (STREAM)	DAMANG TAMANG (STREAM)	DAMANG (BOREHOLE)
PH	6.5-8.5	6.5-8.5	6.5-8.5	6.46	6.70	6.52	6.33
Colour(Hu)	20	15	15	700	150	150	<5
Suspended solids (Ss)	4	5	1-5	138	17	37	19
Zinc(Zn)	0.1	3.0	5.0	0.05	0.04	0.02	0.05
Cadmium(Cd)	0.005	0.005	0.005	<0.01	<0.01	0.02	0.01
Manganese(Mn)	0.02	0.5	0.05	8.89	0.05	2.4	0.1

Iron(Fe)	0.05	0.3	0.3	0.4	1.8	2.4	0.1
Chloride(Cl)	25	250		7.4	7.8	6.1	8.1
Nickel (Ni)	0.05	0.02		0.04	<0.01	0.11	0.04
Faecal Coliforms (Counts/100m)	0	0-3	1	146	64	68	1

Source: CSIR, December, 1998. Results are in mg/l except pH and where otherwise stated.

Table 3. Samples of water obtained and assessed communities around Tarkwa

PARAMETER	Guide Value for Maximum Concentration in Drinking Water			Sampling Stations			
	EU	WHO	USA	MILE 7 (Well)	MILE 8 (Borehole)	YAWMAN UKROM (Well)	ATEKYENSU TECHIMANVI LL (Stream)
PH	6.5- 8.5	6.5- 8.5	6.5- 8.5	6.38	5.79	6.67	5.94
Colour(Hu)	20	15	15	5.0	5.0	350	250
Suspended solids (Ss)	4	5	1-5	12.0	10.0	36	22.0
Zinc(Zn)	0.1	3.0	5.0	0.03	0.09	0.07	0.06
Cadmium(Cd)	0.005	0.005	0.00 5	<0.01	<0.01	<0.01	<0.01
Manganese(Mn)	0.02	0.5	0.05	0.05	0.25	0.87	0.01
Iron(Fe)	0.05	0.3	0.3	0.2	0.1	2.6	1.4
Chloride(Cl)	25	250		17.4	9.0	7.4	7.0
Nickel (Ni)	0.05	0.02		0.04	0.05	0.09	0.03
Faecal Coliforms (Counts/100m)	0	0-3	1	108	Nil	89	186

Source: CSIR, December, 1998, Results are in mg/l except pH and where otherwise stated

Table 4. Samples of water obtained and assessed communities around Tarkwa

PARAMETER	Guide Value for Maximum Concentration in Drinking Water			Sampling Stations			
	EU	WHO	USA	DISTRICT ASSEMBLY HALL (Borehole)	BONSANO (STREAM)	TEBEREBE (Borehole)	TEBEREBE (Stream)
PH	6.5-8.5	6.5-8.5	6.5-8.5	5.62	6.75	5.37	5.11
Colour(Hu)	20	15	15	<5.0	150	<5.0	<5.0
Suspended solids (Ss)	4	5	1-5	176.0	26.0	14	16.0
Zinc(Zn)	0.1	3.0	5.0	0.07	0.04	0.08	0.09
Cadmium(Cd)	0.005	0.005	0.005	0.01	<0.1	0.02	0.01
Manganese(Mn)	0.02	0.5	0.05	0.15	0.06	0.08	0.11
Iron(Fe)	0.05	0.3	0.3	<0.03	1.2	<0.01	<0.01
Chloride(Cl)	25	250		18.9	7.9	8.0	14.8
Nickel (Ni)	0.05	0.02		0.01	<0.01	0.07	0.15
Faecal Coliforms (Counts/100m)	0	0-3	1	15	142	28	126

Source: CSIR, December, 1998. Results are in mg/l except pH and where otherwise stated

2.14 Illegal (galamsey) mining in Ghana.

The mining industry in Ghana has witness exceptional lawless increase in illegal mining in recent years resulting into more problems that authorities battled to deal with (Amankwah and Anim –Sackey, 2003; Hilson and Potter, 2005). Community leaders always defend this adverse impact that these activities have always been lifeblood of rural people before the arrival of large-scale foreign mining companies. They indicated operators have deep ancestral connections to mining lands and this type of mineral extraction keeps on as an important economic activity in the country. Policymakers mostly argue differently on recent increase of artisanal and small-scale mining (ASM) operations in sub-Sahara Africa. The most broadly accepted justification is nationwide poverty, though ‘opportunism’ and people’s desire to ‘get rich quick’ are easily presented interpretations (Barry, 1996; Labonne, 2003). People get more involved in illegal mining due to few alternative income-earning opportunities available

in the country. According to Labonne, 2003, artisanal mining is hugely driven by poverty and has increased as an economic activity and adding up to traditional forms of rural subsistence earnings. The same conclusion was drawn by the author of *Breaking New Ground* (MMSD, 2002). The number of people who are into galamsey operations ('Galamsey' stands for 'gather or get them and sell') increased from 30,000 in 1995 (World Bank, 1995) to one million in 2006 (Bawa, 2006). Bureaucratic inefficiency and ineffective policies have affected formalization of ASM policies and making illegal mining friendlier. In addition, more macroeconomic developments and several Structural Adjustment Program have resulted into unemployment driving tens of thousands of other Ghanaians to illegal mining communities in search of occupation (Hilson and Potter, 2005; Banchirigah, 2006). One more view of the ASM poverty debate is illegal miners been held in a vicious cycle of poverty (Figure 9) and they cannot readily cast aside their operations. Several factors increasing miners' hardship were identified by Noestaller in 1996. In 2006, Hilson and Pardie build on the same analysis to identify miners' dependency on mercury (for gold amalgamation) as one important factor aggravating hardship in small-scale mining communities. With all these evidence, most commentators continue to argue that miners intentionally avoid laws and do not intend to obtain license. This perception has been reinforced in Ghana because of poor response of miners to government and private sector partners' effort in rural areas towards alternative income-earning activities (Hilson and Banchirigah, 2008).

Illegal mining cause significant environmental degradation mostly comes with hazardous practices and promise the increase of sex workers which leads to the spread of HIV/AIDS. Increase of illegal mining is a serious issue challenge for many developing countries but in Ghana specifically, it operations have proved to be burdensome due to unemployment. There is argument that inability of government to control and limit illegal mining operation is closely associated with the absence and proper implementation of defined policies to guide operations. Small-scale gold mining has been formalized by the Government of Ghana to limit illegal mining and its negative impact but it has been criticized that there is insufficient land available for prospective ASM to be registered on, which has made the policy ineffective (Hilson and Potter, 2003).

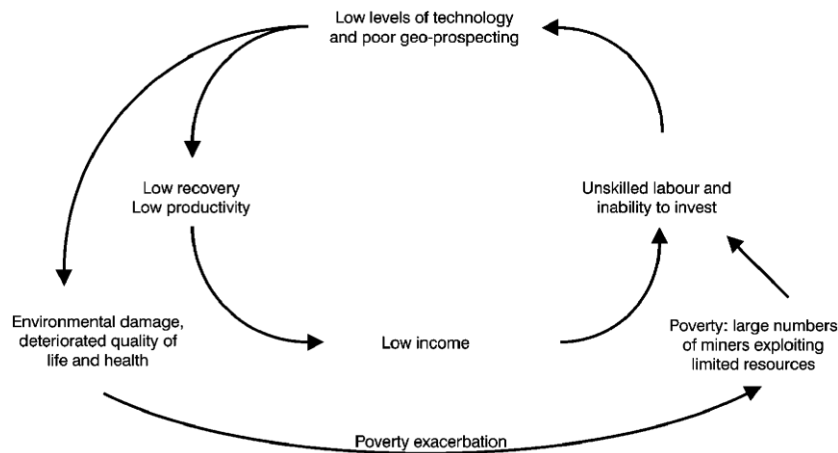


Figure 9: Artisanal mining poverty trap. Source Banchirigah, 2008.

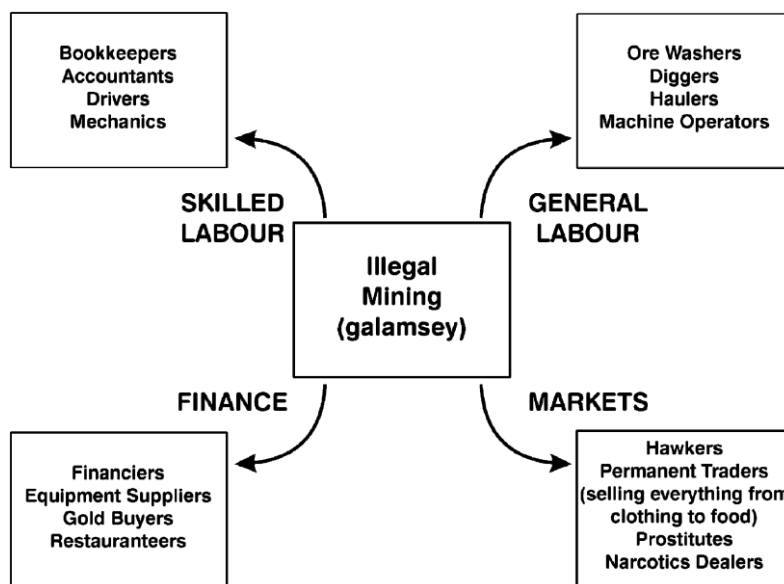


Figure 10: The galamsey 'employment engine'. Source Banchirigah, 2008.

A study conducted by Banchirigah in 2008, identified four (4) major reasons why these illegal mining has been deeply rooted in Ghana especially Noyem, where the survey was carried out. Firstly, illegal mining projects in the community has the support of the Noyem chief, elders and the queen mother in addition to the support of unit of government in the community (i.e. the unit committee). Furthermore, income that comes from these activities is used in the community development operations. Investors in this illegal project buy street lights for the communities and pay some money daily to Unit Committee Chairman. Secondly, illegal mining is an operation that gives employment opportunity for people in menial work to bookkeeping (Figure 10). It is not monotonous farming jobs encourage as alternative livelihoods; ASM recruits people from several fields. These employees can work as packers, diggers, haulers, ore washer and vendors, all these people earn regular salaries at

Noyem where they operate. At this place, there is health and safety officer and technical secretary to space rock mining, the chief Noyem is also the head of the illegal miners' cooperative.

Thirdly, illegal mining is link to influential traditional leaders. Chiefs play an important role in mining sector in Ghana, they supervise compensation processes and leading negotiations which concerns land transfers to companies. Rural inhabitants see chiefs as figure of authority despite they do not play any role in the approval of mining concession, these rights are vested in the presidency. Chiefs gain financially from galamsey operators in areas that are un-policed because they endorse operations from these illegal miners. Finally, the inappropriateness of most of the alternative being promoted is the one of the factors preventing galamsey operators from putting a stop to their operations. Individuals residing near miners are main target of corporate- sponsored programs instead of miners. Artisanal mining generate more income than activities being promoted by these companies which includes snail farming, cassava harvesting and poultry rearing. The earnings of alternative income activity must be comparable to that foreseen in illegal mining. ASM are convinced that it is the only activity capable of providing their needs due to lack of nearby market for farm produce in Noyem (Banchirigah, 2008).

2.15 Forms of operation and foreigners in galamsey

There are various forms of galamsey operations in Ghana which includes open pit mining, underground, mining on school compound, etc (Figures 11 – 13) and the sector in recent years has seen an upsurge of foreign miners (Figure 14). Since March, 2003, the Ghana Immigration Service has deported 80 Chinese who have engaged in small – scale mining and possessing of improper immigration documents. The Minerals and Mining Act (2006) Act 703, prevents foreigners from engaging in small-scale mining which is sole reserved for citizens of the country. However, these foreigners working in the small-scale sector are aided effort of local collaborators which have made them to invade the small-scale sector against the law of the state. So much impunity have been displaced by these illegal miners, a group of Chinese small-scale miners were alleged to have shot and killed two Ghanaians over a disputed land at Mamiriwa a suburb near Obuasi (Myjoyonline.com, 2013).



Figure 11: Open pit mining by illegal miners, source: (Al-Hassan, 2012)



Figure 12: Underground mining (illegal miners), source: (Al-Hassan, 2012)



Figure 13: Illegal mining on school compound source: (Al-Hassan, 2012)



Figure 14: Illegal foreign miners in Ghana (Myjoyonline.com, 2013)

3 MATERIALS AND METHOD

Literature reviewed in the above chapter provided a background of various aspects of the mining sector in Ghana with respect to economic, socio-economic benefits and environmental implications of the sector. Considering information gathered from various literatures about mining sector in Ghana, effective research methodology was adopted to collect and analyze data from various institutions and field survey. It is important to carry out field survey to understand how citizens view the mining industry with respect to its contributions to national development. This chapter identified specific methods employed to understand mining industry. Qualitative and quantitative research techniques were used to analyze data collected. Various information sources were contacted in the course of the research including field trips to administer standardized questionnaires (Appendix 3) combined with effective interaction with respondents. Different statistical test procedures including direct regression model and econometric techniques were applied on data collected from institutions that are mandated by law to manage and promote the sector as well as empirical data from field survey. Data for the research was gathered from various sources as; Minerals Commission, Environmental Protection Agency (E.P.A), Ghana Chamber of Mines, Precious Minerals Marketing Company Limited and several mining and non-mining communities as well as different categories of professional and general populace. Some of these personnel includes; Accountants (Ghana Revenue Authority), Medical Practitioners, Lecturers and Students of tertiary institutions, Security Personnel, Mining Professionals and Non-professionals in mining and non-mining communities (Tarkwa, Obuasi, Prestea, Sunyani, Koforidua, Cape Coast) as well as the general public.

3.1 Data collection instruments and processing

Data collection is a process of creating primary data records from a given population of observations (Knoke and Bohrnstedt, 1994). Babbie identified experimental, survey, unobtrusive and evaluation as different method or modes of data collection (Babbie, 1992). Since survey is the method of collecting data or information from groups of people or sample of population by the use of questions, telephone interviews, face to face interviews, we adopted the survey method by designing questions for data collection from various institutions and professional identified above. The survey method applied in this research has

the basic features as identified by Fowler in 1993 by gathering information from various correspondents with questionnaires on the subject matter from people with experience in the field to others with little knowledge that are negatively or positively affected by mining in Ghana. The various primary methods were employed for data collection;

- Mining communities were visited to administer questionnaires on indigenes to determine their opinions on basic operations of mining and how it contributes to their standard of living or vice versa.
- Some mining sites were assessed including mining communities to identify developmental projects initiated by industries in the sector.
- Mining Companies were visited to administer questionnaires to establish if basic international standard are adhered to in their operations to protect the environment.
- Personal interviews were conducted to collect data for the study with correspondents who cannot read, write or do not have sufficient time to complete the questionnaires
- Some illegal mining sites were visited to interact with miners on their operational methods before and after mining.

Secondary data was collected from stakeholders and other sources like; Text books; Journals; Articles; Internet; Magazines, etc. In order to effectively assess the contribution of extractive sector and its effect on the environment, the researcher combined different techniques to analyze data collected. Different techniques employed to analyze data are;

- Time series analysis
- Regression statistics and econometric models with graphical presentation
- Descriptive statistics, etc.

For statistical data processing, the researcher applied Microsoft excel 2010 and IBM SPSS 20.

3.1.1 Data sample

The research sample included direct professionals, indirect professionals and the general populace who are one way or the other familiar with the sector. Among them are; managers, technicians, qualified (blue color) workers, journalist, social scientists, educationists, etc. The aim is to get as much as possible enough respondents from communities to respond to issues raised about the sector. This sample size describes falls within the target of the research to ascertain opinions of people in mining and non-mining communities and their knowledge

relating to the sector. Combination of purposive and snowball sampling techniques were applied to achieve this target. Purposive sampling was adopted which was defined as “the participant are hand-pick from the accessible population” (Gliner and Morgan, 2000). Respondents to questionnaires were approached in these communities, institutions related to mining operations, tertiary institutions and other relevant populations. These correspondents were selected based on simple accessibility to the survey administrators. According to (Gliner and Morgan, 2000), “these participants are selected on the basis of convenience rather than chosen in a serious attempt to select participants who are representative of the theoretical population” In addition to the above method snowball sampling was used which has been defined as “ modification of convenience or accidental sampling People are asked for additional references” (Gliner and Morgan, 2000). These techniques aided the researcher to administer questionnaires without too many constraints in identifying respondents for the survey. The researcher was assisted by two masters’ students in the administration of questionnaires. Total number of eight hundred and forty (840) questionnaires was administered but six hundred and forty-seven (647) were collected representing 77 per cent outcome of population contacted. The process took the researcher two months to gather all necessary data.

3.2 Limitation

In the course of the research some financial constraints were encountered, correspondents’ reaction towards the survey as well as inability to collect all questionnaires distributed. Some respondents were unable to complete questionnaire due to their busy schedule. Few respondents were demanding financial rewards before answering questionnaires. A long hour of travelling from one mining community to the other was problematic due to poor road networks linking these mining communities which contributed to data collection process very tiresome.

3.3 Statistical tools

Regression Model

To estimate future scenarios of both productions and revenue of these minerals (i.e. gold, diamond, bauxite and manganese) this regression model was used. The core problem in time series analysis is linked to their non-stationary attributes. Due to this deficiency the mechanic application of the regression analysis could show the so called spurious regression. Particularly this situation is observed when time series data is studied and analyzed and where the dependent variables Y_t are correlated with their predecessors $Y(t-j)$, where $j = 1, \dots, L$ and L is equal to the number of lags considered (detected).

There are various techniques to deal with this problem. Among them the identification of the unit root of these time series data by special software products could be done. The same result, providing the detrended time series data, with easy understandable interpretation according formula (1) could be found.

$$Y_t = \beta_0 + \beta_1 * Y(t-1) + \beta_2 * Y(t-2) + \dots + \beta_L * Y(t-L) \quad (\text{Eqn. 1})$$

Where:

Y_t is value of the dependent variable in year t .

L is number of lags considered

$Y(t-1)$ and $Y(t-L)$ represent values of the same variable for years $(t-1)$, respectively $(t-L)$.

Equation (1) was adopted for the estimation of the future development in mining industries outputs.

4. RESULTS AND DISCUSSION

The following chapter identifies evaluated various data collected from mandated institutions and survey carried out about the mining industry in Ghana and other mineral rich nations.

4.1 Comparative analysis of Ghana's mining industry and other mineral rich countries in the world and GDP development in Ghana since 1961

This diagram below illustrates ranking of mineral rich countries in chronological order of 25 out of 58 countries. The quality of governance in the oil, gas and mining industry of 58 countries were measured in 2013 by Resource Governance Index (RGI). These countries which were measured produces 85 per cent of the world's petroleum, 90 per cent of diamonds and 80 per cent of copper which generates over trillions of US dollars in yearly benefits to these nations (Resource Governance, 2013). The futures of these nations depend on how effectively they manage their minerals. Four major indicators were used to rank these countries management of these natural resources (i.e. institutional and legal setting, reporting practices, safeguards and quality controls and finally enabling environment). Outcome from these four indicators were computed into composite for final ranking of these 58 mineral rich nations. Color coded (red, orange, yellow and green) with four categories (0-40: Failing, 41-50: Weak, 51-70: Partial and 71-100: Satisfactory) were employed after various computations to rank these countries. Norway is rich in hydrocarbons and the number one nations by all standards which also serve as a benchmark for other nations in terms of management of the sector. Based on all the categories, Norway has satisfactory institutional and legal setting (100%), reporting and practices (97%), safeguards and quality controls (98%) and enabling environment (98%) proceeded by United States (Gulf of Mexico), United Kingdom respectively. According to the ranking of RGI, Ghana is placed at the fifteenth position in the world with a satisfactory institutional and legal setting (79%), partial reporting practices (51%), satisfactory safeguards and quality controls (73%) and partial enabling environment (59%) in Africa. Liberia, Zambia was ranked 16th and 17th but both have failing enabling environment with 31 and 37 per cent respectively. South Africa which is the highest gold producer in Africa and richer in other minerals was ranked as 21st with partial institutional and legal settings (69%), failing reporting practices (31%), satisfactory safeguards and quality controls (75%) and satisfactory enabling environment (72%). Russia, Philippines,

Bolivia and Morocco were ranked 22nd, 23rd, 24th and 25th respectively (Figure 15 and appendix 4).

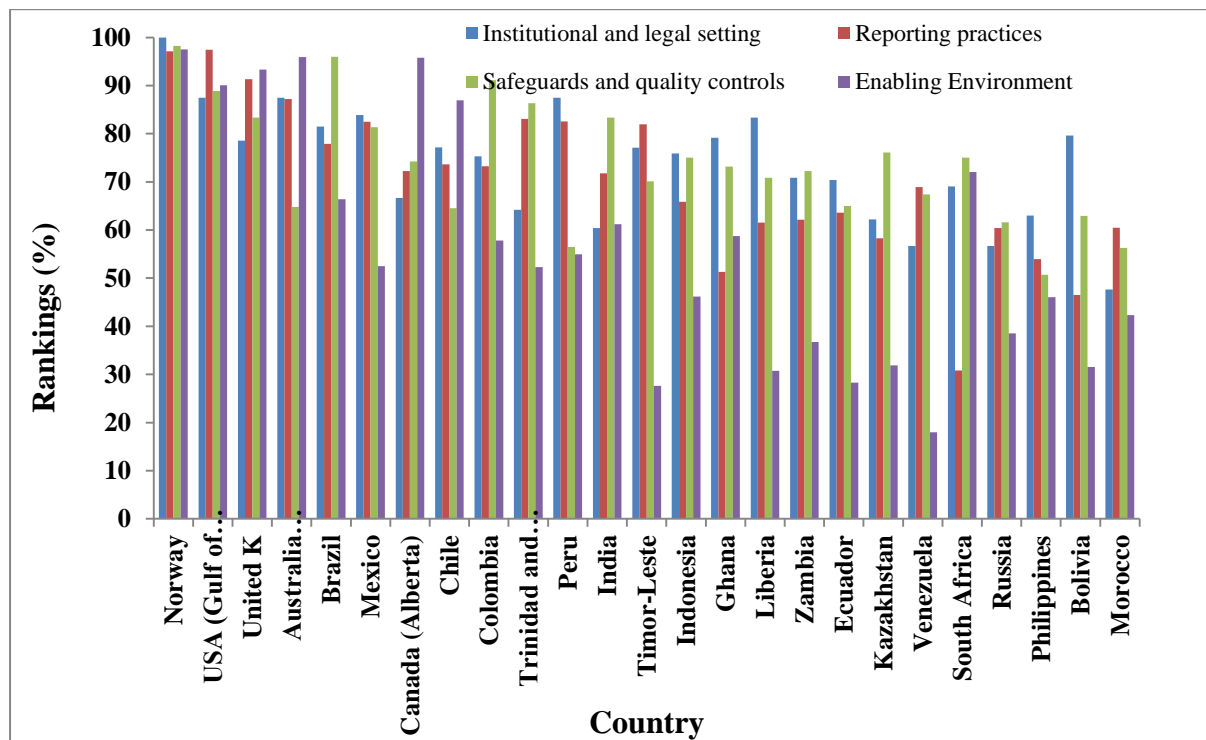


Figure 15: Relationship between mineral rich countries and their rankings according the RCI as at 2013.

The pictorial representation below illustrates the dynamics of Gross Domestic Product per capita development in Ghana since 1960 to 2011. In 1960, GDP was over 282 US dollars, this amount appreciated to 289US dollars in 1963. As of 1966, the amount declined to 265US dollars and later appreciated in 1971. However, from 1972 to 1982, the gross domestic product of the country has witness a major setback with some random fluctuation. From 1983 to 2011, these figures have seen continuous increase from 200US dollars to 403US dollars respectively. The structural adjustment program introduced in early 1980s has impacted positively on the Gross Domestic Product of the nation which has resulted into its continuous appreciation to date. Governments over the years introduced several reforms to encourage investors and boost production in the mining industry. The sector and nation economy generally has benefited significantly from the reforms in terms of GDP since 1983 to 2011 as shown in (Figure 16).

