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Master Thesis

**Effects of illegal small scale mining on crop production in Amansei
Central, Ghana.**

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Dedication

The study is dedicated to my parents John Osei Poku (1959-2012) even in your absence daddy your strong beliefs on value of education continued to empower me throughout my studies and to my mum Mrs. Mary Osei Poku.

Declaration

I declare that I carried out this thesis: The effects of galamsey on crop production case study Amansei Central district in Ghana independently, and only with the cited sources, literature and other professional sources. I agree that my work will be published in accordance with Section 47b of Act No. 111/1998 Coll. on Higher Education as amended thereafter and in accordance with the Guidelines on Publishing University Student Theses. I understand that my work relates to the rights and obligations under the Act No. 121/2000 Coll., the Copyright Act, as amended, in particular the fact that Mendel University in Brno has the right to conclude a license agreement on the use of this work as a school work pursuant to Section 60 paragraph 1 of the Copyright Act. Before closing a license agreement on the use of my thesis with another person (subject) I undertake to request for a written statement of the university that the license agreement in question is not in conflict with the legitimate interests of the university, and undertake to pay any contribution, if eligible, to the costs associated with the creation of the thesis, up to their actual amount

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Abstract

In recent years there have been reports on increase of illegal mining activities and several factors contribute to the influx. Although illegal mining to an extent is a source of job for the unemployed folks in Ghana, their activities have dire effects on crops production and environmental health. This study investigates effects of illegal mining of crop production in the Amansei Central district of Ghana. The major primary source data for the study were farm and galamsey household survey and interviews. The study revealed that 83% of males and 17% of females are engaged are engaged in galamsey operations whereas 45% of males and 55% of females are engaged in farming. The contribution of men and women in crop production were not significant ($p>0.05$). The contribution of men and women engaged in galamsey operation were also not significant ($p>0.05$). The portion of change in cultivated farm land size showed 53% of no change in farm size, 21% decrease in farm size and 26% increase in farm size. The difference between initial farm size acquired and current farm size under cultivation is significant ($p< 0.05$). Regarding pollution of water for food cropping, 84% of farmers indicated in-land water source is polluted whereas 16% of farmers have not had problems with illegal mining polluting their agricultural water sources. For the portion of natives and non-natives engaged in farming, the study revealed 68% of natives are engaged in galamsey activities whereas 32% are non- natives. Major crop produced in Ghana over ten years production appears differently. The study observed that maize, cassava and plantain production significantly change over every decade. Effective political and communal wills stemmed from policies need to be exercised to eradicate galamsey activities in rural communities of Ghana. And efforts to train and create jobs in rural communities of Ghana for the rising youth population should be prioritised.

Key Words: Amansei, Artisanal and small scale mining (ASM), crop production, Ghana.

Abbreviations

AGL	Anglo Gold Ashanti
ASM	Artisanal Small Scale mining
EITI	Extractive Industry Transparency Initiative
ERP	Economic Recovery Program
DA	District Assembly
FAO	Food and Agriculture
GDP	Gross domestic product
GH	Ghana cedis
ITDG	Intermediate Technology Development Group
MC	Mineral Commission
MMSD	Mining minerals and sustainable development
MoFA	Ministry of Food and Agriculture
PPP	Purchase power priority
PPMG	Precious Mineral Marketing Company
UNFCCC	United Nations Framework Convention on Climate Change
UN	United Nations
WHO	World Health Organization
ILO	International Labour Organization
IMF	International Monetary Fund

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1 Introduction

West Africa for centuries has been one of the most important gold mining regions resulting rich mineral deposit ranging in complex forms for both large and small scale mining (Hilson, 2002b). Precious minerals including bauxite and diamonds among others are largely mined in the region. Artisanal and small scale mining (hereafter referred to as, ASM) has experienced rise as an essential livelihood for poor people in the sub- Saharan region over the past decades (Hilson, 2002b). Although small scale miners operate informally it provides employment and generate a source of income to many poor households in economic constraint economies to over three million people on sub-Saharan (Jennings, 1999).