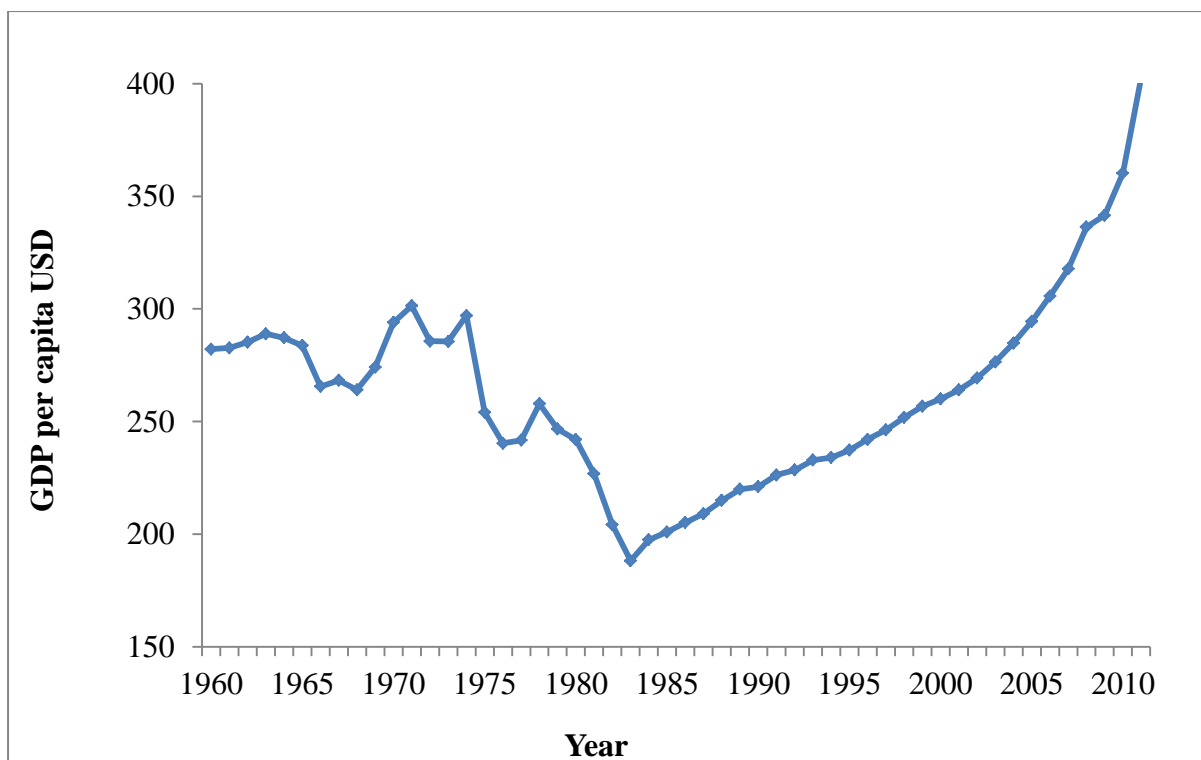


Figure 16: Dynamic of Gross Domestic Product per capita development in Ghana since 1961 in US dollar.

4.2 Mining industry in Ghana and its macroeconomic parameters

4.2.1 Current Situation - Economic Performance of the sector.

The result of marginal investment per worker based on large –scale mining; total investment and marginal growth in investment; employment data in the large- scale mining sector; mining contribution to government revenue between 1983 and 2011 are presented in tables 5 – 8. For further statistical processing and forecasting purposes we derived and presented detrended values of the time series.

The outcomes of corporate social responsibilities programs and impact on selected public sector between 2004 and 2011 are shown in tables 9a and 9b. Results of regression analysis of major minerals produced with revenues and autoregression outcome with prognosis of production and revenues from 2012 – 2016 are represented in appendix 1 and 2.

Table 5: Marginal investment per worker - Large Scale (MIPW-L/S)

Year	Total Investment (US \$m)	Employment Data – Large Scale	Marginal Investment per Worker – Large Scale (%)
	a	b	a/b*100
1995	164.96	22,519	0.73
1996	774.76	21,030	3.68
1997	593.02	20,343	2.92
1998	267.54	21,261	1.26
1999	214.77	17,858	1.20
2000	231.78	16,537	1.40
2001	275.53	16,340	1.69
2002	315.59	14,311	2.21
2003	545.62	16,056	3.40
2004	638.33	15,525	4.11
2005	797.52	15,396	5.18
2006	586.74	18,742	3.13
2007	670.22	19,240	3.48
2008	765.3	18,717	4.09
2009	762.26	18,226	4.18
2010	770	18,370	4.19
2011	970.3	19,000	5.11

Source: Minerals Commission and Calculated Marginal Investment per worker.

Percentage marginal investment per worker in relation to total investment and employment data of large-scale mining sector in 1995 was 0.73%. This figure increased to about 3.7% in 1996 which did not continue but declined from the subsequent year till 2001. In 2008, marginal investment per worker increased to 4.1% and rose to 5.1 % in 2011 as shown in table 5.

Table 6a: Total investment and marginal growth in investment

Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total Invt(US\$M)	6.0	58.0	175.0	0.0	6.9	0	205.2	398.2	279.5	595.4	236.9	98.3	165.0	774.0
MGTI	0.0	52.0	117.0	-175.0	6.9	-6.9	205.2	193.0	-118.8	315.9	331.5	-165.6	66.6	609.8

*MGTI = Marginal growth in total investment

Table 6b: Total investment and marginal growth in investment

1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
593.0	267.5	214.8	231.8	275.5	315.6	545.6	638.3	797.5	586.7	670.2	762.3	762.3	770.0	970.3
-181.7	-325.5	-52.8	17.0	43.8	40.1	230.0	92.7	159.2	-210.9	83.5	95.1	-3.0	7.7	200.3

Total investment and its marginal growth in 1984 were US \$ 58.04 million and US \$ 52.04 million. In 1985, total investment appreciated to US \$ 175.02 million more than the previous year. This astronomical increase could not sustained but fell drastically by US \$ -175.02 million in 1986. In 2010, marginal growth in investment was US \$ 7.74 million as a result of total increase in investment. Over US \$ 970 million was invested in 2011 that resulted into a huge increase of marginal growth in the same year to US \$ 200.3 million as shown in (tables 6a – 6b).

Table 7: Employment development between 1995 and 2012 (Large-scale)

Year	Employment development
1995	22,519
1996	21,030
1997	20,343
1998	21,261
1999	17,858
2000	16,537
2001	16,340
2002	14,311
2003	16,056
2004	15,525
2005	15,396
2006	18,742
2007	19,240
2008	18,717
2009	18,226
2010	18,370
2011	19,000
2012	19,120

Source: Minerals Commission, 2013

Employment data from the large scale mining sector have seen a significant reduction in number of employees which was 22,519 in 1995 decreased to 19,120 in 2012. A significant reduction of 2,029 employees was noticed between 2001 and 2002. This situation of reduction in employment confirmed assertion of various researchers that many employees of

various skills were expendable after structural adjustment and reform of the sector; which led to retrenchment of tens of thousands of various workers including large-scale employees decided to migrate down-town or countryside to look for employment (Chachage, 1995; Dreschler, 2001; Mondlane and Shoko, 2003; Hilson and Maponga, 2004; Hilson and Potter, 2005; Banchirigah, 2006). The following year 2003, saw an increase of almost same number noticed in the previous year reduction. New technologies introduced into the sector have led to this reduction gradually and giving way to more skilled labor as shown in table 7.

Table 8: Mining contribution to Government revenue from 1990 – 2012

YEAR	CORPORATE TAX (A) GH¢	MINERAL ROYALTIES (B) GH¢	P.A.Y.E (C) GH¢	RECONSTRUCTION LEVY (D) GH¢	WITHHOLDING TAX (E) GH¢	MISCELLANEOUS (F) GH¢	TOTAL INCOME GH¢ G=A+B+C+D+E+F	TOTAL IRS COLLECTIO N (H)	TOTAL MINING/TOTAL IRS I = G/H*%
1990	282594	189344	-	-	-	-	471938	5281807	8.9
1991	82184	302128	-	-	-	-	384312	6148563	6.3
1992	455505	454580	-	-	-	-	910085	7473153	12.2
1993	439345	748512	264931	-	-	-	1452788	11323700	12.8
1994	721408	1278369	481080	-	-	-	2480857	16659594	14.9
1995	2039297	2091193	795176	-	-	-	4925666	27551320	17.9
1996	916053	3552703	1683453	-	-	-	6152209	42449191	14.5
1997	986880	3459495	2502202	-	-	-	6948577	60578258	11.5
1998	1445077	4984124	3101651	-	-	-	9530852	78543669	12.1
1999	3111711	4862042	2783926	-	-	-	10757679	90166376	11.9
2000	1578917	11873694	5924380	-	-	-	19376991	140944527	13.7
2001	2481289	12735839	7611168	425147	-	-	23253443	195016275	11.9
2002	2350116	15345247	10145767	2647463	-	-	30488593	275774778	11.1
2003	6813770	19438758	14104945	1678588	-	-	42036061	382407839	11.0
2004	10033114	21574371	13435771	5318591	11310661	-	61672508	533311470	11.6
2005	26988964	23595190	15437126	1951628	13490703	12509203	93972814	644638505	14.6
2006	21566208	31625479	18271007	1582873	17381530	-	90427097	734135448	12.3
2007	47415690	40882042	34587597	-	21208062	136537	144229928	910235784	15.8
2008	73554697	59006509	47139242	-	30804675	277934	210783057	1222475246	17.2
2009	124600880	90415902	103061985	-	36288407	-	354367174	1790557800	19.8
2010	241578778	144697345	132469345	-	36350000	-	555095468	2338542674	23.7
2011	649902536	222024705	178037079	-	-	472361	1,050,436,681	3705747795	28.3
2012	893773828	359392853	207495934	-	-	540362	1,461,202,977	5403032412	27.0
Total	2,113,118,841	1,074,530,424	799,333,765	13,604,290	166,834,038	13,936,397	4,181,357,755	18,622,996,184	

GH¢ = Ghana New Cedis, Source: Minerals Commission,2013.

Table 8 gives an overview of various taxes and levies paid by mining companies to support the economic development of Ghana. The government places high hope on taxes from the sector which goes into socio-economic development of mining communities and the nation. The mining sector contributes significantly to government revenue. Taxes and levies paid by the sector are; corporate tax, mineral royalties, P.A.Y.E (Pay As You Earn), reconstruction levy, withholding tax and other miscellaneous taxes. Ghana Revenue Authority is the main institution responsible for collections of these taxes from mining industries and other companies. In 2011 and 2012, the mining sector contributed 28.3% and 27.0% respectively to government revenue. Total income collected from the mining sector from 1990 to 2012 was GH ¢ 4,181,357,755. Corporate tax contributed 51%, minerals royalties 26%, P.A.Y.E 19%, etc for the 23 years data (Table 8).

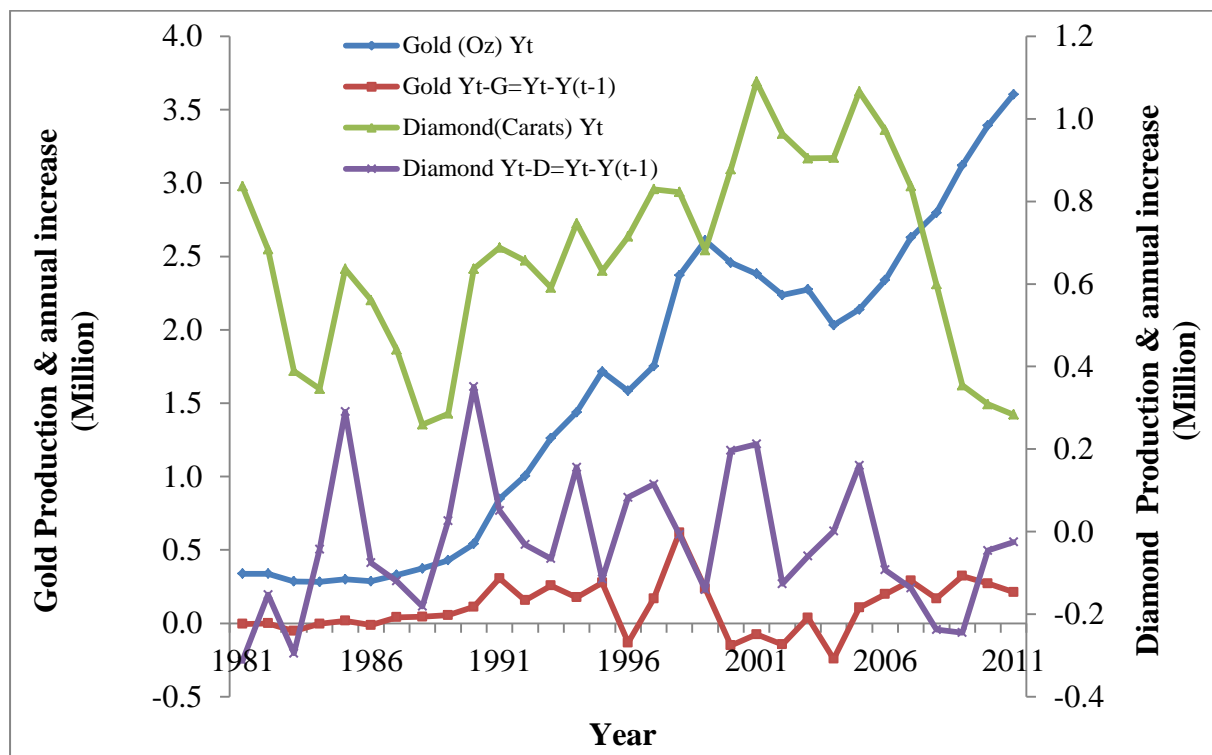


Figure 17: Development in gold and diamond with annual increase in production from 1980 – 2011

The development in gold and diamond production and its annual increase in production are depicted on primary (left-hand) and secondary (right-hand axis) on Figure 17. The values of $Y_t - G$ and $Y_t - D$ represents the detrended time series of annual changes in time series values. These values will be used for further statistical analysis, particularly for prediction in development of these time series. Data on major minerals indicated higher production of gold

compared to diamond. Gold production has seen significant increase in production as well as annual increase but production decreased from 2000 (2.557 million ounce) to 2004 (2.032 million ounce), notwithstanding this, production of gold appreciated from 2005 (2.139 million ounce) to 2011 (3.604 million). Major factor that impacted negatively on gold production between 2000 and 2004 was the political atmosphere. In 2000, political regime changed to new government and investors confidences reduced because it was the previous regime that reformed the mining sector. During first period (2000 – 2004) of the new government, investors adopted wait and see attitude and it had negative impact on production and annual increase of gold production. The trend reversed after 2004 and gold production appreciated thereafter. Apparently, production of diamond in 1980 was 1,150 million carat but subsequently declined in 1988 to 822,563 carats with corresponding figures in annual increase. Diamond production continues to be unstable but mostly experienced decline in its output from 2006 (972,992 carats) to 2011 (283, 369 carats) which can be seen in annual increase production rate. Gold indicated an increase trend in production but diamond production shows insignificant or stable production growth (Figure 17).

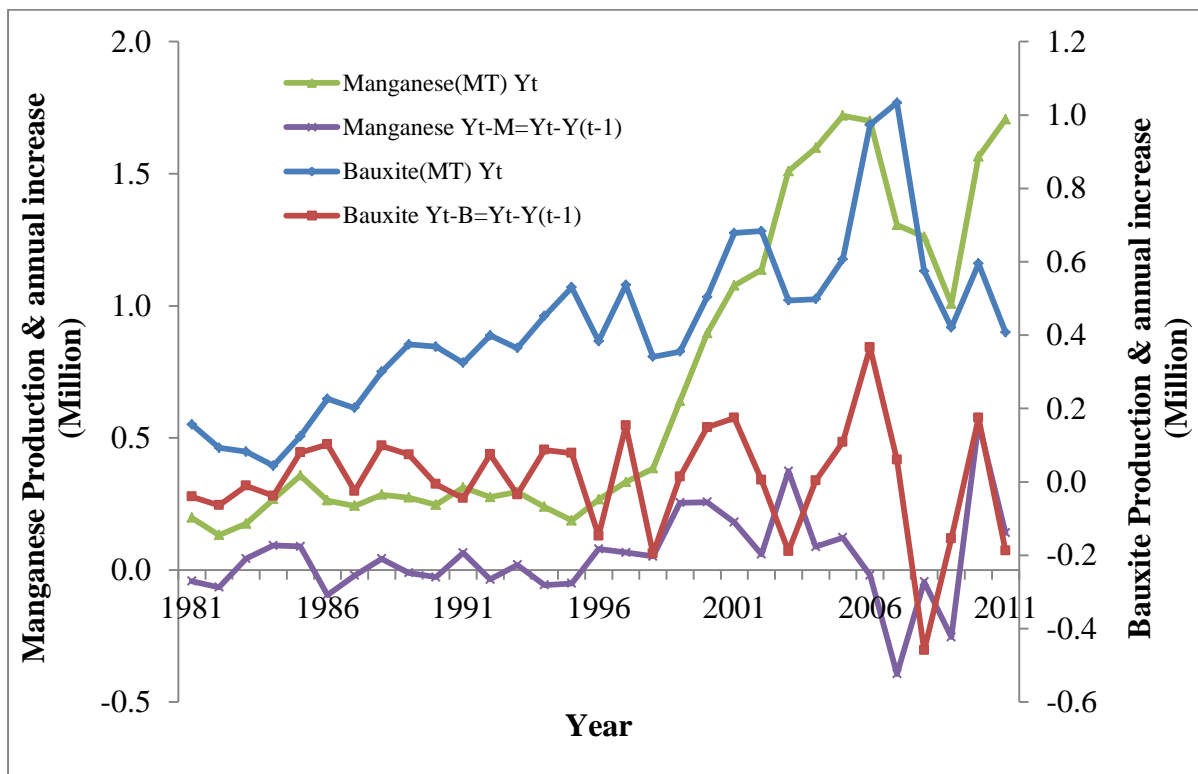


Figure 18: Development in manganese and bauxite with annual increase in production from 1980 – 2011

The development in manganese and bauxite with annual increase in production is shown on primary (left-hand) axis and secondary (right-hand) axis on Figure 18. The values of $Y_t - M$ and $Y_t - B$ also represents the detrended time series of annual changes in time series values. These will be used for further statistical analysis, particularly for prediction in development of these time series. In 1981, Bauxite and manganese produced were 157 thousand metric tons and 197 thousand metric tons. Production of bauxite appreciated more than manganese from 1988 to 1997. Manganese production increased steadily from 1996 (266,765 metric tons) to 2005 (1,719,589 metric tons). However, manganese production decreased significantly from 2006 (1,699,546 metric tons) to 2009 (1,007,010 metric tons). Trend of decrease in manganese production changed significant in 2010 and 2011 from 1.55 million metric tons to 1.71 million metric tons respectively. The trend of increase and decrease can be seen in annual increase production. On the other hand, development in bauxite production with its annual increase indicated ups and downs year on year. Furthermore, bauxite production appreciated gradually with some reduction in quantity yearly but output increased in 2006 (972,991 metric tons) and 2007 (1,033,368 metric tons) but declined in 2008 (574,389 metric tons). Production trend and annual increase of manganese is appreciating gradually while bauxite production is reducing year on year (Figure 18).

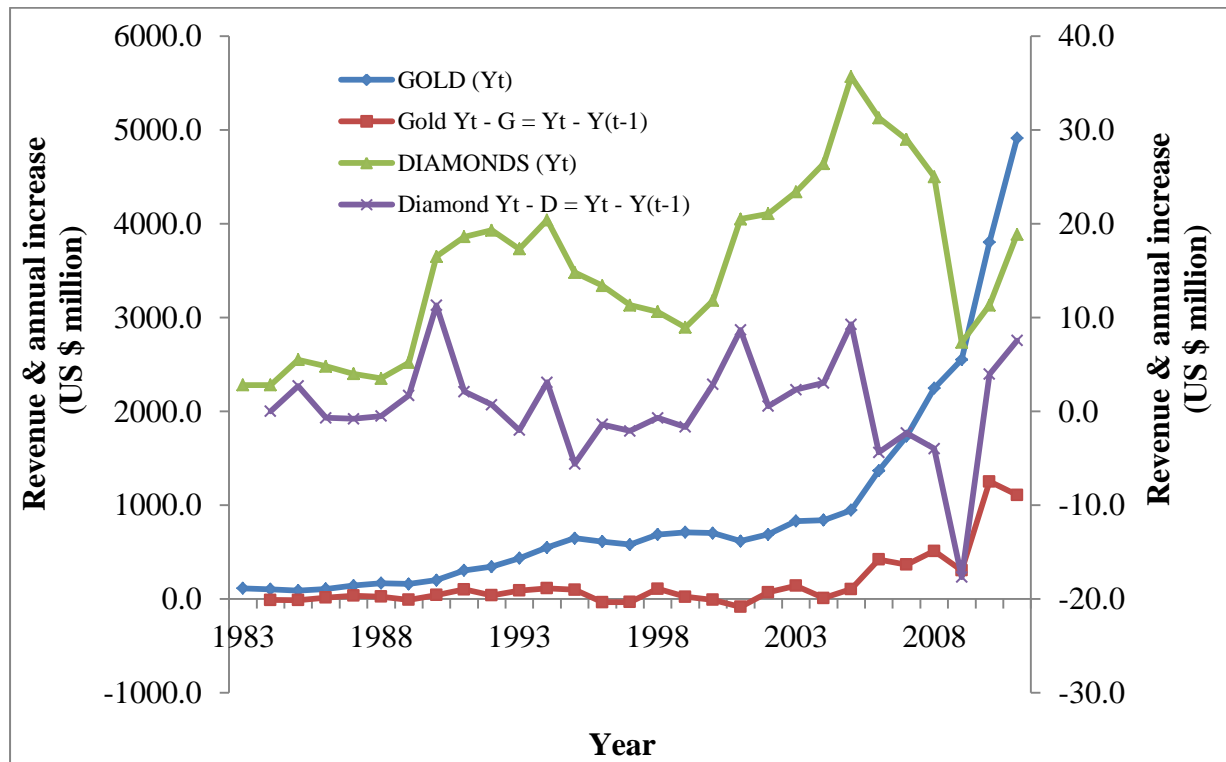


Figure 19: Development in revenue and annual increase of gold and diamond revenue from 1983 – 2011.

Gold revenue plotted on primary (left-hand) axis and diamond on secondary (right-hand) axis illustrates both revenue and annual increase from 1983 – 2011 on figure 19. Since the introduction of the Economic Recovery Program and Structural Adjustment Program, the mining sector has enjoyed significant growth (Jonah, 1987; Aryee and Aboagye, 1997; Addy, 1999; Aryee, 2000). Gold typically accounts for 95% of total minerals earnings and is the significant contributor to foreign exchange resources of Ghana (Aryee, 2001). Revenue from gold increased significantly year after year. In 1983, US \$ 114.1 million revenues accrued from gold which forms 93.8% (US \$ 114.1 million) of total income and in 2011, revenue from same mineral appreciated to US \$ 4912.9 million. Income from diamond in 1983 was US \$ 2.8 million and later increased to US \$ 18.9 million in 2011. Between 1995 to 2000, production of declined from US \$ 14.8 million to US \$ 11.8 million. The phenomena of continuous increased identified in gold revenue was totally different from diamond revenue. In the case of diamond, revenue experienced ups and downs year on year. Trends noticed in gold and diamond revenue indicated continuous increase in gold revenue while revenue from diamond is decreasing gradually (Figure 19).

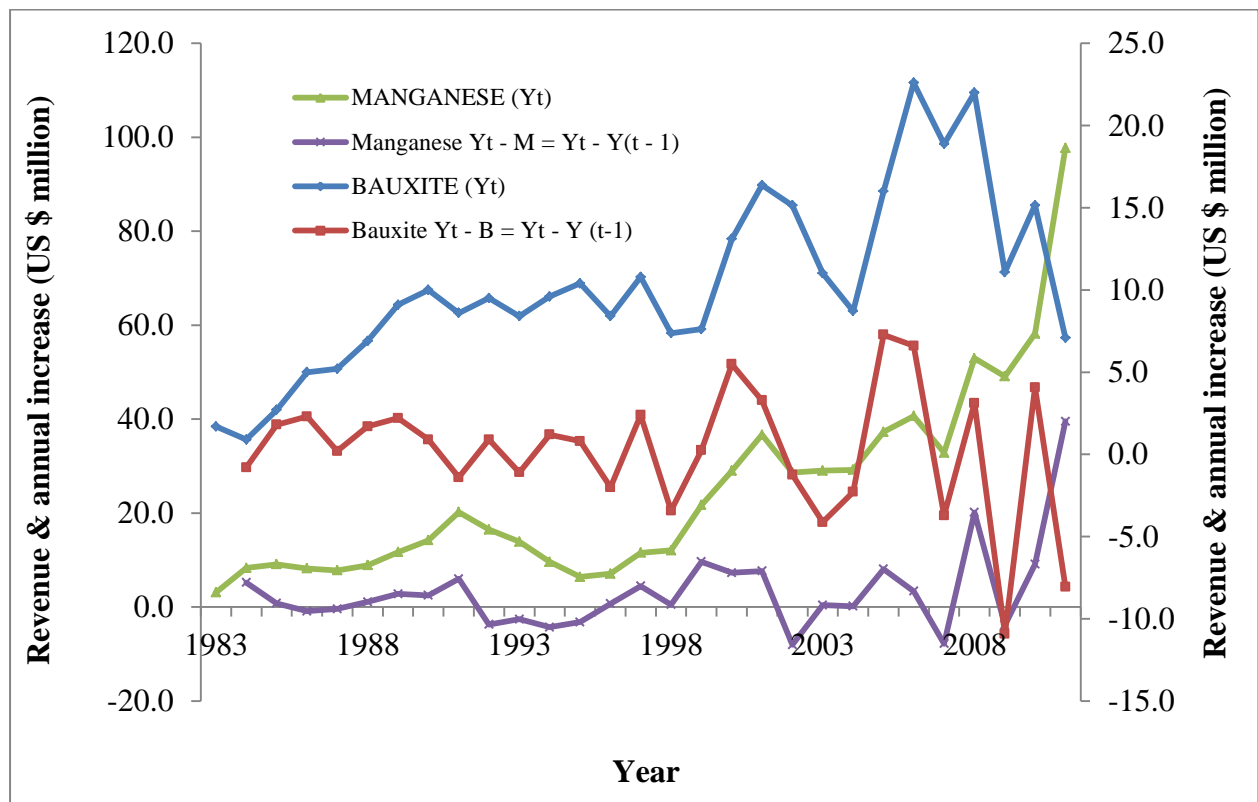


Figure 20: Development in revenue and annual increase of manganese and bauxite revenue from 1983 – 2011.

Revenue of manganese and annual increase on primary (left-hand axis) and bauxite on secondary (right-hand axis) indicated different trends year on year as shown on figure 20. Manganese income appreciated from 1983 (US \$ 3.1 million) to US \$ 97.7 million in 2011. Revenue and annual increase of manganese shows a continuous appreciation in both dimensions though there are ups and downs in increase over the years. In 1990, bauxite generated US \$ 10.0 million but reduced to US \$ 8.6 million in 1991 while manganese contributed US \$ 14.2 million and US \$ 20.2 million respectively in the same years. With respect to bauxite and annual increase in revenue, there is insignificant increase in revenue. Revenue from bauxite has been undulating year on year and it reflected in annual increase. In 2001, bauxite revenue increased to US \$ 16.4 million but declined in 2004 to the amount of US \$ 8.7 million and later increased to US \$ 22.6 million in 2006. Trends noticed in both revenue indicated increased in manganese revenue and decreased in bauxite revenue (Figure 20).

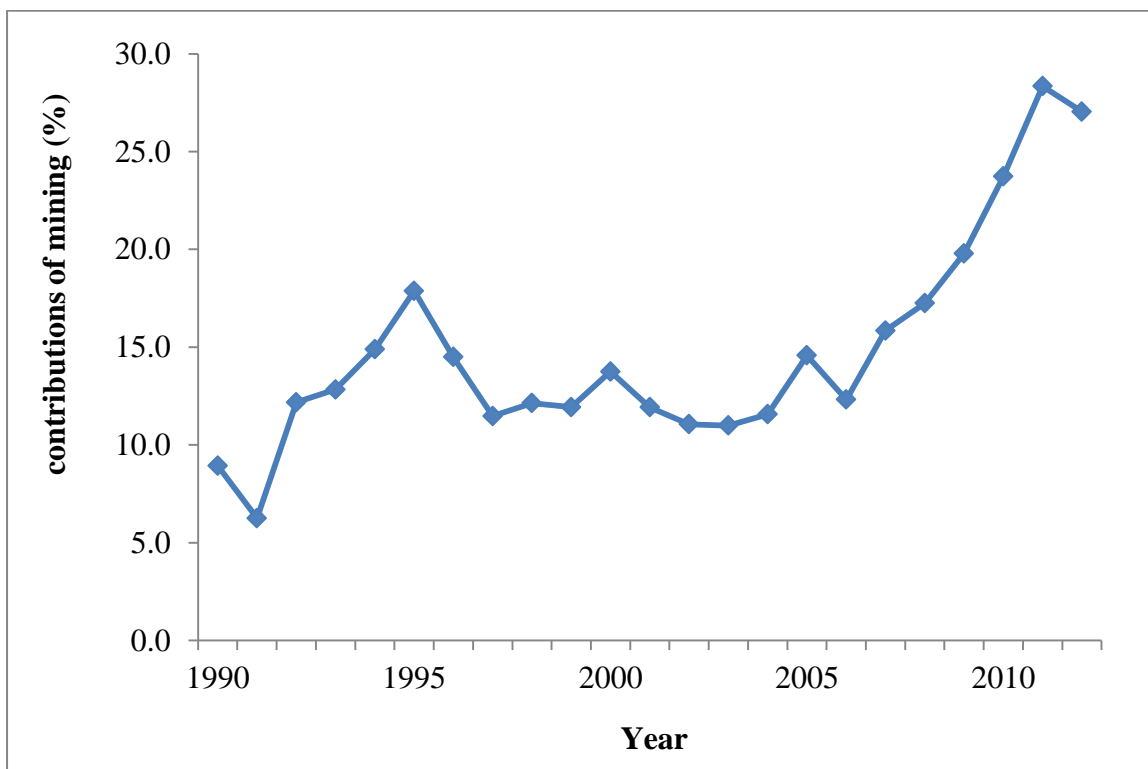


Figure 21: Relationship between percentage contributions of mining sector to government revenue from 1990 – 2011.

Contribution from the mining sector to government revenue has witness significant improvement in the past years after the industry was reformed in 1983. Different taxes and levies such as; corporate tax, minerals royalties, P.A.Y.E (Pay As You Earn), reconstruction levy, withholding tax and other miscellaneous are main contributors to government income. Figure 21 is percentage of mining contribution to government revenue from 1990 – 2011. Contribution from the sector towards economy development has seen tremendous increase. In 1990, the mining sector contributed 8.9 % of total revenue collected and appreciated to 17.9 % in 1995. However, the trend of increase reversed in 2003 to 11%. From the subsequent year, total contribution from the sector towards government revenue increased year on year with random fluctuations. In 2011, 28.4 % of government revenue came from the mining industry. All the above presentation confirms the high variability in production and revenue results of the mining industry. This leads to the conclusion that forecasting of these processes requires more sophisticated approaches toward the time series data. Particularly the detrending techniques as presented in chapter three.

The figure 22 represents total of various mineral rights granted by Minerals Commission of Ghana from 1990 – 2011. These mineral rights are; mining leases, prospecting licenses, reconnaissance license, diamond digging license, quarry, clay /kaolin, salt, mica, sand wining, mining (medium) and small-scale gold licenses. For the past 22 years, small – scale mining licenses was the highest with 2081 mineral rights granted which shows continuous demand for small-scale mining. The second highest mineral right granted for the pass years was prospecting licenses of 1152 rights. Reconnaissance and sand wining licenses mineral rights were third and fourth with 825 and 758 respectively. Mica license was the lowest with only 5 mineral rights granted from 1990 to 2011.

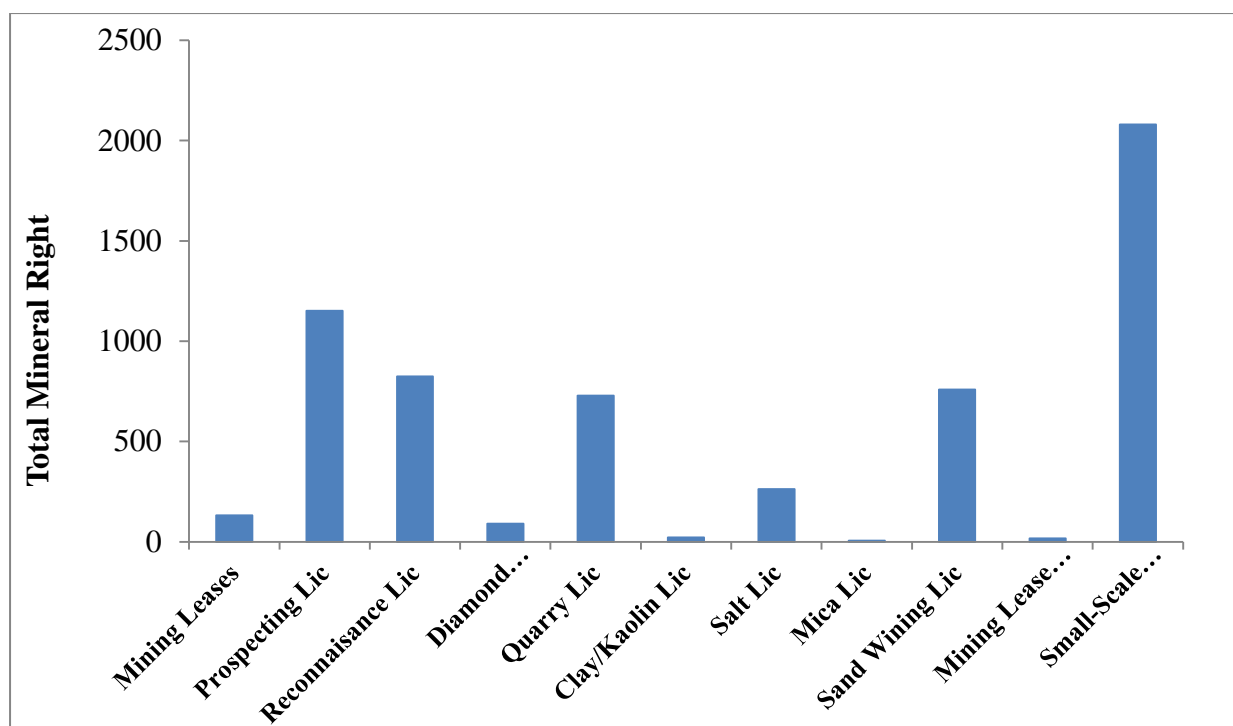


Figure 22: Total minerals rights granted from 1990 – 2011

Socio-economic impact of the mining sector in Ghana

Mining companies have embraced Corporate Social Responsibilities as part of their aims with intension of improving standard of living of people in catchments and non-catchments communities in various forms. Activities of companies towards socio-economic has upsurge in recent years towards development of communities directly and indirectly affected by mining. The tables below identify some social benefits from the industry to communities directly and indirectly in catchments areas of these companies. These investment from the industry in general impacts positively on social livelihood of the people in the country.

Table 9a: Corporate Social Responsibility contributions of Mining Companies between 2004 and 2011.

Year	Education US \$ (000)	Health US \$ (000)	Electricity US \$ (000)	Roads US \$ (000)	Water US \$ (000)	Housing US \$ (000)
2004	486.9	549.9	140.9	75.3	265.5	264.7
2005	603.5	332.9	65.9	692.3	350.0	79.5
2006	1121.1	368.4	176.1	399.0	19.5	1289.7

2007	1010.2	565.6	458.8	609.1	220.9	618.5
2008	1406.2	415.7	333.6	2613.0	649.7	686.5
2009	1259.3	777.5	285.3	1375.6	284.7	112.6
2010	2826.7	1055.3	526.2	1459.0	679.0	155.3
2011	1767.8	407.1	1941.3	1406.8	1560.8	294.5
TOTAL	10481.7	4472.4	3928.2	8630.2	4030.1	3501.4

Source: Ghana Chamber of Mines, 2013

Table 9b: Corporate Social Responsibility contributions of Mining Companies between 2004 and 2011 (US \$).

Agro-Industry	Resettlement	Alternative Livelihood	Others	Total
US \$ (000)	Action Plan	Projects	US \$ (000)	US \$ (000)
US \$ (000)	US \$ (000)	US \$ (000)	US \$ (000)	US \$ (000)
0.0	548.5	242.2	370.7	3070.4
2.3	19.8	361.7	337.9	2922.6
1228.4	2649.0	880.4	845.1	11713.2
386.7	4503.4	2897.8	830.7	13108.6
779.0	567.8	993.0	2004.2	12405.9
50.6	800.2	798.7	2841.6	9424.3
0.0	1190.4	2214.6	6478.4	17590.5
55.0	29345.3	752.3	5528.3	44887.6
2502.0	39624.3	9140.6	19237.0	115123.0

Source: Ghana Chamber of Mines, 2013

Survey conducted from 1996-1998 by Aryee indicated communities within and outside mining jurisdictions have benefited both in kind and cash from these companies through either jointly projects or solely sponsored projects by mining companies. During the same periods of the research, total of US \$ 8 million was spent by surveyed mines to finance different categories of socio-economic and infrastructure projects (Aryee, 2001). Mining companies have significantly invested in socio-economic projects such as Education, Health, Electricity, Roads, Water, Housing, Agro-Industry, Agriculture, Sanitation, Resettlement Action Plan, and Alternative Livelihood Projects. From 2004, total amount of about US \$ 3

million was invested into Corporate Social Responsibility and later appreciated to over US \$ 44 million in 2011. Considering CSR Expenditure on these projects over the period 2004 – 2011, Resettlement Action Plan accounted for more than US\$ 39,624,284 million followed by Others (miscellaneous expenses) (i.e. entertainment, sponsorship package for national teams, etc.) of US \$ 19,237,035 million, Education US \$ 10,481,688 million, Alternative Livelihood Projects US \$ 9, 140, 632, Road US \$ 8,630,244 million and other projects of total investment of US \$ 115,123,024 million (Tables 9a – 9b).

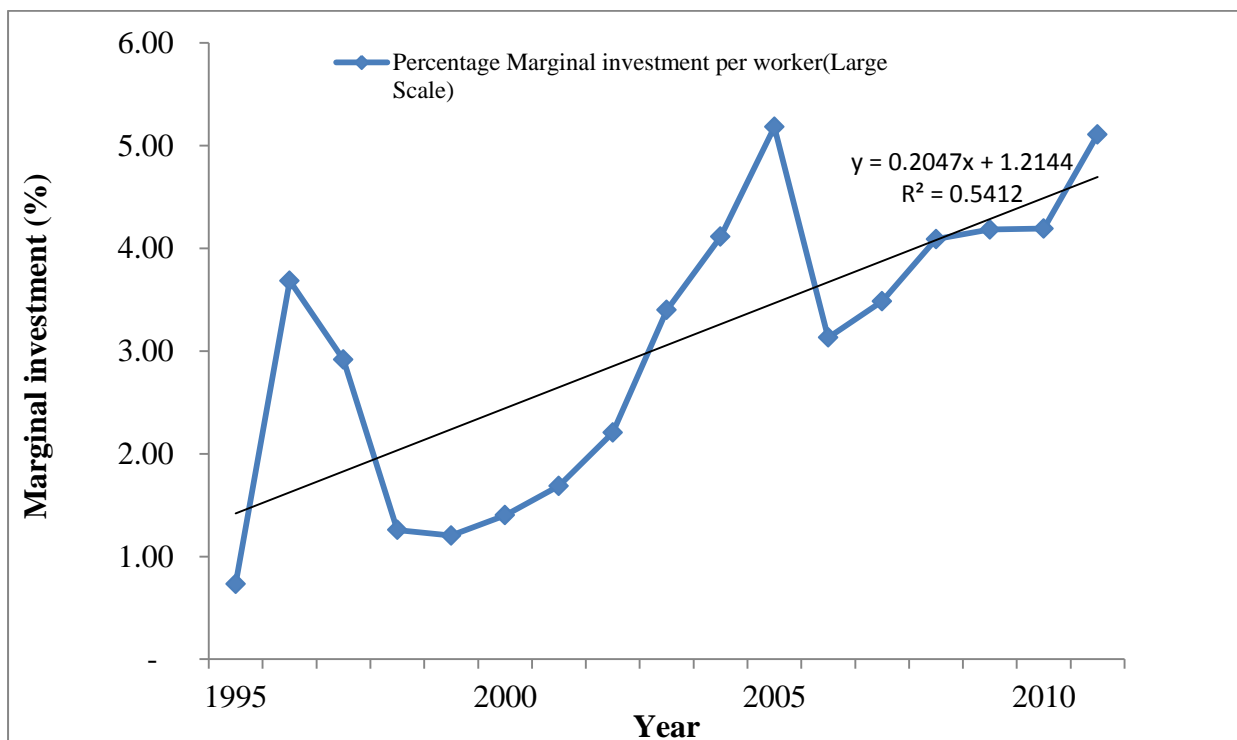


Figure 23: Dynamics percentage of marginal investment per worker (Large scale) between 1995 and 2011

The percentage of marginal investment per worker from large-scale mining ranged from 0.73 to 5.18 illustrated on figure 23. The graphical dynamics of marginal investments has been single digit between 1995 and 2011 which keeps on increasing and decreasing year-on-year. This type of time series cannot be processed in standard way; it requires the special detrending techniques to identify the structural changes and to enable the forecasting of data. Marginal investment started to decline from 1997 to 2002 and later improved thereafter. Linear function which best described the percentage of marginal investment per worker of which $R^2 = 0.54$ can be employed to estimate large scale mining future scenario (Figure 23).

Analyzing impact of total investment and marginal growth of the mining sector shows poor investment trend from 1985 to 2011. Comparing investment year-on-year has not shown a better trend and this suggests effective policies are not in place to promote or encourage continuous investments after Economic Recovery Program/ Structural Adjustment Program implemented in 1983 to involve private participation in the sector and reduce government direct responsibility as has been the target. This time series is rather short in terms of total investment to do some statistical forecasting. The downward and upward investment as well as marginal growth must be monitored and guided by polices to increase rather than decline trend. In 2000 investment took different form by increasing gradually but decreased after 6 years. Marginal growths in investment were stable in 2009 and 2010 but appreciated in 2011 as shown in figure 24.

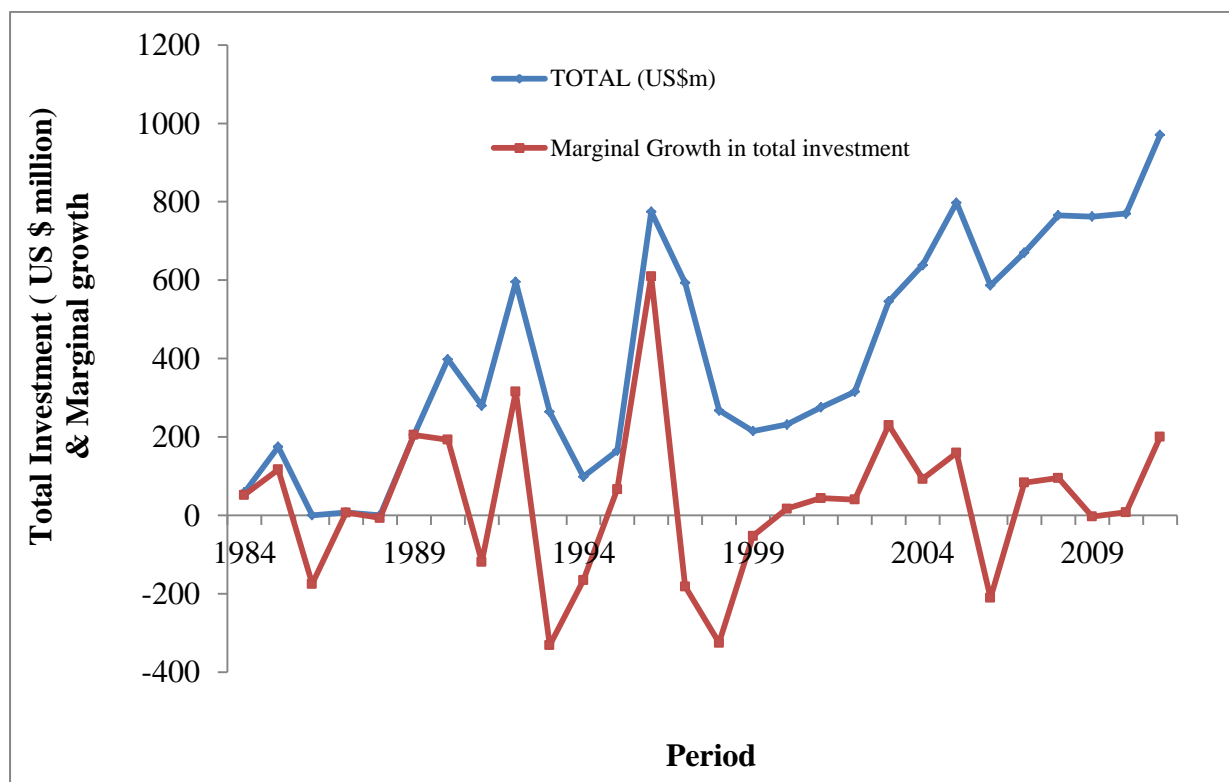


Figure 24: Development of total investment and marginal growth rate between 1984 and 2011

Dynamics of Investments in production, exploration and support services between 1997 and 2010 presented graphically revealed significant improvement in investment towards production than exploration and support service. These three categories form various investments in the mining industry in Ghana. Investment in production was between

US \$ 218 million to US \$ 186 million from 1997 to 2003. It appreciated significantly from the following year to 2010. Maximum investment was noticed in 2005 (US \$ 543 million) and fell sharply in 2006 (US \$ 330 million) but progressed rapidly till 2010 to the amount of US \$ 508 million. During the 14 years span of exploration investment, 1997 has been the highest. This amount declined sharply in 1999 (i.e. US \$ 24 million). It later increased in 2000 and has been fluctuating yearly. Investments into exploration companies exceeded all investment in 1997, 2000, 2001 and 2002. Support services investment was slightly over US \$ 52 million in 1997. This amount fluctuated in the subsequent two years showing fixed investment on yearly basis. Over US \$ 7.4 billion was invested into these categories. Percentage investment into these various agents (i.e. production, exploration and support services) was 57.7%, 36.9% and 5.2% respectively (Figure 25).

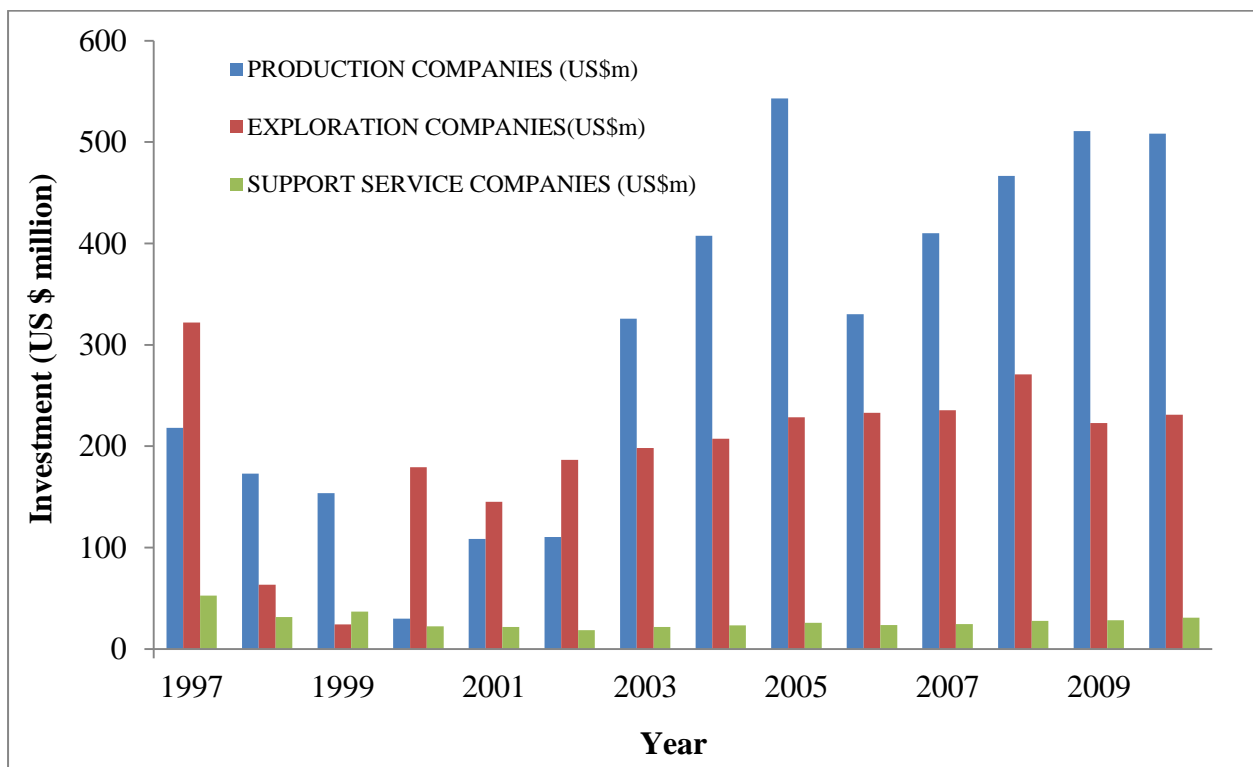


Figure 25: Investment dynamics between 1997 and 2010 by various agents

Analyzing representation of large-scale employment data between 1995 and 2012, it indicated major decrease in employment between 1995 and 2002. During this period 8,208 employees lost their jobs as a result of introduction of new technologies, restructuring of companies, etc. The political tension had a significant impact in the sector which resulted in the decline of investment and employment figures since investor were mindful of their

investment because of political conflicts in most developing countries. In addition, companies adopted new technologies to optimize production which led to decrease in employment data. The situations revert in 2003 after things were normalized. Employment in the sector improved from 2003 but could not catch up with number of employees of the sector as at 1995. However, employment figures increased from 2006 to 2012 and became stable with temporal fluctuations. Steps must therefore be taken by various stakeholders to boost stabilize or even to increase in employment in the sector. Since governments have ceded investment into the industry for private investors, it is important for governments to provide enabling environment for increase in employment and monitoring of the local content legal framework (Figure 26).