Ghana is one of the smallest countries in Africa with population size of twenty- five million and among the largest gold producers in Africa. Previously in Ghana gold production and diamond minerals were mined on a small scale during pre- colonial times (Aryee, Ntibery, & Atorkui, 2003). Presently the sector has expanded and provided number of native Ghanaians with employment.. While accurate extent of ASM are unavailable primarily it is estimated 80,000 including women are actively engaged in small scale mining of gold and diamond (Aryee et al., 2003).

Notwithstanding the positives from the sector, ASM is plagued with impact on crop production, environment and society. As examined by various revised literature and researchers. According to Aryee mining greatly degrades land at uncontrollable rates and unmonitored at mining sites. Agriculture lands are largely destroyed as a result of excessive vegetation removal resulting in reduced crop production (Aryee et al., 2003). Illegal operation is also associated with health adversity.

Their nomadic nature of operations calls for supportive policies in order to formalise and regulate their operation in order for the country to benefit from its mineral endowment (Hilson, 2002b).

This study focuses on the effects of the operation of illegal mining on crop production. The analysis is informed by field work carried out in Ashanti region, an area where there has been an

influx of galamsey operations. Two different groups of respondents were interviewed, galamsey workers and farmers drawing predominantly detailed case study work from three selected towns in Amansei Central district. While the analysis outlines that galamsey operations affect water for farmland irrigation, it also confirms change in farm size and shows that galamsey operations are largely practiced by natives of the towns.

1.1 Background

United Nations (UN) and Intermediate Technology Development Group (ITDG) defines small-scale mining as any single unit mining process having annual production of unprocessed material of 50,000 tonnes or less as measured at the entrance of the mine and small scale miners are poor individuals or group who solely depend on mining for a living (UN, 2004). Mining is the process of digging into the earth to extract naturally occurring mineral deposit. Mining is the second most essential industry after agriculture in Ghana (Down & Stocks, 1978). Mining and Agriculture sector has aided to improve the development activities in Ghana. These two sectors have contributed immensely towards the economic development in Ghana. Ghana's long history of mining is appreciable and well documented hence the name "Gold Coast" reflecting the historical relevance towards sustainable and economic development of Ghana (Akabzaa & Darimani, 2001). The mining industry in Ghana is influenced by gold which predominantly contributes over 95 percent of the country's total mineral revenue. There are other commercially exploited minerals such as manganese, bauxite and diamond. Although limestone, kaolin and salt may exist as other industrial minerals they are not exploited on a large scale. In Africa, Ghana is second most essential producer of gold after South Africa, a significant producer of bauxite and diamonds, a third largest producer of manganese and aluminum (Coakley, 1997).

Ghana's mining industry has undergone several reforms. Prior to 1989, artisanal operations together with marketing of gold from such work were considered illegal "galamsey" (Aryee et al., 2003). Mining production was state owned until World Bank/IMF structural adjustment programme (SAP) recommended to Ghana and other developing countries with important mining sectors to emphasize on private sector-led development as the engine of economic recovery program. This economic programme included obliged policy towards increasing tax revenue from mining and deregulation with a flexible investment code followed by incentives to

invest in sector (Akabzaa & Darimani, 2001). The outcome has been the attraction of foreign mining companies and subsequent intensification of the operation of the existing ones. Ghana's mining by far is primarily owed by foreigners while government holds a less carried significance in main active large – scale mines (The Ghana Chamber of Mines & ICMM, 2015); while small scale mining industry is reserved for Ghanaians.