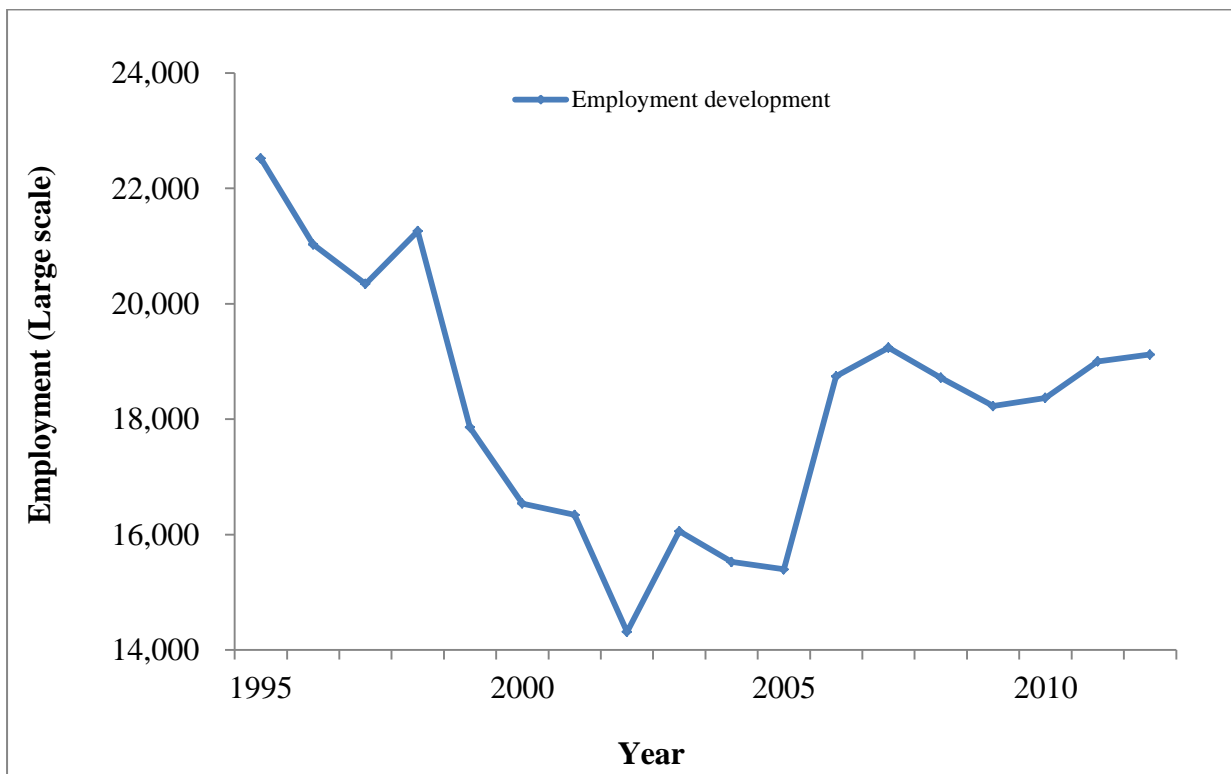


Figure 26: Employment scenario of large-scale mining companies between 1995 and 2012.

Corporate Social Responsibility is mutually beneficial to companies and communities. Over US\$115 million was total investment from 2004 to 2011 for various projects in catchment communities as well as other places. Resettlement Action Plan for communities, other projects (i.e. entertainment facilities, sponsorship package for national sport teams, etc.) and Education were major beneficiaries with 34%, 17% and 9% respectively. Other projects that benefited were Alternative Livelihood Projects 8%, road 8%, Agriculture 5%, Health,

Sanitation, Water and Electricity 4% each, Housing 3% and Agro-industry 2% as shown in (Figure 27). Good relationship is developed between companies and external factors when these companies reinvest part of their profits into community projects to signify their good intentions towards development.

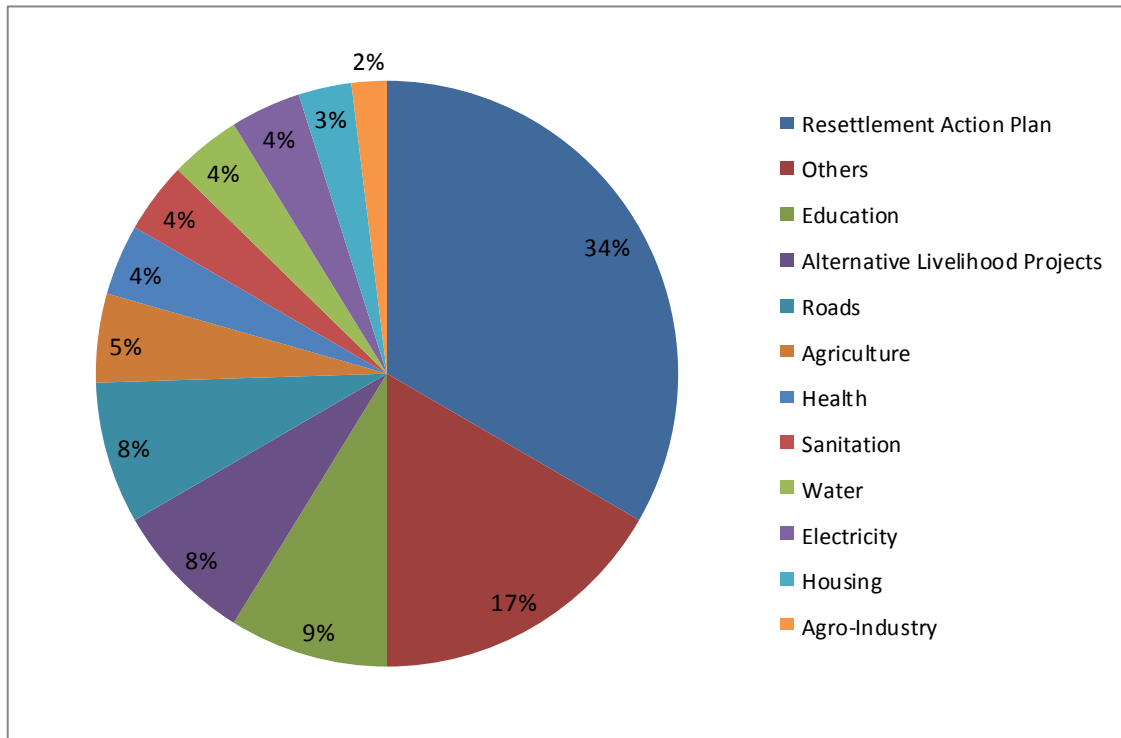


Figure 27: Transfers under the Corporate Social Responsibility Schemes of Mining Companies to various recipients and programs between 2004 and 2011.

Future scenario of the mining industry (Minerals production and revenue)

One of the core aims of our research is to estimate the future development of production and revenue in mining industries in Ghana based on its historical data. To get some better base for forecasting the development in mining industries we applied the direct regression function on minerals produced from 1985 – 2011 and revenue from 1988 – 2011. Outputs of gold, diamond, bauxite and manganese productions with respective revenues can be used for projection which could be estimated by new auto regression function. As shown by tables 10a and 10b of output of direct regression model, projections of minerals production and revenues (gold, diamond, bauxite and manganese) could be estimated by new regression function, representing the detrended time series process with highly significant $R^2 = 0.971, 0.684, 0.607, 0.925$ and $R^2 = 0.989, 0.623, 0.524, 0.873$ respectively. The explanatory variables in

these estimations are lagged values of time series data for various degrees of differentiation. Results of regression of major minerals produced with revenues and autoregression outcome with prognosis of production and revenues from 2012 – 2016 with 2011 as the base year shown in (Appendixes 1a – 1h and 2a – 2b).

Table 10a: Statistical analysis of minerals production from 1985 – 2011

Regression Function, $Y_t = \text{Alfa} + \text{Beta1} * Y(t-1) + \text{Beta2} * Y(t-2) + \text{Beta3} * Y(t-3) + \text{Beta4} * Y(t-4) + \text{Beta5} * Y(t-5)$

We have opted for the 5years lag, because in some studied cases we confirmed the 5th lags impact on the forecast variables.

Time series in production of	Alfa	Beta 1	Beta 2	Beta3	Beta 4	Beta 5	R ²	F
Gold	0.090	1.383	-0.490	0.112	0.106	-0.118	0.971**	0.000
P-values	0.238	0.000	0.200	0.775	0.779	0.606		
Diamond	0.147	1.097	-0.494	0.184	0.142	-0.147	0.684**	0.000
P- values	0.239	0.000	0.132	0.578	0.646	0.464		
Bauxite	0.142	0.697	-0.389	0.298	-0.226	0.385	0.607**	0.001
P - values	0.051	0.009	0.208	0.353	0.513	0.253		
Manganese	0.037	1.120	0.423	-0.969	0.113	0.350	0.925**	0.000
P - values	0.524	0.000	0.262	0.041	0.822	0.287		

** Highly significant

Table 10b: Statistical analysis of minerals revenue from 1988 - 2011

Time series in revenue of	Alfa	Beta 1	Beta 2	Beta3	Beta 4	Beta 5	R ²	F
Gold	-71.914	1.156	0.550	-0.787	1.668	-1.438	0.989**	0.000
P - values	0.209	0.000	0.123	0.175	0.015	0.002		
Diamond	6.459	0.912	-0.211	0.125	-0.294	0.116	0.623**	0.002
P - values	0.047	0.001	0.516	0.766	0.512	0.725		

Bauxite	4.593	0.420	0.385	-0.704	0.296	0.286	0.524**	0.013
P - value	0.052	0.092	0.154	0.032	0.433	0.342		
Manganese	-1.805	0.747	0.329	0.525	-1.221	0.939	0.873**	0.000
P - values	0.615	0.022	0.388	0.192	0.018	0.028		

** Highly significant

Productions of gold, diamond, bauxite and manganese have shown varied trends over the periods 1985 – 2011. The diagrams below illustrate dynamics of gold, diamond, bauxite and manganese production with empirical and predicted data at confidence intervals of 95%. Gold production has seen continuous increase for the past periods but declined sharply from 2000 to 2004 and appreciated from 2005 to 2011. The phenomenon is expected to continue based on statistical data obtained. We estimated production of these minerals for the next 5 year (i.e. 2012 – 2016). Gold production is expected to appreciate in 2012 as 3.748 million ounce and 4.270 million ounce in 2016. Diamond production in 1985 was over 6 hundred thousand carats but reduced subsequently and keeps on decreasing for the past periods as low as 2 hundred thousand carats in 2011. Estimated production of diamond in 2012 and 2013 is expected at 0.332 million carats, 0.391 million carats respectively. From 2014 to 2016, production would appreciate from 0.455 million carats to 0.558 million carats. Empirical data of bauxite production experienced ups and downs and with future output witnesses same scenario based on direct regression model. In 2012, prognosis result of bauxite is estimated at 0.588 million metric tons later increase to 0.697 million metric tons in 2013. From 2014 to 2016 estimated outputs were 0.548 million metric tons, 0.565 million metric tons and 0.554 million metric tons respectively. Manganese saw an increased in production since 1985 but output fell in 2008 and 2009. Production increased later and future output is expected to increase based on historical data assessment. Manganese production is expected to appreciate in 2012 as 2.232 million metric tons and increased further to 2.431 million metric tons in 2014 but decline in the subsequent year to 2.309 million metric tons to 2.275 million metric tons in 2016 (Figures 28- 31 and Appendix 2a).

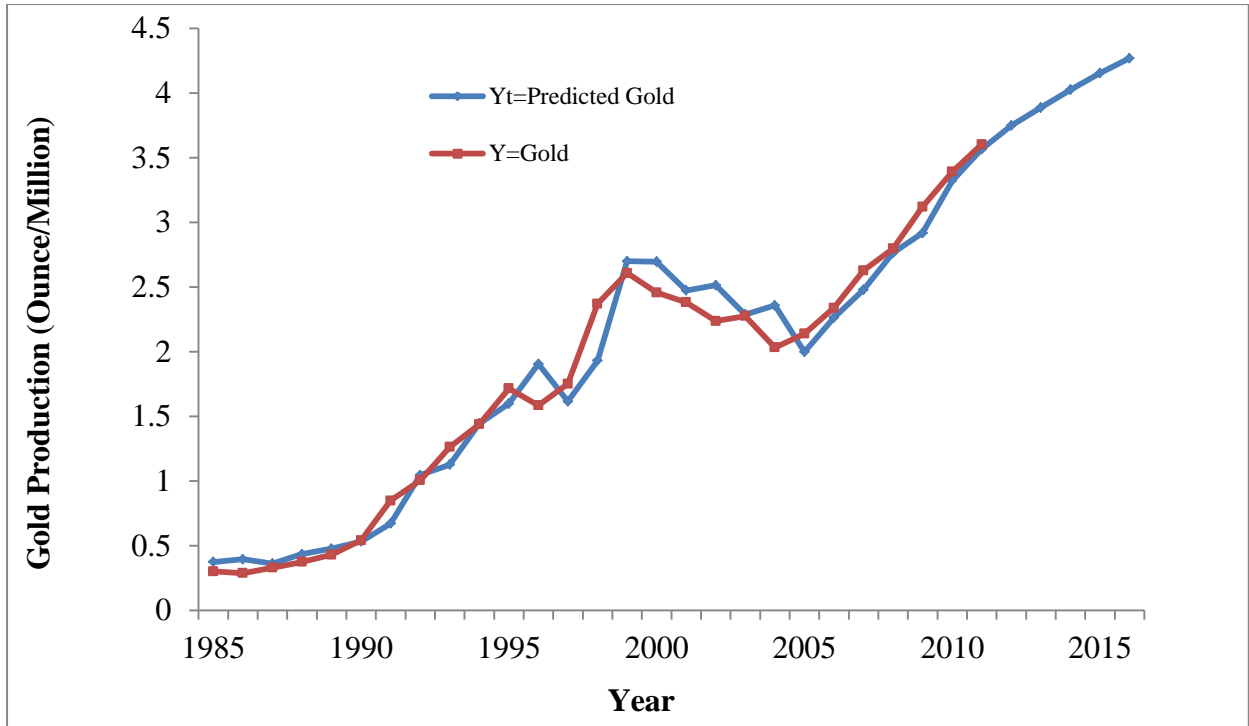


Figure 28: Dynamics of current and future scenario of gold production from 1985 - 2016

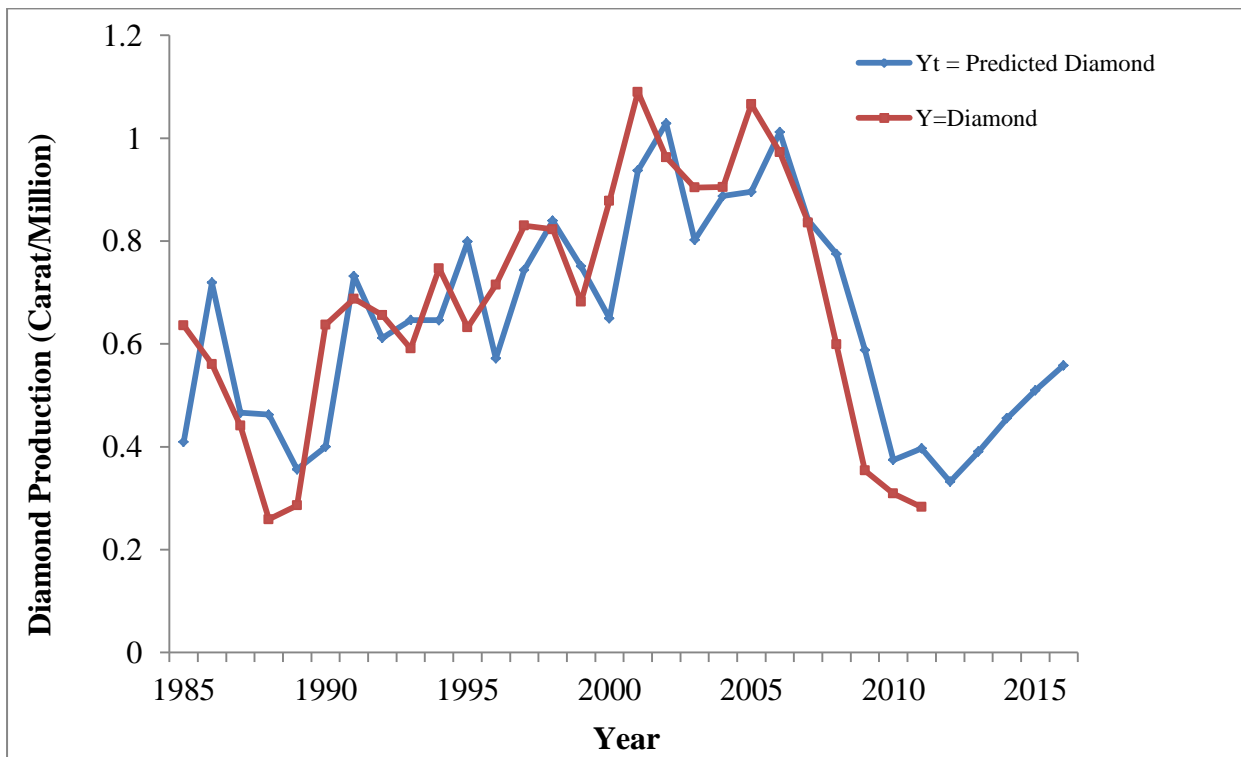


Figure 29: Dynamics of current and future scenario of diamond production from 1985 - 2016

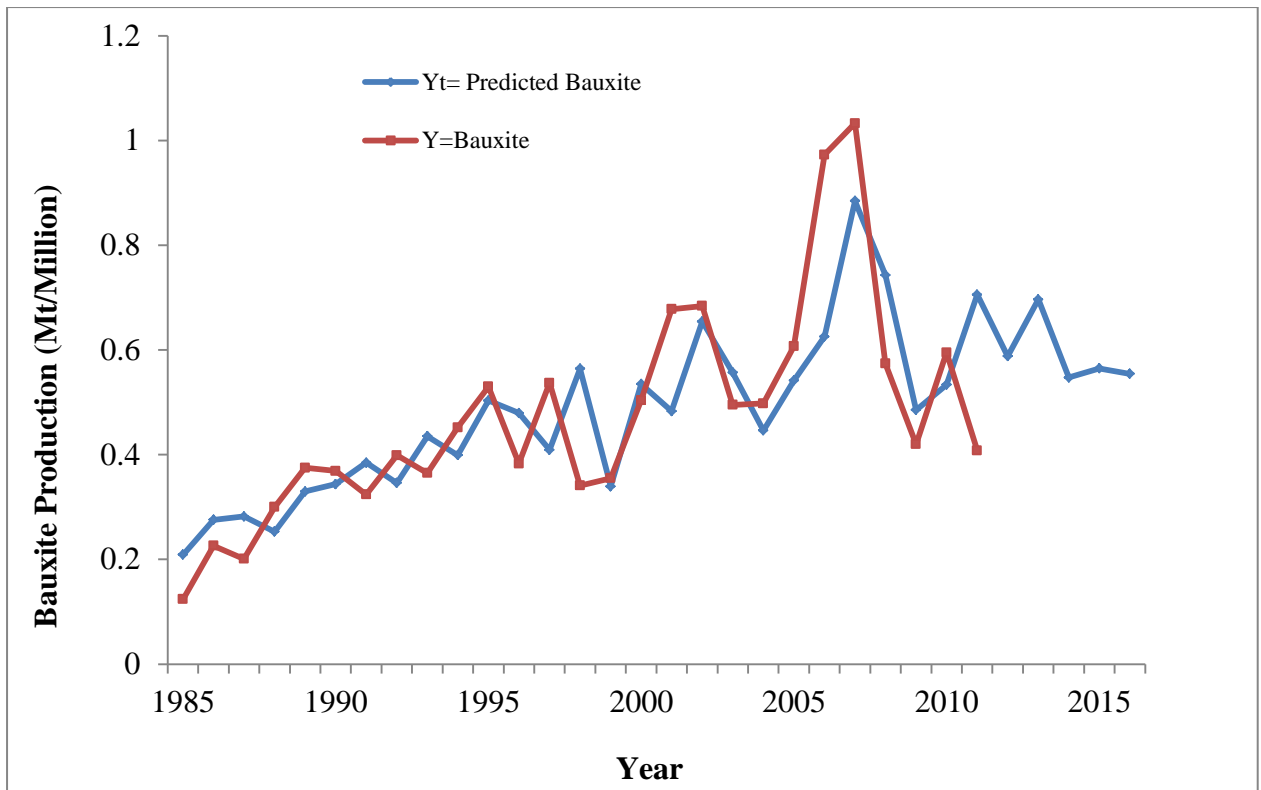


Figure 30: Dynamics of current and future scenario of bauxite production from 1985 – 2016

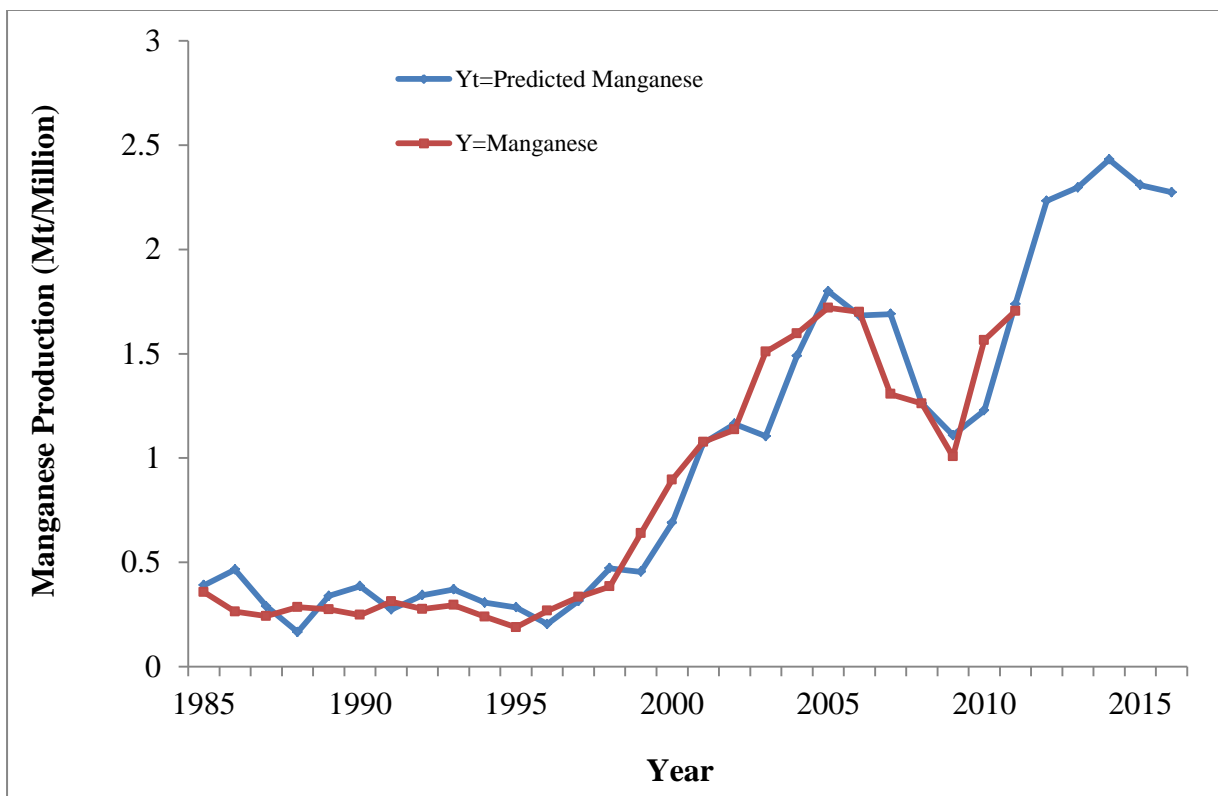


Figure 31: Dynamics of current and future scenario of manganese production from 1985 - 2016

Current and future scenarios of revenue (1988 – 2016)

Revenue from mining sector has appreciated over the periods from (i.e.1988 – 2011) with respect to years. Figures 32 – 35 below are graphical representations of empirical and forecast data of revenues from gold, diamond, bauxite and manganese at confidence intervals of 95%. We estimated revenue of gold, diamond, bauxite and manganese from 2012 – 2016. Revenue from gold is expected to appreciate significantly from 2012 to 2016 and within the range of US \$ 6,944.50 million – US \$ 23,655.30 million. However, diamond revenue encountered ups and downs for the past years; its future revenue exhibits long term increase with temporal fluctuations. In 2012, revenue from diamond is expected to reach US \$ 18.24 million and appreciate further to US \$ 21.90 million in 2014 but decreased to US \$ 19.98 million and US \$ 19.55 million in 2015 and 2016 respectively. In terms of bauxite, expected forecast revenue is expected to fluctuate for next 5 years based on the model. Revenue would appreciate in 2012 to US \$ 17.52 million and decline in 2013 to US \$ 13.59 million and appreciate again to US \$ 19.70 million in the following year. This amount would reduce in 2015 and 2016 to US \$ 12.20 million and US \$ 14.95 million respectively. Finally, manganese revenue appreciated for the past years which has been noticed in the prognosis from 2012 – 2016. Forecast revenue in 2012 for manganese is expected at US \$ 82.30 million which shows a reduction in previous revenue but increased significantly to US \$ 112.17 million in 2013 to US \$ 178.66 million in 2016. Based on estimated figures of these minerals, gold would continue to be the number one contributor to nation's Gross Domestic Product. Manganese is expected to be second highest contributor to government revenue followed by diamond and bauxite (Figures 32 – 35 and Appendix 2b).

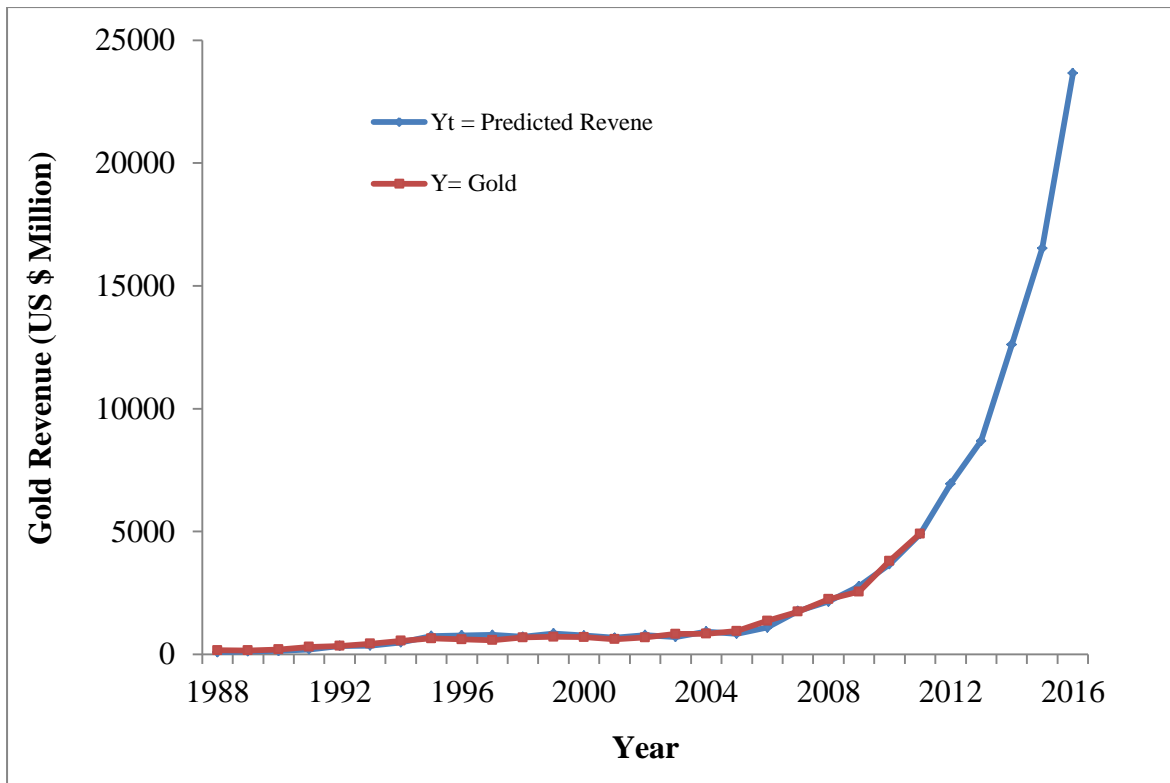


Figure 32: Dynamics of current and future scenario of gold revenue from 1988 - 2016

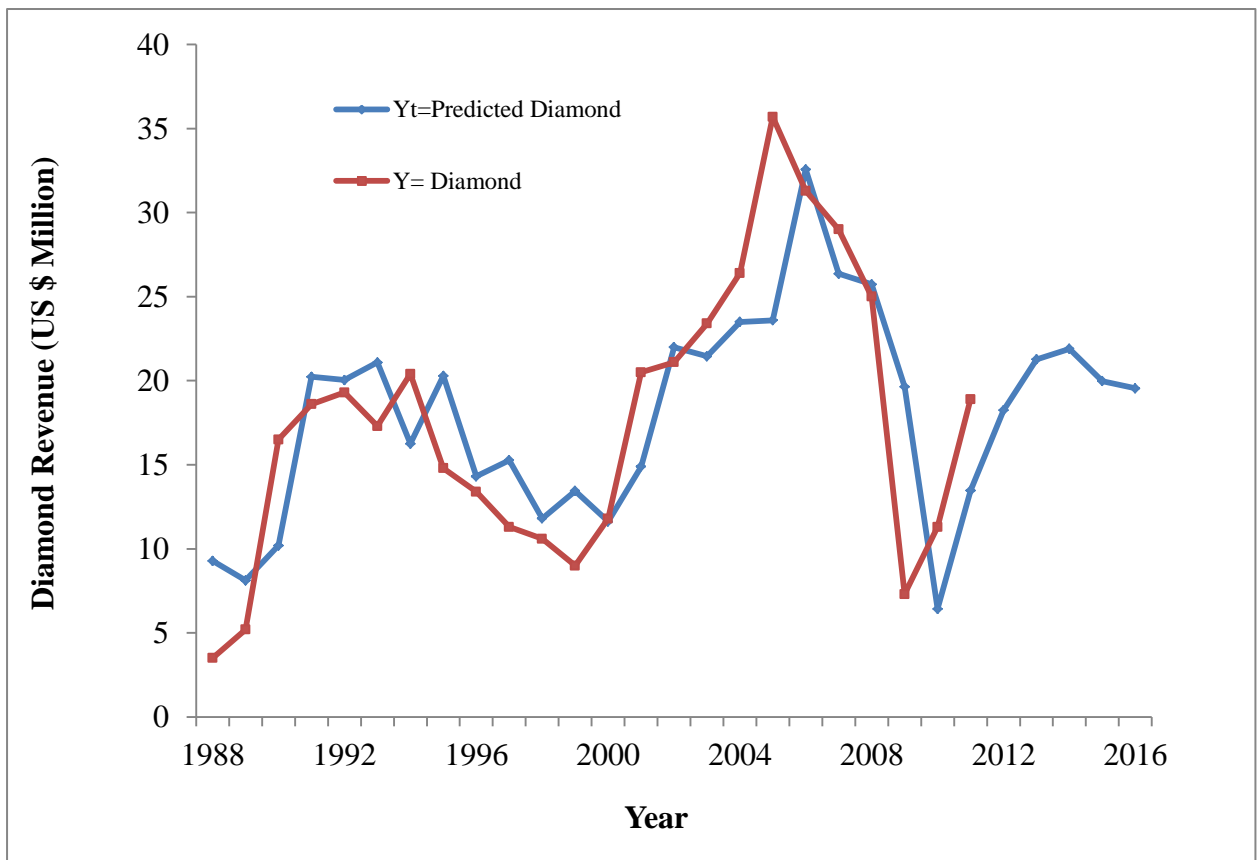


Figure 33: Dynamics of current and future scenario of diamond revenue from 1988 - 2016

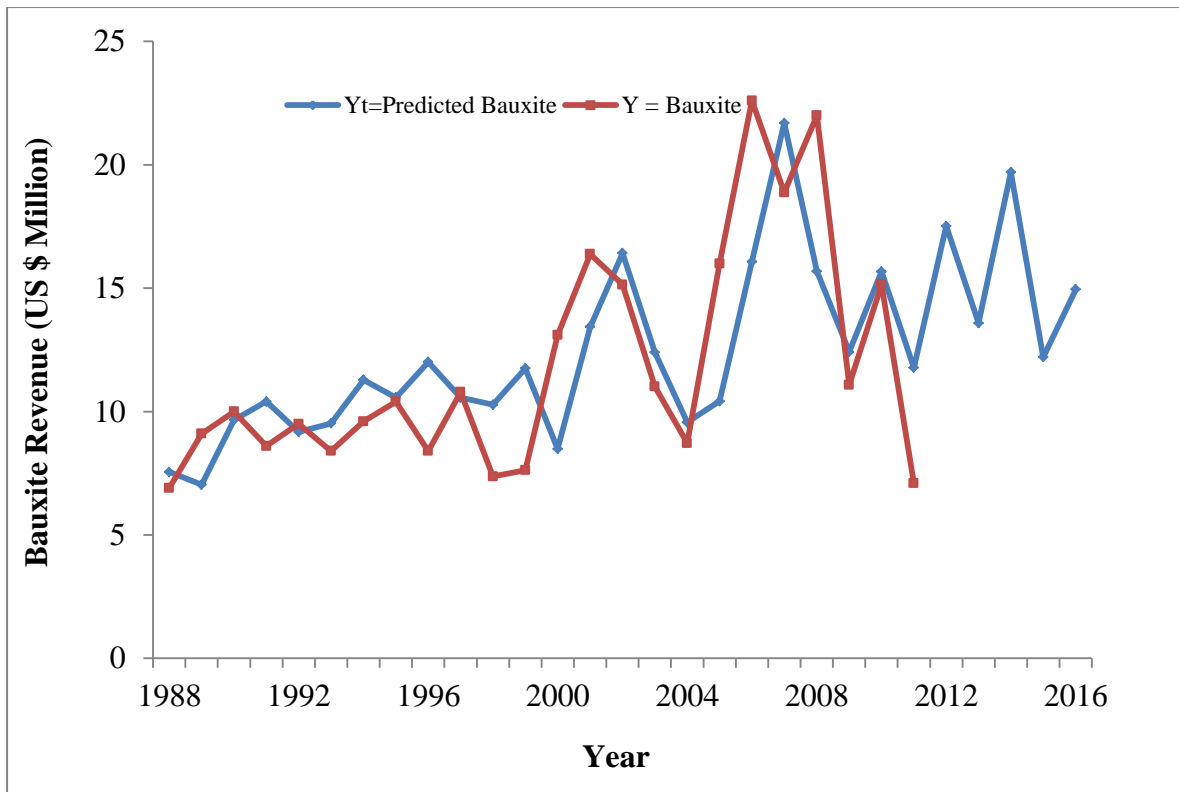


Figure 34: Dynamics of current and future scenario of bauxite revenue from 1988 - 2016

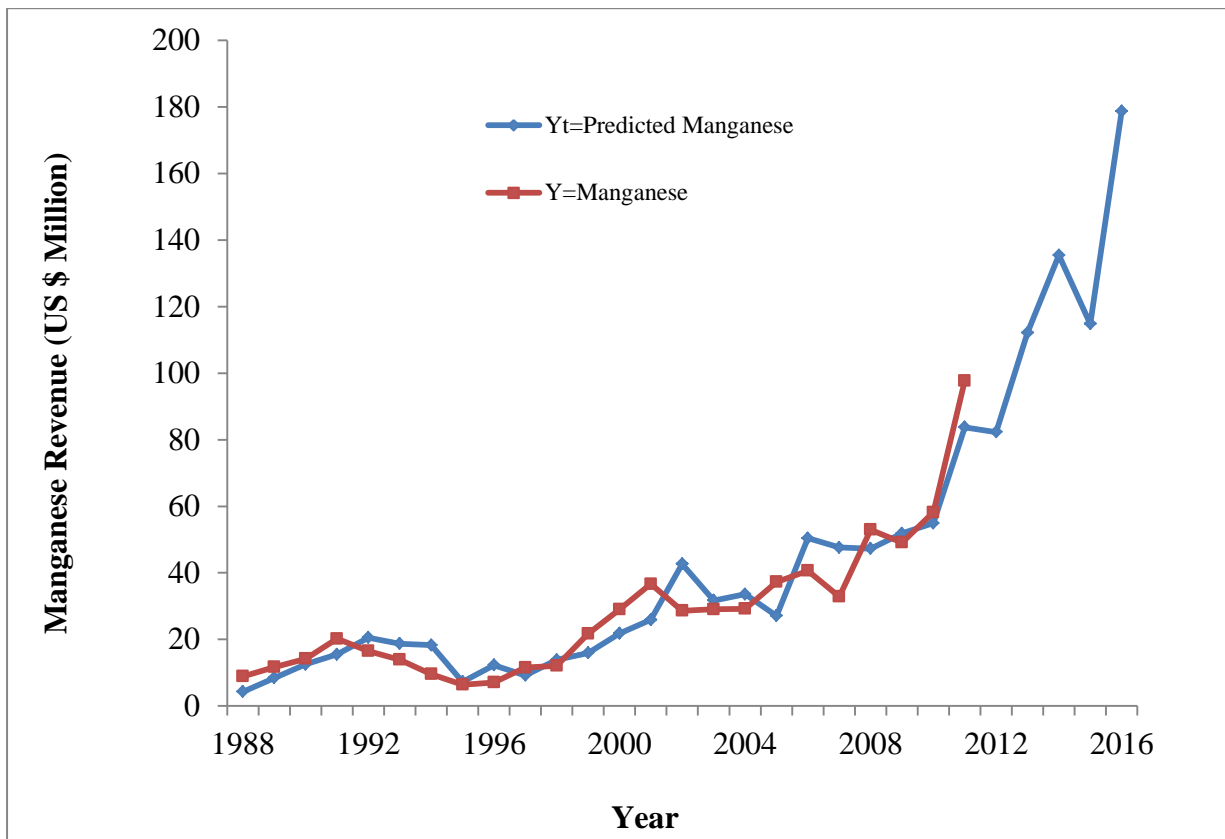


Figure 35: Dynamics of current and future scenario of manganese revenue from 1988 - 2016

4.3 Analysis of empirical data on socio-economic benefits, environmental and illegal mining impacts of the industry

It is important to carry out empirical research in some mining related communities and non-mining communities to ascertain perceived views of Ghanaians about the mining industry. Statistical figures from various institutions have trumpeted various socio-economic achievements and contributions of the mining industry towards the economy of Ghana. Due to these statistical figures, it is important to find out from the general public how they perceive the sector in terms of its input towards development of the entire nation. Citizens must feel the positive impact trumpeted by these statistical figures. In case where general public do not feel the benefit of that comes with mining industry, they would continue to criticize the sector and expect more from them. In the long-run, various institutions as well as citizens would be operation on different platforms. To analyze data collected from field survey conducted, IBM Statistical Package for Social Sciences 20 (SPSS) software was used. We sampled six hundred and forty-seven respondents, 442 males and 205 females. The responses of respondents were evaluated in four categories (i.e. gender, age, sector of employment and managerial level within an organization of respondents). Statistical analysis of total respondents indicated 41.4% are public sector workers, 37.7% private workers and 20.9% works in the media and others. The percentages of respondents at managerial levels are as follows: 20.4 % junior and others, 33.7% middle and 45.9% senior staffs. The research data was collected in three different categories (socio – economic impact, environmental issues and illegal operations) on the mining industry and analyzed.

4.3.1 Socio-economic impact result analysis

Table 11. Statistical analysis of socio-demographic information of respondents in relation to contributions of mining companies towards communities' development

Variables	Categories	Contributions of mining companies to communities development				Total
		Excellent	Very Good	Good	Poor	
Gender	Males	6.8%	16.4%	26.3%	18.9%	68.3%
	Females	2.9%	6.8%	13.4%	8.5%	31.7%
Age (Between)	18 – 27	5.7%	11.4%	19.8%	11.9%	48.8%
	28 – 47	3.6%	11.3%	16.8%	14.4%	46.1%
	48>	0.5%	0.5%	3.1%	1.1%	5.1%

Sector of Employment	Public	2.8%	8.7%	17.2%	12.8%	41.4%
	Private	4.6%	11.1%	13.6%	8.3%	37.7%
	Media	2.3%	3.4%	9.0%	6.2%	20.9%
Level within an organization	Junior	2.8%	4.8%	7.7%	5.1%	20.4%
	Middle	2.8%	9.9%	12.1%	9.0%	33.7%
	Senior	4.2%	8.5%	19.9%	13.3%	45.9%
Total %		9.7%	23.2%	39.7%	27.4%	100.0%

Source: Filed survey, 2013.

Respondents view on contributions of mining companies towards immediate communities in which they operate was analyzed according to their socio-demographic information (i.e. gender, age, sector of employment and managerial level within an organization). Under gender, 6.8% males and 2.9% females' respondents perceived companies' contributions to communities' development as excellent, 16.4% males and 6.8% females perceived it as very good, 26.3% males and 13.4% females identified it as good and 18.9% males and 8.5% females rated it as poor. On age categories, 5.7%, 3.6% and 0.5% rated it as excellent, 11.4%, 11.3%, and 0.5% perceived it as very good, 19.8%, 16.8% and 3.1% as good and 11.9%, 14.4% and 1.1% of participants in the survey graded their input towards communities development as poor between 18 – 27 years, 28 – 47 years and 48 years and above respectively. With respect to views expressed by respondents based on their sector of employment, 2.8%, 4.6% and 2.3% perceived it as excellent; 8.7%, 11.1% and 3.4% rated it very good; 17.2%, 13.6% and 9.0% as good whilst 12.8%, 8.3% and 6.2% as poor based on public, private and media related employees' perspectives respectively. Finally, responses based on managerial level of respondents (thus junior, middle and senior staffs), 2.8%, 2.8% and 4.2% rated it as excellent; 4.8%, 9.9% and 8.5% as very good; 7.7%, 12.1% and 19.9% as good and 5.1%, 9.0% and 13.3% saw it as poor respectively. To sum it up, 39.7% of respondents perceived it as good, 27.4% as poor, 23.2% as very good and 9.7% as excellent contribution of mining companies towards communities' development directly linked to mining operations. Based on the survey analysis, 40% which constitute majority of participants confirmed that mining companies contribute directly to the communities' general socio-economic development (Table 11).

Table 12. Statistical analysis of socio-demographic information of respondents in relation to contributions of mining to nation’s development

Variables	Categories	Contribution of mining to the nation’s development				Total
		Excellent	Very Good	Good	Poor	
Gender	Males	4.3%	20.1%	28.1%	15.8%	68.3%
	Females	2.9%	9.4%	13.8%	5.6%	31.7%
Age (Between)	18 – 27	3.6%	16.2%	18.4%	10.7%	48.8%
	28 – 47	3.4%	12.4%	20.2%	10.0%	46.1%
	48>	0.3%	0.9%	3.2%	0.6%	5.1%
Sector of Employment	Public	2.5%	10.0%	20.7%	8.2%	41.4%
	Private	3.9%	12.2%	14.7%	7.0%	37.7%
	Media	0.9%	7.3%	6.5%	6.2%	20.9%
Level within an organization	Junior	2.2%	6.0%	7.4%	4.8%	20.4%
	Middle	2.3%	11.3%	13.8%	6.3%	33.7%
	Senior	2.8%	12.2%	20.7%	10.2%	45.9%
Total %		7.3%	29.5%	41.9%	21.3%	100.0%

Source: Filed survey, 2013.

Perceived views of participants of the survey were analyzed. Opinions expressed in terms of contributions of mining companies to national development according to gender indicated 4.3% and 2.9% as excellent, 20.1% and 9.4% as very good, 28.1% and 13.8% as good while 15.8% and 5.6% as poor with respect to males and females respectively. Responses based on age categories of respondents between 18 – 27 years, between 28 – 47 years and 48 years and above saw it as excellent contribution with 3.6%, 3.4% and 0.3% respectively. In addition, 16.2%, 12.4% and 0.9% rated it as very good, 18.4%, 20.2% and 3.2% as good whilst 10.7%, 10.0% and 0.6% indicated contributions to national development as poor. Echoed views in terms of sector of employment (thus public, private and media employees) by participants of the survey rated it as excellent with 2.5%, 3.9% and 0.9% respectively. Further rating shows 10.0%, 12.2% and 7.3% as very good, 20.7%, 14.7% and 6.5% as good and lastly, 8.2%, 7.0% and 6.2% of respondents perceived it as poor respectively. Opinions expressed based on their managerial levels in an organization (i.e. junior, middle and senior) rated the industry’s contribution towards national development with 2.2%, 2.3% and 2.8% as excellent, 6.0%, 11.3% and 12.2% as very good, 7.4%, 13.8% and 20.7% as good. Finally, views shared by 4.8%, 6.3% and 10.2% of respondents saw it as poor respectively. In general, 41.9% of total

sample population perceived contribution of companies as good, 29.5% as very good, 21.3% graded impact of mining companies towards national development as poor and 7.3% rated it as excellent contribution. According to the survey analysis, 42% of participants of the survey confirmed that mining companies contribute towards the nation's macroeconomic development (Table 12).

Table 13. Statistical analysis of socio-demographic information of respondents in relation to provision of infrastructure

Variables	Categories	Infrastructure provided by mining sector				Total
		Excellent	Very Good	Good	Poor	
Gender	Males	6.3%	17.8%	26.0%	18.2%	68.3%
	Females	2.5%	7.4%	13.3%	8.5%	31.7%
Age (Between)	18 – 27	3.6%	16.2%	18.4%	10.7%	48.8%
	28 – 47	3.4%	12.4%	20.2%	10.0%	46.1%
	48>	0.3%	0.9%	3.2%	0.6%	5.1%
Sector of Employment	Public	3.4%	8.5%	18.4%	11.1%	41.4%
	Private	3.9%	11.9%	13.8%	8.2%	37.7%
	Media	1.5%	4.8%	7.1%	7.4%	20.9%
Level within an organization	Junior	2.5%	5.6%	8.2%	4.2%	20.4%
	Middle	2.8%	10.0%	13.8%	7.1%	33.7%
	Senior	3.6%	9.6%	17.3%	15.5%	45.9%
Total %		8.8%	25.2%	39.3%	26.7%	100.0%

Source: Filed survey, 2013.