In Ghana there are two forms of gold mining- small-scale and large-scale. Small-scale miners are primarily self-employed indigenous youth, with little financial backing and limited mining expertise. Within the small-scale sector is a form of illegal mining activity known locally as *galamsey* – the practice of discreetly gathering minerals found either at or just below the soil surface and selling them in contravention of state laws (Garvin, McGee, Smoyer-Tomic, & Aubynn, 2009). In this study the terms illegal mining and *galamsey* would be frequently interchanged. Small scale mining method in Ghana involves individual or a group of persons not exceeding nine in number or by a co-operative society made up of tens or more. The operation of mining is in two forms- surface and underground mining. Surface mining is also referred to as open- pit mining; process is done if the mineral deposits lie on the surface of the earth. This method mostly requires less labour whereas underground mining is when deposits of minerals lie very deep in the soil. Small scale mining activities are identified with significant problems affecting Ghanaians in the mining community. These major impacts affect food, land and water within the community resulting in removing vegetation and inevitable farmland loss which livelihood depends on. Also, it leads to the destruction of road path leading to farming area. The existence of illegal mining has increased the migration of miners in search of minerals leading to population increase and escalating social vices such as alcohol abuse and sex trading.. Surface mining often forces population to relocate and farmers develop alternative income strategies (Kumah, 2006) and also displacement of indigenes within a community.

1.2 Problem statement

In sub-Saharan Africa majority of the population live in rural communities where almost every household directly or indirectly depend on agriculture. Agriculture is a key player in slashing poverty in most growing economies; however, most African countries have not met the criteria for successful revolution and factor productivity in agriculture (Diao, Hazell, Resnick, &

Thurlow, 2007). Several contributing factors may lead to less agriculture productivity. In Africa, agriculture is largely dependent on rains and as a result yields are low and farmers are usually trapped in food insecurity and poverty for decades (Conceição, Fuentes-Nieva, Horn-Phathanothai, & Ngororano, 2011). This menace results in farmers engaging in off-farm activities to generate income in order for the household to be food secured. During poor rainy seasons, farmers living in rural communities abandon their farms and engage in other income generating jobs and later returns to their farm when the rains are back. Mining is increasingly essential sector in most growing economies in West Africa since mining has the potential to boost development within a nation.

Agriculture and mining has contributed largely towards the growth of Ghana's economy in a form of taxes and royalties (UNO, 2016). In 2011 Ghana's economy grew by 14.3% led by an increased rise in minerals like gold and receipts from oil. In general mining accounts about 7% of the nation's GDP (Hilson, 2002a). Aside gold, Ghana produces other minerals including diamond, bauxite and magnesium ore. In Ghana, about 65% of the population are engaged in agriculture as a source of livelihood (Mumuni, Al-hassan, & Oladele, 2012). As majority of the population are actively engaged in farming much attention should be paid in order to help boost the development of the country. The leading cash crop contributed approximately \$1,731 million in exports (Government of Ghana, 2013). Despite the contributions and growth made from these various sectors towards sustainable development they both compete for natural resources including land, water and human resource. It is estimated about 30% of the nation's land reserves has been licensed to more than 200 mining companies for their operation including 2% of the county's forest (Hilson, 2002a). Most agricultural lands are presently concession of mining companies resulting in farmers losing their farm lands. Usually farmers reluctantly give up their ancestral farm lands passed on from generations to large mining companies (Mumuni et al., 2012).

An assessment of the district from secondary sources showed the influx of illegal mining operation within the township. Illegal mining activities pollutes water bodies in communities since they are the source where minerals extracted and washed (Aryee et al., 2003). In Hia, the practice of galamsey activities has led to the destruction and pollution of river Fena within the township. Illegal mining has led to the destruction and pollution of the environment with the

daily use of mercury. Farm lands are largely destroyed and also the road paths leading to farms are destroyed as a result of galamsey activities leading to inability to access food produce and leaving it in the farms.

1.3 Study objectives

Generally this study sought to research into the activities of small scale artisanal mining on crop production in Amansei central of the Ashanti region in Ghana. The study however focuses on the following specific objectives.

- i. To characterise the major food crop production in Ghana
- ii. To characterise crop farming and illegal mining activities in the hinterlands of Ghana
- iii. To examine the effects of illegal mining on food crop production

1.4 Research questions

The following were the key questions that guided this study.

- i. What are the important food crops produced in illegal mining hotspots that have suffered the menace of the illegal mining activities?
- ii. How much have illegal mining practices affected resources that support increasing food crop production in traditional farming communities?

1.5 Scope and limitation of the study

The major focus of the study was to investigate effects of illegal mining on crop production in Amansei central district, Ghana. Related issues including challenges of illegal mining and agriculture and the socio- economic impacts of mining were part of the study.