Statistical analysis of responses from respondents' on provision of infrastructure by the mining sector was evaluated. Opinions evaluated based on gender indicated 6.3% and 2.5% as excellent, 17.8% and 7.4% as very good, 26.0% and 13.3% as good and lastly, 18.2% and 8.5% as poor based on males and females responses accordingly. In addition, views shared in terms of age categories between 18 – 27 years, 28 – 47 years and 48 years and above were 3.6%, 3.4% and 0.3% as excellent, 16.2%, 12.4% and 0.9% as very good, 18.4%, 20.2% and 3.2% as good and 10.7%, 10.0% and 0.6% as poor respectively. Assessment made based on various sectors of employment of respondents of which 3.4%, 3.9% and 1.5% indicated provision of infrastructure as excellent, 8.5%, 11.9% and 4.8% as very good, 18.4%, 13.8% and 7.1% as good whilst 11.1%, 8.2% and 7.4% rated it as poor according to public, private and media related employees respectively. Furthermore, 2.5% junior staffs, 2.8% middle

staffs and 3.6% senior staffs indicated provision of infrastructure by mining sector as excellent, 5.6%, 10.0% and 9.6% as very good, 8.2%, 13.8% and 17.3% as good and 4.2%, 7.1% and 15.5% as poor respectively according to their managerial level within an organization. To sum up, results based on general perception of sampled data rated provision of infrastructure (road, school, health posts, etc) in totality as good with 39.3% of sample size, 26.7% as poor, 25.2% as very good and 8.8% as excellent input from the industry (Table 13).

Table 14. Statistical analysis of socio-demographic information of respondents in relation to maximization of revenue and royalties

Variables	Categories	Communities and nation maximization of revenue and royalties			Total
		Agree	Slightly agree	Disagree	
Gender	Males	13.6%	29.5%	25.2%	63.3%
	Females	6.5%	15.3%	9.9%	31.7%
Age (Between)	18 – 27	10.4%	24.0%	14.5%	48.8%
	28 – 47	9.0%	18.5%	18.5%	46.1%
	48>	0.8%	2.3%	2.0%	5.1%
Sector of Employment	Public	7.7%	16.8%	16.8%	41.4%
	Private	8.2%	17.5%	12.1%	37.7%
	Media	4.2%	10.5%	6.2%	20.9%
Level within an organization	Junior	4.5%	9.3%	6.6%	20.4%
	Middle	7.7%	15.0%	11.0%	33.7%
	Senior	7.9%	20.6%	17.5%	45.9%
Total %		20.1%	44.8%	35.1%	100.0%

Source: Filed survey, 2013.

On maximization of revenues and royalties of communities and the nation, views of respondents were analyzed based on four socio-demographic information/indicators. In terms of gender, 13.6% and 6.5% agreed, 29.5% and 15.3% slightly agreed, 25.2% and 9.9% disagreed based on males and females respondents respectively on the notion of mutual benefits of communities and the entire nation on royalties and revenues from the sector. On perceived views by respondents under age categories 18 – 27 years, 28 – 47 years and 48 years and above, 10.4%, 9.0% and 0.8% agreed, 24.0%, 18.5% and 2.3% slightly agreed, 14.5%, 18.5% and 2.0% disagreed respectively. On opinions expressed by public, private and media related workers on maximization of royalties and revenues, 7.7%, 8.2% and 4.2%

agreed, 16.8%, 17.5% and 10.5% slightly agreed whilst 16.8%, 12.1% and 6.2% disagreed. Perception on managerial levels of respondents indicated that, 4.5%, 7.7% and 7.9% agreed, 9.3%, 15.0% and 20.6% slightly agreed whilst 6.6%, 11.0% and 17.5% disagreed based on junior, middle and senior positions respectively according to organizations. In the nutshell, 44.8% of participants' of the survey slightly agreed on maximization of revenue and royalties by communities and the state whilst 35.1% disagreed and 20.1% agreed on this notion (Table 14).

Table 15. Statistical analysis of socio-demographic information of respondents in relation to standard of living of people in mining communities

Variables	Categories	Standard of living of people in mining communities				Total
		Excellent	Very Good	Good	Poor	
Gender	Males	7.3%	12.7%	22.8%	25.5%	68.3%
	Females	4.8%	5.3%	8.4%	13.3%	31.7%
Age (Between)	18 – 27	7.0%	9.0%	15.3%	17.5%	48.8%
	28 – 47	4.5%	8.4%	14.1%	19.2%	46.1%
	48>	0.6%	0.6%	1.7%	2.2%	5.1%
Sector of Employment	Public	5.0%	5.1%	12.8%	18.6%	41.5%
	Private	4.8%	9.9%	11.3%	11.8%	37.8%
	Media	2.3%	2.9%	7.0%	8.5%	20.7%
Level within an organization	Junior	3.1%	2.2%	7.6%	7.6%	20.4%
	Middle	3.9%	7.4%	9.9%	12.5%	33.7%
	Senior	5.1%	8.4%	13.6%	18.7%	45.8%
Total %		12.1%	18.0%	31.1%	38.9%	100.0%

Source: Filed survey, 2013.

Respondents' perspectives on standard of living of people in mining communities were analyzed with respect to gender, age, sector of employment and managerial level within an organization. Responses of respondents on gender rated it as excellent with 7.3% and 4.8%, 12.7% and 5.3% graded it as very good, 22.8% and 8.4% as good while 25.5% and 13.3% indicated standard of living in mining communities as poor with respect to males and females respondents. On age, 7.0%, 4.5% and 0.6% considered it as excellent, 9.0%, 8.4% and 0.6% as very good, 15.3%, 14.1% and 1.7% as good and 17.5%, 19.2% and 2.2% as poor based on 18 – 27 years, 28 – 47 years and 48 years and above age categories respectively. Furthermore, frequency distribution of responses based on sector of employment, (i.e. public,

private and media workers) rated this view as excellent with 5.0%, 4.8% and 2.3%. Additionally, 5.1%, 9.9% and 2.9% of respondents saw it as very good, 12.8%, 11.3% and 7.0% as good and 18.6%, 11.8% and 8.5% as poor. Finally, perception echoed based on their managerial levels within an organization indicated 3.1%, 3.9% and 5.1% respondents graded it as excellent, 2.2%, 7.4% and 8.4% saw it as very good, 7.6%, 9.9% and 13.6% as good while 7.6%, 12.5% and 18.7% as poor. In a nutshell, 38.9% of total respondents saw standard of living of people in mining communities as poor, 31.1% as good, 21.1% as excellent and 18.0% as very good (Table 15).

Table 16. Statistical analysis of socio-demographic information of respondents in relation to increase royalty payment

Variables	Categories	Decision to increase royalties percentage and its impact on development			Total
		Agree	Slightly agree	Disagree	
Gender	Males	16.4%	37.1%	14.8%	68.3%
	Females	8.5%	17.2%	6.0%	31.7%
Age (Between)	18 – 27	12.5%	28.1%	8.2%	48.8%
	28 – 47	11.3%	23.0%	11.7%	46.1%
	48>	1.1%	3.1%	0.9%	5.1%
Sector of Employment	Public	10.8%	21.8%	8.8%	41.4%
	Private	10.4%	20.1%	7.3%	37.7%
	Media	3.7%	12.4%	4.8%	20.9%
Level within an organization	Junior	4.3%	11.6%	4.5%	20.4%
	Middle	10.7%	16.7%	6.3%	33.7%
	Senior	9.9%	26.0%	10.0%	45.9%
Total %		24.9%	54.3%	20.9%	100.0%

Source: Filed survey, 2013.

Perceived views were analyzed to determine if fixing of royalty percentage at five (5) would increase revenue and impact positively on development of mining communities and the nation. Responses according to gender shows that 16.4% and 8.5% agreed, 37.1% and 17.2% slightly agreed and 14.8% and 6.0% disagreed on the positive impact on the increment based on males and females responses. Analyzed outcome based on ages between 18 – 27 years, 28 – 47 years and 48 years and above of which 12.5%, 11.3% and 1.1% agreed it could lead to positive impact on development. However, 28.1%, 23.0% and 3.1% slightly agreed and 8.2%,

11.7% and 0.9% disagreed respectively. On sector of employment of participants of the research, 10.8%, 10.4% and 3.7% agreed, 21.8%, 20.1% and 12.4% slightly agreed with 8.8%, 7.3% and 4.8% disagreed. According to responses on managerial level of respondents within an organization, 4.3%, 10.7% and 9.9% agreed, 11.6%, 16.7% and 26.0% slightly agreed with 4.5%, 6.3% and 10.0% of sampled size entirely disagreed on it. Lastly, results in general indicated 54.3% of respondents slightly agreed it would increase revenue and aid development of communities. Positive and negative responses from respondents made up 24.9% and 20.9% of sampled population respectively (Table 16).

Table 17. Statistical analysis of socio-demographic information of respondents in relation to payment of compensation

Variables	Categories	Compensation paid to farmers and others agencies as a result of negative impact of mining				Total
		Excellent	Very Good	Good	Poor	
Gender	Males	8.2%	11.7%	19.8%	28.6%	68.3%
	Females	3.2%	5.1%	9.6%	13.8%	31.7%
Age (Between)	18 – 27	6.5%	9.0%	13.3%	20.1%	48.8%
	28 – 47	4.6%	7.4%	13.9%	20.1%	46.1%
	48>	0.3%	0.5%	2.2%	2.2%	5.1%
Sector of Employment	Public	4.0%	5.3%	13.8%	18.4%	41.4%
	Private	5.4%	7.9%	10.2%	14.2%	37.7%
	Media	2.0%	3.7%	5.4%	9.7%	20.9%
Level within an organization	Junior	2.5%	4.0%	6.0%	7.9%	20.4%
	Middle	4.3%	7.0%	9.3%	13.1%	33.7%
	Senior	4.6%	5.9%	14.1%	21.3%	45.9%
Total %		11.4%	16.8%	29.4%	42.3%	100.0%

Source: Filed survey, 2013.

Respondents' opinion on compensation paid to farmers and other agents as a result of negative impact of mining was analyzed based on their socio-demographic information (gender, age, sector of employment and managerial level within an organization). With respect to gender, 8.2% and 3.2% saw it as excellent remittance to farmers and related agencies whilst 11.7% and 5.1% rated it as very good, 19.8% and 9.6% as good and 28.6% and 13.8% indicated compensation as poor according to opinions of males and females respondents respectively. Outcome based on age categories between 18 – 27 year, 27 – 47

years and 48 years and above, 6.5%, 4.6% and 0.3% rated compensation as excellent, 9.0%, 7.4% and 0.5% as very good, 13.3%, 13.9% and 2.2% as good with 20.1%, 20.1% and 2.2% as poor accordingly. Responses analyzed on sector of employment (thus, public, private and media related workers) of which 4.0%, 5.4% and 2.0% rated compensation as excellent, 5.3%, 7.9% and 3.7% as very good, 13.8%, 10.2% and 5.4% as good with 18.4%, 14.2% and 9.7% as poor in that order. On responses based on managerial level of respondents within an organization (i.e. junior, middle and senior employees), 2.5%, 4.3% and 4.6% rated compensation as an excellent, 4.0%, 7.0% and 5.9% as very good, 6.0%, 9.3% and 14.1% as good whilst 7.9%, 13.1% and 21.3% saw it as poor remuneration. To conclude, analyzed result in totality indicated that 42.3% of all participants rated compensation as poor, 29.4 % agreed it was good, 16.8% saw it as very good and 11.4% as excellent reimbursement of farmers and other related agencies as a result of negative impact of mining (Table 17).

4.3.2 Environmental result analysis

Table 18. Statistical analysis of socio-demographic information of respondents in relation to pollution of water bodies

Variables	Categories	Pollution of water bodies by mining companies				Total
		Excellent	Very Good	Good	Poor	
Gender	Males	6.0%	7.0%	10.0%	45.3%	68.3%
	Females	3.1%	3.9%	4.2%	20.6%	31.7%
Age (Between)	18 – 27	4.5%	5.9%	5.4%	33.1%	48.8%
	28 – 47	3.7%	4.5%	8.3%	29.5%	46.1%
	48>	0.9%	0.5%	0.5%	3.2%	5.1%
Sector of Employment	Public	3.2%	3.4%	6.2%	28.6%	41.4%
	Private	3.9%	4.8%	5.7%	23.3%	37.7%
	Media	2.0%	2.6%	2.3%	13.9%	20.9%
Level within an organization	Junior	1.2%	1.7%	4.3%	13.1%	20.4%
	Middle	3.6%	3.1%	4.8%	22.3%	33.7%
	Senior	4.3%	6.0%	5.1%	30.4%	45.9%
Total %		9.1%	10.8%	14.2%	65.8%	100.0%

Source: Filed survey, 2013.

Perceived statistical analysis of respondents' views shared according to these variables (i.e. gender, age, sector of employment and managerial level within an organization) of respondents based on pollution of water bodies by mining companies. With respect to

responses according to gender of respondents (i.e. males and females) 6.0% and 3.1% rated pollution as low, 7.0% and 3.9% as average, 10.0% and 4.2% as satisfactory and 45.3% and 20.6% as high respectively. In respect to responses on age categories between 18 -27 years, 28 – 47 years and 48 years and above, 4.5%, 3.7% and 0.9% rated pollution of water bodies as low, 5.9%, 4.5% and 0.5% as average, 5.4%, 8.3% and 0.5% as satisfactory and 33.1%, 29.5% and 3.2% graded it as high. Responses, on sector of employment, indicated 3.2%, 3.9% and 2.0% of sampled population rated pollution as low, 3.4%, 4.8% and 2.6% as average, 6.2%, 5.7% and 2.3% as satisfactory and 28.6%, 23.3% and 13.9% as high according to perceived views of public, private and media related workers. On opinions based on managerial level within an organization, 1.2%, 3.6% and 4.3% identified pollution as low, 1.7%, 3.1% and 6.0% as average, 4.3%, 4.8% and 5.1% as satisfactory whilst 13.1%, 22.3% and 30.4 % as high according to junior, middle and senior workers or people who participated in the survey. General views expressed by total participants of the research shows that 65.8% of respondents rated water bodies' pollution of mining companies as high, 14.2% as satisfactory, 10.8% as average and 9.1% as low as shown in (Table 18).

Table 19. Statistical analysis of socio-demographic information of respondents in relation to attitude of companies towards other pollutions

Variables	Categories	Attitude of mining companies towards pollution apart from water bodies				Total
		Excellent	Very Good	Good	Poor	
Gender	Males	5.1%	8.0%	18.4%	36.8%	68.3%
	Females	3.1%	4.0%	7.3%	17.3%	31.7%
Age (Between)	18 – 27	4.3%	6.6%	11.7%	26.1%	48.8%
	28 – 47	3.1%	5.3%	11.7%	26.0%	46.1%
	48>	0.8%	0.2%	2.2%	2.0%	5.1%
Sector of Employment	Public	3.2%	3.9%	10.0%	24.3%	41.4%
	Private	3.7%	6.3%	10.8%	16.8%	37.7%
	Media	1.2%	1.9%	4.8%	13.0%	20.9%
Level within an organization	Junior	2.2%	2.2%	4.3%	11.7%	20.4%
	Middle	1.9%	5.6%	10.2%	16.1%	33.7%
	Senior	4.2%	4.3%	11.1%	26.3%	45.9%
Total %		8.2%	12.1%	25.7%	54.1%	100.0%

Source: Filed survey, 2013.

Opinions of respondents based on attitude of mining companies towards other pollutions in exception of water, example air, noise, destruction of forest and other agents were analyzed. Apart from water pollution which is major environmental problem for mining companies, other pollutions are of important to life of indigenous people directly or indirectly living in these mining communities. Analyzed outcome based on gender (males and females) shows that 5.1% and 3.1% rated it as excellent, 8.0% and 4.0% as very good, 18.4% and 7.3% as good and 36.8% and 17.3% saw it as poor attitude of companies towards other pollutions respectively. Responses in line with age categories, 4.3%, 3.1% and 0.8% rated it as excellent attitude, 6.6%, 5.3% and 0.2% as very good, 11.7%, 11.7% and 2.2% as good and 26.1%, 26.0% and 2.0% as poor attitudes of companies between ages of 18 – 27 years, 28 – 47 years and 48 years and above respectively. Perception of respondents based on their sector of employments (i.e. public, private and media related workers), 3.2%, 3.7% and 1.2% rated it as excellent, 3.9%, 6.3% and 1.9% as very good, 10.0%, 10.8% and 4.8% as good and 24.3%, 16.8% and 13.0% identified their attitudes as poor. On responses of respondents based on managerial level within an organization, 2.2%, 1.9% and 4.2% saw this attitude as excellent, 2.2%, 5.6% and 4.3% as very good, 4.3%, 10.2% and 11.1% as good and 11.7%, 16.1% and 26.3% as poor from mining companies in Ghana. In totality, 54.1% saw it as poor, 25.7% as good, 12.1% as very good and 8.2% as an excellent attitude of mining companies towards others according to their managerial positions at work (thus, junior, middle and senior staffs) respectively as shown in (Table 19).

Table 20. Statistical analysis of socio-demographic information of respondents in relation to EPA duties and responsibilities

Variables	Categories	Duties and responsibilities of Environmental Protection Agency (EPA)				Total
		Excellent	Very Good	Good	Poor	
Gender	Males	4.8%	16.8%	24.1%	22.6%	68.3%
	Females	1.4%	6.6%	14.1%	9.6%	31.7%
Age (Between)	18 – 27	3.7%	12.2%	17.6%	15.3%	48.8%
	28 – 47	2.2%	10.4%	17.8%	15.8%	46.1%
	48>	0.3%	0.9%	2.8%	1.1%	5.1%
Sector of Employment	Public	2.3%	7.3%	17.6%	14.2%	41.4%
	Private	2.5%	11.6%	13.1%	10.5%	37.7%
	Media	1.4%	4.6%	7.4%	7.4%	20.9%
	Junior	0.6%	4.0%	8.5%	7.3%	20.4%

Level within an organization	Middle	2.5%	8.3%	12.1%	10.8%	33.7%
	Senior	3.1%	11.1%	17.6%	14.1%	45.9%
Total %		6.2%	23.5%	38.2%	32.1%	100.0%

Source: Filed survey, 2013.

Responses were analyzed on duties and responsibilities of EPA as regulatory institution to monitor, evaluate and regulate activities of mining companies and other agents related to environmental issues according to participants' socio-demographic information. Responses based on gender indicated 4.8% and 1.4% rated duties and responsibilities of EPA as excellent, 16.8% and 6.6% as very good, 24.1% and 14.1% as good and 22.6% and 9.6% as poor according to males and females respectively. Responses, on ages groupings between 18 – 27years, between 28 – 47years and 48 years and above shows that 3.7%, 2.2% and 0.3% graded it as excellent, 12.2%, 10.4% and 0.9% as very good, 17.6%, 17.8% and 2.8% as good and 15.3%, 15.8% and 1.1% as poor effort in terms of monitoring, evaluating and regulating activities of the sector respectively. With regards to analysis on public, private and media employees' perception, 2.3%, 2.5% and 1.4% saw it as excellent work, 7.3%, 11.6% and 4.6% as very good, 17.6%, 13.1% and 7.4% as good and 14.2%, 10.5% and 7.4% as poor. Respondents view shared on the same issue based on managerial level within an organization shows 0.6%, 2.5% and 3.1% rated it as excellent, 4.0%, 8.3% and 11.1% as very good, 8.5%, 12.1% and 17.6% as good and 7.3%, 10.8% and 14.1% as poor duties and responsibilities from Environmental Protection Agency in the management of activities of mining companies and it related agents in the sector. Overall result from the analysis indicated that 38.2 % of respondents saw duties and responsibilities of the institution as good, 32.1 % as poor, 23.5% as very good and 6.2% as an excellent work as shown in (Table 20).

Table 21. Statistical analysis of socio-demographic information of respondents in relation to EPA personnel and resources

Variables	Categories	Personnel and resources of EPA to achieve duties and responsibilities			Total
		Agree	Slightly agree	Disagree	
Gender	Males	13.0%	27.4%	28.0%	68.3%
	Females	6.5%	15.3%	9.9%	31.7%
Age (Between)	18 – 27	10.4%	21.6%	16.8%	48.8%
	28 – 47	8.2%	18.4%	19.5%	46.1%
	48>	0.9%	2.6%	1.5%	5.1%
Sector of Employment	Public	7.4%	16.8%	17.2%	41.4%
	Private	7.6%	15.5%	14.7%	37.7%
	Media	4.5%	10.4%	6.0%	20.9%
Level within an organization	Junior	3.6%	10.0%	6.8%	20.4%
	Middle	6.6%	12.4%	14.7%	33.7%
	Senior	9.3%	20.2%	16.4%	45.9%
Total %		19.5%	42.7%	37.9%	100.0%

Source: Filed survey, 2013.

Data collected and analyzed on whether EPA has personnel and resource to accomplish its core targets in the mining sector and other related environmental obligations received a mixed results. Perceived views on gender (i.e. males and females) shows 13.0% and 6.5% agreed on availability of personnel and resources, 27.4% and 15.3% slightly agreed while 28.0% and 9.9% disagreed respectively. Perception of 10.4%, 8.2% and 0.9% of participants agreed, 21.6%, 18.4% and 2.6% slightly agreed and 16.8%, 19.5% and 1.5% totally disagreed based on ages categories between 18 – 27 years, 28 – 47 years and 48 years and above respectively. On sector of employment, 7.4%, 7.6% and 4.5% agreed, 16.8%, 15.5% and 10.4% slightly agreed and 17.2%, 14.7% and 6.0% disagreed respectively according to views expressed by participants of the survey who are public, private and media related workers respectively. However, views shared by respondents based on managerial level within an organization indicated 3.6%, 6.6% and 9.3% agreed, 10.0%, 12.4% and 20.2% slightly agreed whilst 6.8%, 14.7% and 16.4% disagreed. Generally, 19.5% of total respondents agreed, 37.9% disagreed while 42.7% slightly agreed with the notion that personnel and

resources are available at the disposal of Environmental Protection Agency for accomplishment of its duties and responsibilities in Ghana (Table 21).

Table 22. Statistical analysis of socio-demographic information of respondents in relation to performance of Minerals Commission

Variables	Categories	Performance of Minerals Commission				Total
		Excellent	Very Good	Good	Poor	
Gender	Males	6.3%	14.2%	29.1%	18.7%	68.3%
	Females	2.3%	5.9%	14.1%	9.4%	31.7%
Age (Between)	18 – 27	4.8%	11.0%	19.2%	13.9%	48.8%
	28 – 47	3.4%	8.5%	21.5%	12.7%	46.1%
	48>	0.5%	0.6%	2.5%	1.5%	5.1%
Sector of Employment	Public	2.8%	6.0%	20.7%	11.9%	41.4%
	Private	4.3%	8.5%	15.0%	9.9%	37.7%
	Media	1.5%	5.6%	7.4%	6.3%	20.9%
Level within an organization	Junior	1.9%	3.2%	9.3%	6.0%	20.4%
	Middle	3.7%	7.3%	13.6%	9.1%	33.7%
	Senior	3.1%	9.6%	20.2%	13.0%	45.9%
Total %		8.7%	20.1%	43.1%	28.1%	100.0%

Source: Filed survey, 2013.

Responses of respondents were analyzed based on all four variables to ascertain if Minerals Commission is performing effectively. Data evaluated based on gender indicated 6.3% and 2.3% respondents rated their performance as excellent, 14.2% and 5.9% as very good, 29.1% and 14.1% as good and 18.7% and 9.4% as poor according to males and females respondents respectively. Perception evaluated according to age categories between 18 – 27 years, 28 – 47 years and 47 years and above responded with 4.8%, 3.4% and 0.5% as excellent, 11.0%, 8.5% and 0.6% as very good, 19.2%, 21.5% and 2.5% as good and lastly, 13.9%, 12.7% and 1.5% as poor performance of the institution. According to sector of employment of respondents, 2.8%, 4.3% and 1.5% indicated their performance as excellent, 6.0%, 8.5% and 5.6% as very good, 20.7%, 15.0% and 7.4% as good, 11.9%, 9.9% and 6.3% as poor based on public, private and media workers respectively. Categorized responses according to managerial level of respondents shows that 1.9%, 3.7% and 3.1% rated performance as

excellent, 3.2%, 7.3% and 9.6% as very good, 9.3%, 13.6% and 20.2% as good and 6.0%, 9.1% and 13.0% as poor work from the commission. In all, 43.1% of total participants of the survey indicated performance of Mineral Commission as good, 28.1% as poor, 20.1% as very good and 8.7% as excellent as shown in (Table 22).

Table 23. Statistical analysis of socio-demographic information of respondents in relation to adherence to international environmental standards by companies

Variables	Categories	International Environmental Standard of waste disposal by companies				Total
		Excellent	Very Good	Good	Poor	
Gender	Males	5.2%	13.3%	19.8%	30.0%	68.3%
	Females	3.9%	4.9%	9.1%	13.7%	31.7%
Age (Between)	18 – 27	6.0%	9.4%	12.5%	20.9%	48.8%
	28 – 47	2.6%	8.3%	14.7%	20.4%	46.1%
	48>	0.5%	0.5%	1.7%	2.5%	5.1%
Sector of Employment	Public	2.5%	6.8%	11.6%	20.6%	41.4%
	Private	4.5%	9.6%	10.7%	13.0%	37.7%
	Media	2.1%	1.8%	6.6%	10.1%	20.9%
Level within an organization	Junior	1.5%	4.3%	6.0%	8.5%	20.4%
	Middle	3.9%	7.1%	10.0%	12.7%	33.7%
	Senior	3.7%	6.8%	12.8%	22.6%	45.9%
Total %		9.1%	18.2%	28.9%	43.7%	100.0%

Source: Filed survey, 2013.

Data was analyzed based on adherence to international environmental standard of waste disposal by mining companies in the industry according to gender, age, sector of employment and managerial level within an organization. Responses according to gender indicated 5.2% and 3.9% as excellent, 13.3% and 4.9% as very good, 19.8% and 9.1% as good and 30.0% and 13.7% as poor in relation to males and females responses respectively. Analysis based on age, 6.0%, 2.6% and 0.5% rated it as excellent, 9.4%, 8.3% and 0.5% as very good, 12.5%, 14.7% and 1.7% as good and 0.9%, 20.4% and 2.5% as poor on waste disposal between 18 – 27 years, 28 – 47 years and 48 years and above categories respectively. Outcome on sector of employment shows that 2.5%, 4.5% and 2.1% of respondents saw it as excellent adherence to international standard, 6.8%, 9.6% and 1.8% rated it as very good, 11.6%, 10.7% and 6.6% as good and 20.6%, 13.0% and 10.1% as poor based on opinions from public, private and media

related workers respectively. In relation to responses according to managerial level within an organization, 1.5%, 3.9% and 3.7% graded waste disposal in line with international standard as excellent, 4.3%, 7.1% and 6.8% as very good, 6.0%, 10.0% and 12.8% as good and 8.5%, 12.7% and 22.6% as poor. Finally, 43.7% of total participants of the survey graded waste disposal according to international environmental standard as poor, 28.9% as good, 18.2% as very good and 9.1% as excellent work from mining companies (Table 23).

Table 24. Statistical analysis of socio-demographic information of respondents in relation to cooperation between communities and companies

Variables	Categories	Communities' co-operation with mining companies to manage environment				Total
		Excellent	Very Good	Good	Poor	
Gender	Males	5.1%	13.4%	28.1%	21.6%	68.3%
	Females	2.9%	6.6%	11.9%	10.2%	31.7%
Age (Between)	18 – 27	4.6%	8.5%	20.4%	15.3%	48.8%
	28 – 47	2.5%	11.1%	17.3%	15.1%	46.1%
	48>	0.9%	0.5%	2.3%	1.4%	5.1%
Sector of Employment	Public	2.3%	7.3%	16.8%	15.0%	41.4%
	Private	4.0%	9.3%	14.1%	10.4%	37.7%
	Media	1.7%	3.6%	9.1%	6.5%	20.9%
Level within an organization	Junior	1.7%	3.6%	8.7%	6.5%	20.4%
	Middle	2.9%	8.5%	12.2%	10.0%	33.7%
	Senior	3.4%	8.0%	19.2%	15.3%	45.9%
Total %		8.0%	20.1%	40.0%	31.8%	100.0%

Source: Filed survey, 2013.

Response from participants of the survey on communities' cooperation's with mining institutions towards management of the environment was evaluated according to four variables. Perspectives based on gender shows that 5.1% and 2.9% saw it as an excellent cooperation's , 13.4% and 6.6% as very good, 28.1% and 11.9% as good and 21.6% and 10.2% as poor cooperation from both parties. Analyzed outcome on age categories indicated 4.6%, 2.5% and 0.9% as excellent, 8.5%, 11.1% and 0.5% as very good, 20.4%, 17.3% and

2.3% as good and 15.3%, 15.1% and 1.4% as poor between 18 – 27 years, 28 – 47 years and 48 years and above respectively. With respect to results on sector of employment of respondents, 2.3%, 4.0% and 1.7% pinpointed it as excellent, 7.3%, 9.3% and 3.6% as very good, 16.8%, 14.1% and 9.1% as good and 15.0%, 10.4% and 6.5% as poor according to perceived views by public, private and media related workers. Evaluated result on managerial level within an organization, 1.7%, 2.9% and 3.4% rated it as excellent, 3.6%, 8.5% and 8.0% as very good, 8.7%, 12.2% and 19.2% and 6.5%, 10.0% and 15.3% as poor cooperation between these two important partners. To conclude, 40% of the entire respondents rated mutual collaboration towards management of the environment as good, 38.8% as poor, 20.1% as very good and 8.0% as excellent as shown in (Table 24).

4.3.3 Illegal mining result analysis

Table 25. Statistical analysis of socio-demographic information of respondents in relation to interest of people in illegal mining

Variables	Categories	Interest of people in galamsey operations			Total
		High	Average	Low	
Gender	Males	41.9%	17.0%	9.4%	68.3%
	Females	20.1%	8.0%	3.6%	31.7%
Age (Between)	18 – 27	30.0%	12.1%	6.8%	48.8%
	28 – 47	28.9%	11.3%	5.9%	46.1%
	48>	3.1%	1.7%	0.3%	5.1%
Sector of Employment	Public	26.9%	9.7%	4.8%	41.4%
	Private	21.6%	10.2%	5.9%	37.7%
	Media	13.4%	5.1%	2.3%	20.9%
Level within an organization	Junior	12.8%	4.9%	2.6%	20.4%
	Middle	20.2%	8.5%	4.9%	33.7%
	Senior	28.9%	11.6%	5.4%	45.9%
Total %		62.0%	25.0%	13.0%	100.0%

Source: Filed survey, 2013.

In order to determine interest of people in galamsey operations, survey was conducted on opinion of respondents and analyzed based on four variables. Perceived views expressed in terms of gender of respondents indicated 41.9% and 20.1% rated interest of people in galamsey operations as high, 17.0% and 8.0% as average, 9.4% and 3.6% as low according to males and females participants respectively. Responses analyzed on age categories between 18 – 27 years, 28 – 47 years and 48 years and above also expressed 30.0%, 28.9% and 3.1% as high, 12.1%, 11.3% and 1.7% as average, 6.8%, 5.9% and 0.3% as low interest in galamsey operations respectively. Public, private and media sectors related employees' of which constitute 26.9%, 21.6% and 13.4% sampled population rated the desire of people as high, 9.7%, 10.2% and 5.1% as average, 4.8%, 5.9% and 2.3% as low accordingly. On responses based on respondents managerial level within an organization, 12.8%, 20.2% and 28.9% indicated it as high, 4.9%, 8.5% and 11.6% as average, 2.6%, 4.9% and 5.4% as low according to junior, middle and senior staffs respectively. Generally, majority of respondents rated interest in illegal mining as high with 62.0% of sampled size, 25.0% saw it as average and 13.0% as low interest of people in galamsey operations (Table 25).

Table 26. Statistical analysis of socio-demographic information of respondents in relation to environmental damage by illegal mining

Variables	Categories	Level of environmental damage by illegal miners			Total
		High	Average	Low	
Gender	Males	51.9%	10.8%	5.6%	68.3%
	Females	23.5%	4.6%	3.6%	31.7%
Age (Between)	18 – 27	36.2%	7.1%	5.6%	48.8%
	28 – 47	35.4%	7.3%	3.4%	46.1%
	48 >	3.9%	1.1%	0.2%	5.1%
Sector of Employment	Public	33.8%	4.3%	3.2%	41.4%
	Private	26.9%	7.3%	3.6%	37.7%
	Media	14.7%	3.9%	2.3%	20.9%
Level within an organization	Junior	14.4%	3.6%	2.5%	20.4%
	Middle	25.0%	5.4%	3.2%	33.7%
	Senior	36.0%	6.5%	3.4%	45.9%
Total %		75.4%	15.5%	9.1%	100.0%

Source: Filed survey, 2013.

Perceived views of respondents were analyzed on extent of environmental damage by illegal miners in the country dependency on gender, age, sector of employment and managerial level within an organization. Opinions expressed in terms of gender with the level of environmental damage associated with illegal mining shows 51.9% and 23.5% as high, 10.8% and 4.6% as average, 5.6% and 3.6% as low for males and females responses respectively. Rating of responses according to age categories, 36.2%, 35.4% and 3.9% ranked it as high, 7.1%, 7.3% and 1.1% as average, 5.6%, 3.4% and 0.2% as low according to respondents between 18 – 27 years, 28 – 47 years and 48 years and above respectively. Evaluated responses on sector of employment (thus public, private and media related employees) which constitutes 33.8%, 26.9% and 14.7% as high, 4.3% , 7.3% and 3.9% as average and 3.2%, 3.6% and 2.3% as low environmental damage accordingly. With respect to perceived views shared on managerial level within an organization of participants of the survey, 14.4%, 25.0% and 36.0% saw it as high, 3.6%, 5.4% and 6.5% as average and finally, 2.5%, 3.2% and 3.4% as low damage to the environment according to junior, middle and senior staffs respectively. Generally, 75.4% of respondents indicated high level of environmental damage is associated with illegal mining followed by 15.5% as average and 9.1% as low shown in (Table 26).

Table 27. Statistical analysis of socio-demographic information of respondents in relation to lucrateness of galamsey to attract people

Variables	Categories	Is galamsey lucrative to attract people			Total
		Agree	Slightly agree	Disagree	
Gender	Males	34.8%	22.4%	11.1%	68.3%
	Females	14.1%	12.5%	5.1%	31.7%
Age (Between)	18 – 27	21.3%	16.4%	11.1%	48.8%
	28 – 47	24.7%	16.5%	4.8%	46.1%
	48>	2.8%	2.0%	0.3%	5.1%
Sector of Employment	Public	22.6%	13.8%	5.1%	41.4%
	Private	16.8%	13.6%	7.3%	37.7%
	Media	9.4%	7.6%	3.9%	20.9%
Level within an organization	Junior	8.2%	8.3%	3.9%	20.4%
	Middle	17.5%	11.1%	5.1%	33.7%
	Senior	23.2%	15.5%	7.3%	45.9%
Total %		48.8%	34.9%	16.2%	100.0%

Source: Filed survey, 2013.

Results on opinion of lucriveness of galamsey operations were analyzed in line with socio-demographic information of respondents. Views analyzed according to gender shows that 34.8% and 14.1% agreed it is lucrative, 22.4% and 12.5% slightly agreed and 11.1% and 5.1% disagreed based on males and females respondents respectively. Between age categories of 18 – 27 years, 28 – 47 year and 48 years and above, 21.3%, 24.7% and 2.8% do agreed, 16.4%, 16.5% and 2.0% slightly agreed and 11.1%, 4.8% and 0.3% disagreed with the notion that galamsey operations are lucrative business to lure people respectively. Perspectives evaluated according to public sector workers (22.6%), private sector workers (16.8%) and media related workers (9.4%) agreed on lucriveness of illegal mining. In addition, 13.8%, 13.6% and 7.6% of respondents slightly agreed, whilst 5.1%, 7.3% and 3.9% disagreed with respect to their sector of employment (public, private and media workers). Responses according to managerial level of respondents, 8.2%, 17.5% and 23.2% agreed, 8.3%, 11.1% and 15.5% slightly agreed whilst 3.9%, 5.1% and 7.3% disagreed according to junior, middle and senior staffs' perceptions. In general, 48.8% of respondents agreed that illegal mining is a lucriveness business, 34.9 % slightly agreed and 16.2 % respondents disagreed on the lucriveness of illegal mining as shown in (Table 27).

Table 28. Statistical analysis of socio-demographic information of respondents in relation to stakeholders' effort to minimize galamsey operations

Variables	Categories	Effort by stakeholders to minimize illegal mining operations				Total
		Excellent	Very Good	Good	Poor	
Gender	Males	5.9%	15.5%	24.3%	22.7%	68.3%
	Females	3.4%	9.7%	9.0%	9.6%	31.7%
Age (Between)	18 – 27	4.9%	12.2%	15.9%	15.8%	48.8%
	28 – 47	4.2%	11.9%	14.8%	15.1%	46.1%
	48>	0.2%	1.1%	2.5%	1.4%	5.1%
Sector of Employment	Public	4.2%	7.7%	14.7%	14.8%	41.4%
	Private	4.2%	12.7%	11.1%	9.7%	37.7%
	Media	0.9%	4.8%	7.4%	7.7%	20.9%
Level within an organization	Junior	2.0%	4.8%	7.7%	5.9%	20.4%
	Middle	3.6%	10.0%	9.7%	10.4%	33.7%
	Senior	3.7%	10.4%	15.8%	16.1%	45.9%
Total %		9.3%	25.2%	33.2%	32.3%	100.0%

Source: Filed survey, 2013.

Perceived opinions on effort by stakeholders (i.e. mining companies, opinion leaders, chiefs, etc) to minimize galamsey operations in the mining sector based on gender, age, sector of employment and managerial level within an organization of respondents were analyzed. Responses associated with gender (thus, males and females) indicated 5.9% and 3.4% as excellent, 15.5% and 9.7% as very good, 24.3% and 9.0% as good, 22.7% and 9.6% as poor effort respectively. In relation to age categories between, 18 – 27 years, 28 – 47 years and 48 years and above, 4.9%, 4.2% and 0.2% saw it as excellent effort, 12.2%, 11.9% and 1.1% rated it as very good, 15.9%, 14.8% and 2.5% as good and 15.8%, 15.1% and 1.4% as poor respectively. On sector of employment views echoed by participants of the survey shows that 4.2%, 4.2% and 0.9% termed it as excellent, 7.7%, 12.7% and 4.8% as very good, 14.7%, 11.1% and 7.4% as good, 14.8%, 9.7% and 7.7% as poor according to public, private and media related workers. Assessment of views of respondents on managerial level within an organization also indicated that 2.0%, 3.6% and 3.7% rated effort of stakeholders as excellent, 4.8%, 10.0% and 10.4% as very good, 7.7%, 9.7% and 15.8% as good and 5.9%, 10.4% and 16.1% as poor work done by stakeholders to curtail operations of illegal mining in the country. In a nutshell, 33.2% of total respondents indicated stakeholders’ effort as good, 32.3% responded as poor, 25.2% as very good and 9.3% as an excellent effort (Table 28).

Table 29. Statistical analysis of socio-demographic information of respondents in relation to political will to eradicate illegal mining

Variables	Categories	Political will to eradicate illegal mining				Total
		Excellent	Very Good	Good	Poor	
Gender	Males	7.6%	14.2%	22.1%	24.4%	68.3%
	Females	3.2%	7.4%	11.4%	9.6%	31.7%
Age (Between)	18 – 27	6.2%	10.4%	16.2%	16.1%	48.8%
	28 – 47	4.3%	9.4%	16.1%	16.2%	46.1%
	48>	0.3%	1.9%	1.2%	1.7%	5.1%
Sector of Employment	Public	4.0%	8.2%	14.5%	14.7%	41.4%
	Private	4.2%	10.5%	11.1%	11.9%	37.7%
	Media	2.6%	2.9%	7.9%	7.4%	20.9%
Level within an organization	Junior	2.9%	4.3%	7.3%	5.9%	20.4%
	Middle	3.4%	8.8%	10.0%	11.4%	33.7%
	Senior	4.5%	8.5%	16.1%	16.8%	45.9%
Total %		10.8%	21.6%	33.4%	34.1%	100.0%

Source: Filed survey, 2013.

Political will of governments to eradicate illegal mining was statistically analyzed based on socio-demographic information of respondents to determine commitment from governments towards eradication of galamsey operations in the country. Responses of respondents analyzed according to gender indicated males and females' outcome respectively as 7.6% and 3.2% as excellent, 14.2% and 7.4% as very good, 22.1% and 11.4% as good and 24.4% and 9.6% as poor political will by governments towards minimization of the operations. Responses also on age categories, between 18 – 27 years, 28 – 47 years, and 48 years and above shows that 6.2%, 4.3% and 0.3% rated governmental will as excellent, 10.4%, 9.4% and 1.9% as very good, 16.2%, 16.1% and 1.2% as good whilst 16.1%, 16.2% and 5.1% identified it as poor will respectively. Apparently, responses based on their sector of employment (i.e. public, private and media related workers) which is made up of 4.0%, 4.2% and 2.6% saw it as excellent, 8.2%, 10.5% and 2.9% as very good, 14.5%, 11.1% and 7.9% as good and 41.4%, 11.9% and 7.4% as poor respectively. Analysis based on respondents' perception in relation to their managerial level within an organization (thus, junior, middle and senior employees) shows that 2.9%, 3.4% and 4.5% rated it as excellent, 4.3%, 8.8% and 8.5% as very good, 7.3%, 10.0% and 16.1% as good and 5.9%, 11.4% and 16.8% as poor governmental will in eradicating galamsey operations in the mining industry respectively. Finally, total perceived frequency distribution of responses from the entire respondents on political will by governments towards stamping out the operations indicated 34.1% as poor, 33.4% as good, 21.6% as very good and 10.8% as excellent. Political will towards mitigation of galamsey operations is perceived as woefully inadequate in the sector (Table 29).

Table 30. Statistical analysis of socio-demographic information of respondents in relation to double standard of PMMC

Variables	Categories	Double standard of PMMC to buy minerals from illegal miners			Total
		Agree	Slightly agree	Disagree	
Gender	Males	25.2%	18.9%	24.3%	68.3%
	Females	9.3%	9.3%	13.1%	31.7%
Age (Between)	18 – 27	14.4%	14.5%	19.9%	48.8%
	28 – 47	18.2%	12.7%	15.1%	46.1%
	48>	1.9%	0.9%	2.3%	5.1%
	Public	16.4%	11.1%	13.9%	41.4%

Sector of Employment	Private	12.1%	11.6%	14.1%	37.7%
	Media	6.0%	5.4%	9.4%	20.9%
Level within an organization	Junior	5.7%	6.3%	8.3%	20.4%
	Middle	11.9%	9.3%	12.5%	33.7%
	Senior	16.8%	12.5%	16.5%	45.9%
Total %		34.5%	28.1%	37.4%	100.0%

Source: Filed survey, 2013.

Statistical analysis was carried out on perceived opinions on double standard of Precious Minerals Marketing Company (PMMC) to procure minerals from galamsey operators' dependency on gender, age, sector of employment and managerial level within an organization. Responses based on gender (i.e. males and females), shows that 25.2% and 9.3% agreed on double standard of PMMC in procuring these minerals from illegal miners, 18.9% and 9.3% slightly agreed and 24.3% and 13.1% disagreed on the statement respectively. Respondents responses between age categories of 18 – 27 years, 28 – 47 years and 48 years and above shows 14.4%, 18.2% and 1.9% agreed, 14.5%, 12.7% and 0.9% slightly agreed and 19.9%, 15.1% and 2.3% disagreed respectively on double standard of PMMC. Views expressed according to respondents sector of employment (thus, public, private and media sector workers), 16.4%, 12.1% and 6.0% agreed, 11.1%, 11.6% and 5.4% slightly agreed and 13.9%, 14.1% and 9.4% disagreed respectively. Analyses based on respondents managerial level within an organization attested to the fact that, 5.7%, 11.9% and 16.8% agreed, 6.3%, 9.3% and 12.5% slightly agreed and 8.3%, 12.5% and 16.5% disagreed on the concept of double standard by PMMC in the country. Total responses from the survey indicated that 37.4% of total respondents disagreed, 34.5% agreed while 28.1% slightly agreed that buying of minerals from these operators constitutes double standard as indicated in (Table 30).

Table 31. Statistical analysis of socio-demographic information of respondents in relation to galamsey operators opting for alternative occupations

Variables	Categories	Galamsey operators will consider alternative livelihood income earning occupations			Total
		Agree	Disagree	Slightly agree	
Gender	Males	33.2%	21.6%	13.4%	68.3%
	Females	16.7%	7.6%	7.4%	31.7%

Age (Between)	18 – 27	23.8%	15.8%	9.3%	48.8%
	28 – 47	22.4%	12.5%	11.1%	46.1%
	48>	3.7%	0.9%	0.5%	5.1%
Sector of Employment	Public	21.3%	11.6%	8.5%	41.4%
	Private	18.5%	11.1%	8.0%	37.7%
	Media	10.0%	6.5%	4.3%	20.9%
Level within an organization	Junior	10.7%	6.6%	3.1%	20.4%
	Middle	18.5%	8.7%	6.5%	33.7%
	Senior	20.7%	13.9%	11.3%	45.9%
Total %		49.9%	29.2%	20.9%	100.0%

Source: Filed survey, 2013.

Assessment of views was carried out to determine if illegal miners would prefer alternative livelihood income earning occupations. Diverse views were echoed by respondents according to the four variables analyzed. Responses based on gender (males and females) 33.2% and 16.7% agreed, 21.6% and 7.6% disagreed and 13.4% and 7.4% slightly agreed to opt for another occupation. Perceived opinions according to age groupings (between 18 – 27 years, 28 – 47 years and 48 years and above), 23.8%, 22.4% and 3.7% agreed, 15.8%, 12.5% and 0.9% disagreed, 9.3%, 11.1% and 0.5% slightly agreed. Views communicated by respondents based on their sector of employment (public, private and media related employees), 21.3%, 18.5% and 10.0% agreed, 11.6%, 11.1% and 6.5% disagreed whilst 8.5%, 8.0% and 4.3% slightly agreed respectively to take on another occupation. Finally, perceived opinions analyzed as to opting for alternative livelihood income earning occupation according to managerial level of respondents within an organization (i.e. junior, middle and senior staffs), 10.7%, 18.5% and 20.7% agreed, 6.6%, 8.7% and 13.9% disagreed and 3.1%, 6.5% and 11.3% slightly agreed on the statement. Finally, responses from participants of the survey proved that 49.9% do agreed to consider different alternative livelihood income earning occupation, 29.2% disagreed and 20.9% slightly agreed on the statement. From the survey analysis, 50 % of participants confirmed the third hypothesis that illegal miners will consider alternative livelihood income earning occupations (Table 31).

4.3.4 Discussion

Findings of the survey indicated minerals extractive sector has contributed to development of communities and the nation. Respondents of the survey considered economic, social benefit and environmental implications of the sector. The result is in line with Garvin's et al (2009) where community members considered economic, social and environmental impacts of development (Garvin et al., 2009). Various researchers have identified how communities' development programs have gained eminence in the corporate social responsibility operations of mining companies for the past twenty years (Hamann, 2003; Newell, 2005; Eweje, 2006; Kemp, 2009, 2010, Kemp and Owen, 2013). In addition, Mining firms have adopted corporate social responsibilities programs to foster positive reputation in the eyes of local and foreign stakeholders which would lead to the anticipating of adoption of new regulations and maintenance of social license that would enable these companies to proceed with their operations within immediate communities living in their geographical closeness. Due to this, several multinational and domestic mining companies have deliberately implemented arrays of programs that would give social and economic gains to local communities (Kapelus, 2002; Jenkins, 2004; Yakovleva, 2005; World Bank, 2012; ICMM, 2012b) and to alter communities' resistance towards extractive industry (Jenkins, 2004; Schaefer, 2004). Community members have looked up to mining companies for employment and provision of socio-economic development amenities for the past years. Governments have ceded the responsibility of job creation mostly in these local communities for investors which have led to so much pressure on the firms. Perceived benefits were expressed by participants of the research on basic infrastructure such as roads, schools, boreholes, medical centers, agricultural programs as well as educational scholarships to improve living conditions of people. However, research carried out by Idemudia and Ite stressed the belligerent debate over the efficiency and long-term effects of corporate social responsibility even in the business communities (Idemudia and Ite, 2006). According to Banks', the indigenous cares about environmental effects but social and economic impacts of mining industry are of equal or greater important (Banks, 2002). Broader disregard of this set of concerns by companies may contribute to misunderstanding between local mines and community members (Ballard and Banks, 2003). Throughout the study, participants expressed different perspectives on economic, social benefits and environmental impacts in the industry. Most factors with respect to economic and corporate social responsibility by respondents appeared to influence perspectives of participants which include contribution of companies to communities and

nation's development and provision of infrastructure. Respondents have identified the important role being played by these mining companies towards development of the entire nation. Some of these factors were identified by other researchers (Epps, 1997; Salami and Tsekor, 2000; Veiga et al., 2001; Downing et al., 2002; Garvin et al., 2009). As recognized in many lesser-developed countries, the mining sector is an important contributor to the nation's economy (Bridge, 2004). Negative perceptions were expressed by respondents on standard of living of locals in mining communities as well as poor compensation paid to farmers and other related agents as a result of negative impact of mining operations. In general, feelings expressed by respondents do not indicate the nation maximizes enough from the sector and in the case of government policy to peg royalty payment at certain percentage would not make any significant change in the industry. Companies have embraced Corporate Social Responsibilities as an effective tool of creating good relationship between communities and companies. This has been proven based on positive perspectives expressed on the socio-economic benefits from the sector by participants of the survey. Extensive literature on corporate social responsibility suggests how corporations will experience less level of community conflict (Jenkins, 2004) which is also seen as fundamental component of resources extraction operations (Hamann, 2004).

Despite the industry's input to nations economy, responses from the survey shows that environmental impact are of significant important to the society and it must be considered for the sector to thrive effectively. Apparently, adverse environmental impacts of mining are continuously being identified as critical issues (Bridge, 2004). Views expressed on pollution of water bodies by companies, attitude towards other pollutions (noise, air, etc) and adherence to international environmental standards in relation to waste disposal were negative and these externalities were identified by various researchers as well (Epps, 1997; Akabzaa and Darimani, 2001; Humphreys 2001; Downing et al., 2002; Garvin et al., 2009). Some major environmental issues associated with the sector include cyanide pollution, land degradation and dust pollutions (Kumah, 2006) were confirmed by respondents as a major challenge on the socio-economic livelihood of local communities. Several advocacy groups have advocated against the extractive sector to save the ecosystem and the indigenous directly affected by mining operations. In relation to performance of various institutions assigned to manage the sector, respondents appreciate their effort despite some reservations about their effectiveness towards monitoring, evaluation of companies' day to day operations

in the sector. The Environmental Protection Agency, in 2011, took steps to assess performances of companies in terms of socio-economic and environmental performance (Allotey et al., 2011). The action of Environmental Protection Agency was to keep the sector alert on its operations and role of protecting the environment. For effective management of the environment, respondents have identified the importance of collaboration between mining companies and other stakeholders to work hand-in-hand towards management of the environment since peoples livelihood depends on this. While galamsey operation is a major threat to environment and the sector, opinions expressed in the research confirmed this argument and why it has gained grounds in Sub-Saharan Africa and Ghana. Findings of the research indicated higher interest of people engaging in galamsey and also see it as lucrative business. This is in line with outcome of other researchers on illegal mining in developing countries (Banchirigah, 2008; Tescher, 2012). According to Kemp, “mining operations are sometimes the only viable option that remote communities have for social development” (Kemp, 2009). In spite of this, community members do not gain so much from the mining operations since national or regional elites instead take over the benefits or resources revenue are little for redistribution to communities from which those resources are extracted (ICMM, 2012b) therefore community members resort to their own ways of mining these resources for their livelihood. Responses indicated high environmental damage due to galamsey operations and good effort from stakeholders to minimize or eliminate this illegal operation. Despite the significant environmental damage as a result of their operations in various portions of large-scale miners’ concession, these operators have not accepted the responsibility of these damages (Hilson, 2002). These miners are unwilling to give way at this moment since they do not have alternative occupation or source of livelihood. They disagreed that PMMC’s function is not in any way a double standard. Furthermore, Political will towards limiting galamsey operations is perceived to be poor; they therefore encourage governments to put in more and realistic measures to halt the rise of galamsey operations in the industry. Results indicated illegal miners are willing to opt for alternative livelihood income-earning occupations so long as they can get some money at the end of the day to take care of their families.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Mining is a significant contributor to nations' economy especially lower middle income country like Ghana. The economy has seen substantial Foreign Direct Investment (FDI) into the industry since it was reform. Investment into the mining sector is in three major categories (production, exploration and support service). Prognosis of gold, diamond, bauxite and manganese productions are expected to increase in the next 5 years with gold and manganese dominating followed by bauxite and diamond, with same scenario applying to gold and manganese revenues whilst diamond's revenue is expected to exceed that of bauxite. In 2011, over US \$ 970 million was invested into the Ghanaian economy. Corporate taxes, minerals royalties, pay as you earn (P.A.Y.E) etc, are some taxes and levies that contributes to government revenue. The sector contributed over 28% of government revenue in 2011 but decreased slightly in subsequent years to 27%.

However, despite these investments, companies have initiated different projects as a form of corporate social responsibility to support communities directly or indirectly affected by companies operations. Some corporate social responsibility projects are investments into infrastructure (e.g. road, housing, electrification, etc), health facilities, education, agriculture, sanitation, resettlement action plan, etc. Over US \$ 115 million was invested into these projects from 2004 to 2011 and resettlement action plan had 34% of total investment.

In addition, perceived perspectives of socio-economic benefits associated with mining industry were recognized by respondents. Participants of the survey, who represent the qualified segment of the involved population of the relevant regions and their positions, should be taken into account appreciated contributions made by the sector to development of communities and the nation at large. Notwithstanding these contributions, they are mindful of externalities of mining as well as galamsey operations on the environment. Despite citizens' indication of various positive outcomes of the CSR programs of the mining industries, they are not happy about measures taken to protect the environment especially in relation to pollution of water bodies, companies' attitude towards pollution, adherence to international environmental standards as well as political will by governments to solve illegal mining

problems in the sector. These findings have been forwarded to the national and local government authorities, as well as the mining industries managements.

5.2 Recommendations

Based on these revelations from the research and as a result of effective communication with respondents of the survey, we extracted these recommendations and strategies for relevant policy makers to adopt:

- Minerals Commission, the Ghana Chamber of mines and other stakeholders should engage the public and the media regularly, at least twice a year, to educate them on environmental measures taken by mining companies and regulatory institutions to protect water bodies and other negative impacts of mining sector.
- Frequent monitoring of mining companies on adherence of international laws on waste disposal and companies found to default these procedures should be prosecuted according to laws of the land as well as institute the payment of huge damages for pollution of the environment.
- Corrupt officials have made registration process of mining entities too cumbersome by extorting money from potential businessmen who are willing to legalize their operations. The human factor in the registration process should be critically examined by government and come up with innovative procedures and speed up the legalization of small-scale mining organizations.
- An agro processing factory can be established in these mining communities to employ galamsey operators as factory hands or semi-skilled labors since majority are willing to opt for alternative livelihood income-earning occupations. For instance, a community identified to be suitable for sugar cane production can see the establishment of a sugar production factory by these mining companies to employ citizens and pay them daily wages.
- Information made available to researchers indicated that Environmental Impact Assessment, a role of the Environmental Protection Agency which has been ceded to the mining companies owing to insufficient or non-existing resources should be reverted to EPA but this time with funding of the exercise coming from the mining

companies. This will reduce the high level of bias in their reports which do not paint a good picture of the actual situation on the ground.

- Further recommend that before mining licenses are given to these mining companies to commence operation, a critical focus should be on the aspects of their business plans that have to do with waste control and management as a result of their activities.

Finally, mining companies' contacted were unable to provide us with environmental data due to their mining policies as mostly confirmed by some officials contacted. Furthermore, due to improper data storage, the Minerals Commission could not provide us data on child labor in the mining sector. We intend to proceed with further research into negative implications of the mining sector on agriculture and food security in mining communities as well as the resource curse theory in Ghana.

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7. APPENDIXES

Appendix 1

Direct Regression of major Minerals Production in Ghana from 1985 - 2011

1a. Gold Production

Gold
SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.985
R Square	0.971
Adjusted R Square	0.964
Standard Error	0.190
Observations	27

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	25.28705088	5.057410176	140.1005275	2.16E-15
Residual	21	0.758067193	0.036098438		
Total	26	26.04511807			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0.090	0.073950297	1.214314404	0.238	-0.06399	0.243586973
Gold L -1	1.383	0.216600785	6.384857845	0.000	0.932519	1.833411213
Gold L -2	-0.490	0.370679085	-1.323225606	0.200	-1.26136	0.2803773
Gold L -3	0.112	0.385763647	0.289287434	0.775	-0.69064	0.913835997
Gold L -4	0.106	0.37420049	0.283592915	0.779	-0.67207	0.884313128
Gold L -5	-0.118	0.224563122	-0.523816838	0.606	-0.58463	0.349374633

1b. Diamond Production

Diamond
SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.827
R Square	0.684
Adjusted R Square	0.608
Standard Error	0.151
Observations	27

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	1.041031395	0.20820628	9.080702	0.000
Residual	21	0.481497123	0.02292843		
Total	26	1.522528519			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0.147	0.12141345	1.21301581	0.239	-0.10522	0.399769526
Diamond L -1	1.097	0.219308338	5.00040265	0.000	0.640553	1.552706648
Diamond L-2	-0.494	0.315190961	-1.5676079	0.132	-1.14957	0.161379659
Diamond L-3	0.184	0.325449155	0.56558242	0.578	-0.49274	0.860876889
Diamond L -4	0.142	0.304943319	0.46570672	0.646	-0.49215	0.7761785
Diamond L-5	-0.147	0.197599546	-0.7455587	0.464	-0.55825	0.263608689

1c. Bauxite Production

Bauxite

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.779
R Square	0.607
Adjusted R Square	0.514
Standard Error	0.143
Observations	27

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	0.665735	0.13314697	6.49863004	0.001
Residual	21	0.430258	0.02048847		
Total	26	1.095993			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0.142	0.068772	2.06916827	0.051	-0.00072	0.285321
Bauxite L -1	0.697	0.244168	2.85614257	0.009	0.189603	1.205153
Bauxite L -2	-0.389	0.299633	-1.2981165	0.208	-1.01208	0.234162
Bauxite L -3	0.298	0.314218	0.94988111	0.353	-0.35498	0.951921
Bauxite L -4	-0.226	0.340394	-0.6651483	0.513	-0.9343	0.481475
Bauxite L -5	0.385	0.327375	1.17573835	0.253	-0.29591	1.065722

1d. Manganese Production

Manganese
SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.962
R Square	0.925
Adjusted R Square	0.907
Standard Error	0.176
Observations	27

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	8.04909	1.609817994	51.88664	4.1318E-11
Residual	21	0.651539	0.031025677		
Total	26	8.700629			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0.037	0.057576	0.647630836	0.524	-0.082448094	0.157024
Manganese L -1	1.120	0.213108	5.257341799	0.000	0.677198763	1.563563
Manganese L -2	0.423	0.366878	1.153458724	0.262	-0.339785849	1.186143
Manganese L -3	-0.969	0.44573	-2.174309771	0.041	-1.896100775	-0.04221
Manganese L -4	0.113	0.494984	0.228294515	0.822	-0.916373597	1.142378
Manganese L -5	0.350	0.320781	1.091691142	0.287	-0.316907069	1.017295

Direct Regression of major Minerals Revenue in Ghana from 1988 - 2011

1e. Statistical analysis of Gold Revenue

Gold

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.995
R Square	0.989
Adjusted R Square	0.987
Standard Error	136.916
Observations	24

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	31671021.18	6334204.237	337.8954832	3.90998E-17
Residual	18	337428.8262	18746.0459		
Total	23	32008450.01			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-71.914	55.20690623	-1.302619476	0.209	-187.8989973	44.07181
Gold L -1	1.156	0.178606488	6.47243355	0.000	0.780780319	1.531257
Gold L -2	0.550	0.340125204	1.616628929	0.123	-0.164720293	1.264433
Gold L -3	-0.787	0.557130722	-1.412094708	0.175	-1.957209558	0.383767
Gold L -4	1.668	0.623344173	2.675768037	0.015	0.358326902	2.977522
Gold L -5	-1.438	0.399901734	-3.595019315	0.002	-2.277816827	-0.59749

1f. Statistical analysis of Diamond Revenue

Diamond

SUMMARY OUTPUT

<i>Regression Statistics</i>	
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Multiple R	0.789
R Square	0.623
Adjusted R Square	0.519
Standard Error	5.726
Observations	24

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	976.3521	195.270428	5.955170269	0.002
Residual	18	590.2212	32.7900663		
Total	23	1566.573			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	6.459	3.023223	2.13651592	0.047	0.107608	12.81071942
Diamond L -1	0.912	0.242039	3.76921815	0.001	0.403793	1.42080354
Diamond L -2	-0.211	0.317846	-0.6625869	0.516	-0.87837	0.457169276
Diamond L -3	0.125	0.413228	0.30240281	0.766	-0.7432	0.993121128
Diamond L -4	-0.294	0.439442	-0.6693276	0.512	-1.21736	0.629102905
Diamond L -5	0.116	0.325738	0.3569754	0.725	-0.56807	0.800630632

1g. Statistical analysis of Bauxite Revenue

Bauxite
SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.724
R Square	0.524
Adjusted R Square	0.392
Standard Error	3.579
Observations	24

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	253.8861465	50.7772293	3.965101796	0.013
Residual	18	230.508616	12.80603422		
Total	23	484.3947625			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	4.593	2.211838482	2.076613709	0.052	-0.05377	9.240034

Bauxite L -1	0.420	0.236137892	1.78056825	0.092	-0.07565	0.916567
Bauxite L -2	0.385	0.258344964	1.489685892	0.154	-0.15791	0.927615
Bauxite L -3	-0.704	0.302867771	-2.324956299	0.032	-1.34046	-0.06785
Bauxite L -4	0.296	0.368309904	0.802800057	0.433	-0.47811	1.06947
Bauxite L -5	0.286	0.292822284	0.975174384	0.342	-0.32964	0.90075

1h. Statistical analysis of manganese revenue

Manganese SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.934
R Square	0.873
Adjusted R Square	0.838
Standard Error	8.482
Observations	24

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	8917.377	1783.475393	24.78847	1.74443E-07
Residual	18	1295.06	71.94777946		
Total	23	10212.44			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-1.805	3.528974	-0.511504168	0.615	-9.219183442	5.609013905
Manganese L -1	0.747	0.298287	2.503382497	0.022	0.120048734	1.373404321
Manganese L -2	0.329	0.371918	0.885155716	0.388	-0.452165524	1.110576422
Manganese L -3	0.525	0.38763	1.355130443	0.192	-0.28909093	1.339668385
Manganese L -4	-1.221	0.470231	-2.595681954	0.018	-2.208489638	-0.232651538
Manganese L -5	0.939	0.39147	2.398312083	0.028	0.11641935	1.761316249

Appendix 2

2a. Estimated major minerals production (2012 – 2016)

Year	Gold (Oz)	Diamond(Carat)	Bauxite (Mt)	Manganese(Mt)
Base 2011	3.604	0.283	0.408	1.705
Estimated 2012	3.748	0.332	0.588	2.232
2013	3.888	0.391	0.697	2.297
2014	4.026	0.455	0.548	2.431
2015	4.154	0.509	0.565	2.309

2016	4.270	0.558	0.554	2.275
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2b. Estimated Revenue of major minerals in US \$ Million (2012 – 2016)

Year	Gold	Diamond	Bauxite	Manganese
Base 2011	4,912.900	18.900	7.090	97.740
Estimated 2012	6,944.495	18.238	17.515	82.301
2013	8,690.650	21.270	13.585	112.166
2014	12,602.822	21.897	19.704	135.413
2015	16,536.773	19.975	12.200	114.778
2016	23,655.274	19.545	14.951	178.661

APPENDIX 3



TITLE: The Mining Industry in Ghana – Its Economics, Social Benefits and Environmental Impact

Background:

The purpose of this research is to assess contributions of mining companies in Ghana as well as environmental challenges of the sector and steps taken to mitigate these problems. Information gathered from this interview is strictly confidential and will be used for academic purpose only. Your consent is hereby sought to kindly proceed and answer the questions. These questions will take less than 20 minutes to complete and I will appreciate your contribution.

Instructions: Please read the following carefully before completing the questionnaire:

1. To answer the questions, please tick or circle the most appropriate response
2. Some questions should be rated on a scale of 1 to 4;

1 = Excellent	2 = Very good	3 = Good	4 = Poor.
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3. Most of the questions are seeking Information Regarding Your Personal Experience and Opinion on the Research Issues. Please, answer the questions as accurate as possible.

Thanks in advance for your contribution

PART1. Information on Respondent

Q1. Gender

Female () Male ()

Q2. Please indicate age category

a. Below 18 b. 18-27 years c. 28-37 years d. 38-47 years e. 48-57 years
f. 58 – 67 years g. 68 – years and above

Q3. Education

Primary () Senior High School () HND () Bachelor () Master's () Doctorate () others ()

Q4. Marital status

Single () Married () Divorced () Widowed () Others, Specify ()

Q5. Sector of employment

Public () Private () Non-profit Organization () Media () others, specify ()

Q6. What is your level in the organization? Junior () Middle () Senior ()

Part II (Economic/CSR)

Q7. In your opinion how will you rate contribution of mining companies to communities' development?

1 2 3 4

Q8. How will you rate of contribution of mining to the nation's development?

1 2 3 4

Q9. How will you infrastructure provided by mining sector be rated?

1 2 3 4

Q10. How will you rate salaries of employees of mining sector compared to other sectors?

1 2 3 4

Q11. The nation as well as communities maximizes revenue and royalties from the sector.

Agreed Disagree Slightly agreed

Q12. How do you rate standard of living of people in mining communities?

1 2 3 4

Q13. The decision on-going to peg royalty percentage at 5 will increase revenue and aid development of communities.

Agree Disagree Slightly agree

Q14. The relationship between mining companies and communities are very cordial.

Agree Disagree Slightly agree

Q15. The increase trend of production and operations of mining companies would see future of mining communities well developed.

Agree Disagree Slightly agree

Q16. How can you rate compensation paid to farmers and others rated agents whose properties have been destroyed due to negative impact of mining.

1 2 3 4

Q17. On a scale of preference 1-3 how will you rate these alternative livelihood projects for communities and nation?

Unification of galamsey operators into small-scale mining companies ()

Agricultural Projects for communities (crops, animal) ()

Renewable energy project (solar) ()

Part II (Environmental Issues/Regulatory bodies/Standard)

Q18. How can you rate pollution of water bodies by mining companies?

1 2 3 4

Q19. How do you rate attitude of mining companies in communities towards pollutions apart from water bodies? (e.g. air, noise, farmland, etc).

1 2 3 4

Q20. Environmental Protection Agency as regulatory body is to monitor, evaluate and regulate activities of miners/mining companies and other related environmental issues, how will you rate their performance over the years?

1 2 3 4

Q21. Does EPA have personnel and resources to accomplish its objective effectively?

Agree Disagree Slightly agree

Q22. Minerals Commission up to its responsibility in the sector

Agree Disagree Slightly agree

Q23. How will you rate performance of Mineral Commission?

1 2 3 4

Q24. In terms of international environmental standard of operations in mining sector, what is your scale of the Ghanaian sector in relation to disposal of waste?

1 2 3 4

Q25. How will you rate communities' co-operation with mining companies regarding efforts towards management of the environment?

1 2 3 4

Q26. How can cooperation with mining companies and other stakeholders (i.e. E.P.A, etc) be rated with respect to environmental management?

1 2 3 4

Part III (Illegal mining)

Q27. How can you rate interest of people in galamsey operations?

High Average Low

Q28. What is your opinion on level of damage to environment by illegal miners?

High Average Low

Q29. Which group of people is mostly into illegal mining?

Educated Semi-Educated Uneducated

Q30. Illegal mining is lucrative to attract more people

Agree Disagree Slightly agree

Q31. How can you rate effort by stakeholders to minimize this operation?

1 2 3 4

Q32. How do you rate efforts by government to eradicate illegal mining?

1 2 3 4

Q33. The function of Precious Minerals Marketing Company (PMMC) to buy minerals from small-scale miners contributes to double standard.

Agree Disagree Slightly agree

Q34. How can you rate pollution of galamsey in relation to air, water, etc.?

High Average Low

Q35. Illegal miners (galamsey) will prefer alternative livelihood income-earning jobs.

Agree Disagree Slightly agree

Q36. What is your opinion on mining and environmental issues?

.....

.....

.....

THANK YOU

Appendix 4

Resource Governance Index of mineral rich countries as of 2013

Rank	Country	Resource measured	Composite	Institutional and legal setting	Reporting practices	Safeguards and quality controls	Enabling Environment
1	Norway	Hydrocarbons	98	100	97	98	98
2	United States (Gulf of Mexico)	Hydrocarbons	92	88	97	89	90
3	United Kingdom	Hydrocarbons	88	79	91	83	93
4	Australia (Western Australia)	Minerals	85	88	87	65	96
5	Brazil	Hydrocarbons	80	81	78	96	66
6	Mexico	Hydrocarbons	77	84	82	81	53
7	Canada (Alberta)	Hydrocarbons	76	67	72	74	96
8	Chile	Minerals	75	77	74	65	87
9	Colombia	Hydrocarbons	74	75	73	91	58
10	Trinidad and Tobago	Hydrocarbons	74	64	83	86	52
11	Peru	Minerals	73	88	83	56	55
12	India	Hydrocarbons	70	60	72	83	61
13	Timor-Leste	Hydrocarbons	68	77	82	70	28
14	Indonesia	Hydrocarbons	66	76	66	75	46
15	Ghana	Minerals	63	79	51	73	59
16	Liberia	Minerals	62	83	62	71	31
17	Zambia	Minerals	61	71	62	72	37
18	Ecuador	Hydrocarbons	58	70	64	65	28
19	Kazakhstan	Hydrocarbons	57	62	58	76	32
20	Venezuela	Hydrocarbons	56	57	69	67	18
21	South Africa	Minerals	56	69	31	75	72
22	Russia	Hydrocarbons	56	57	60	62	39
23	Philippine	Minerals	54	63	54	51	46

	s						
24	<i>Bolivia</i>	Hydrocarbons	53	80	47	63	32
25	<i>Morocco</i>	Minerals	53	48	60	56	42
26	<i>Mongolia</i>	Minerals	51	80	39	49	48
27	<i>Tanzania</i>	Minerals	50	44	48	68	42
28	<i>Azerbaijan</i>	Hydrocarbons	48	57	54	51	24
29	<i>Iraq</i>	Hydrocarbons	47	57	52	63	9
30	<i>Botswana</i>	Minerals	47	55	28	53	69
31	<i>Bahrain</i>	Hydrocarbons	47	38	40	59	58
32	<i>Gabon</i>	Hydrocarbons	46	60	51	39	28
33	<i>Guinea</i>	Minerals	46	86	45	43	11
34	<i>Malaysia</i>	Hydrocarbons	46	39	45	39	60
35	<i>Sierra Leone</i>	Minerals	46	52	47	59	24
36	<i>China</i>	Hydrocarbons	43	43	46	46	36
37	<i>Yemen</i>	Hydrocarbons	43	57	46	52	16
38	<i>Egypt</i>	Hydrocarbons	43	40	44	48	40
39	<i>Papua New Guinea</i>	Minerals	43	59	34	50	38
40	<i>Nigeria</i>	Hydrocarbons	42	66	38	53	18
41	<i>Angola</i>	Hydrocarbons	42	58	43	52	15
42	<i>Kuwait</i>	Hydrocarbons	41	28	43	36	57
43	<i>Vietnam</i>	Hydrocarbons	41	63	39	31	30
44	<i>Congo (DRC)</i>	Minerals	39	56	45	42	6
45	<i>Algeria</i>	Hydrocarbons	38	57	41	28	26
46	<i>Mozambique</i>	Hydrocarbons	37	58	26	37	37
47	<i>Cameroon</i>	Hydrocarbons	34	63	33	25	17
48	<i>Saudi Arabia</i>	Hydrocarbons	34	30	35	31	38
49	<i>Afghanistan</i>	Minerals	33	63	29	38	8
50	<i>South Sudan</i>	Hydrocarbons	31	80	17	35	8
51	<i>Zimbabwe</i>	Minerals	31	48	23	56	6
52	<i>Cambodia</i>	Hydrocarbons	29	52	13	46	20
53	<i>Iran</i>	Hydrocarbons	28	26	33	26	23
54	<i>Qatar</i>	Hydrocarbons	26	15	14	20	66
55	<i>Libya</i>	Hydrocarbons	19	11	29	15	10
56	<i>Equatorial Guinea</i>	Hydrocarbons	13	27	14	4	4
57	<i>Turkmenistan</i>	Hydrocarbons	5	13	4	0	3
58	<i>Myanmar</i>	Hydrocarbons	4	8	5	2	2

Source: Resource Governance Index, 2013

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