1.5.1 Limitation of the study

Lack of quality historical data on crop production at district level was one of the limiting factors of the study. This emanates from poor data or record handling and also the unwillingness of authorities to release needed data. Lack of data on illegal mining production in the district was

also a limiting factor and this challenge is emboldened by the illegitimate nature of the galamsey activities.

1.6 Justification and the significance of the study

Although small scale mining provides thousands indigenous people with employment and improves contributions to foreign exchange earnings in Ghana, however problems associated with this industry has intensified and cannot be overlooked. Studies have put less emphasis on the negative effect of small scale mining activities and its impact on crop production. This has left discussion on effect of small scale mining under speculations. This study fills the gap by providing evidence that small scale artisanal mining activities can impose a negative and externalities on crop production.

The study considered three communities in Amansei central district in the Ashanti region of Ghana, and sought to investigate whether indeed the active operation of illegal mining has an influence on crop production in the community. To this end, three communities of illegal mining activities were randomly selected. Interviews were conducted in these communities; namely Ewiasse, Mile Nine and Hia. The desk study made consisted of a literature review of existing reports and studies. It is envisaged that the report of this study becomes very useful material for addressing issues pertaining to mining and crop production.

1.7 Structure of thesis

The study consist of five chapters whose contents have been summarised as the follows.

Chapter 1- This chapter deals with the introduction and background study of the thesis stating clearly the aims and objectives of the study, the research questions and the justification for the research.

Chapter 2- Chapters two of the thesis deals with literature review and the theoretical concept underlining the socio-economic development of the mining sector from the global perspective and provide an overview of the mining in Ghana and discusses the link between mining and agriculture productivity within the related study.

Chapter 3- The chapter outlines the research design and methodology used. The section includes empirical strategy, data collected, data analysis and sources. It also describes the background of the study basically demographic information and economic activities within the study area.

Chapter 4- This chapter presents the results of all analyses and discussion of the effects of galamsey activities on food crop production.

Chapter 5- In the final chapter, study conclusions and recommendations were presented.

2 Literature Review

This chapter deals with the theoretical concept underlining the socio-economic development of the mining sector from the global perspective and provides an overview of the mining in Ghana. It further discusses the link between mining and agriculture productivity within the related study provides definitions and ideas of terms and ideas.

2.1 Overview of mineral mining

Mining contributes towards human development and will continue to play a role in meeting the needs of societies. The rise in population growth and urbanization in China and other developing countries has granted high demands for minerals from individuals and emerging economies to improve living standards. Studies have regularly confirmed that when a per capita income in a country reaches US\$ 5,000-10,000 per year mineral demand increase quickly (Jenkins & Yakovleva, 2006). For instance, as populous China and India go through development there is an increase in demand for minerals (Jenkins & Yakovleva, 2006; Trends, 2001). The mineral gold is a subtle which is very valuable. Aside, it has been used to make jewelry and serves the purpose of electronics since it can be shaped into a very fine wire and resistant to corrosion (McAra, 1978). Minerals are also relevant to other service in contemporary society including education, health and wide range of associated consumer goods and service. Presently the trend of mining is gearing towards emerging countries whereas smelter and refinery production remains located in developed countries (Jenkins & Yakovleva, 2006). As demand for minerals increases human resource is challenged since there is the need to hire highly skilled employees because of the cyclical long- term at all times, even when markets slump and activities go down (Jenkins & Yakovleva, 2006).

Primarily gold mining is the economic drive for many countries since minerals are non-renewable it is of great relevance that income generated is used to assist sustainable development. A well – managed mining industry can contribute largely to the economic growth as a result of creation of employment and business opportunities for inhabitants (Trends, 2001).

Gold mining leads to tax exchange, foreign exchange and foreign direct investment. The existence of responsible gold mining companies in communities improves the health and education of the local people. Among the benefits mining may bring to a community, it also has negative impacts on the environment and society.

Mining significantly has an effect directly or indirectly on the environment. Mining operations disturb water sources within mining communities and forest reserves and farm lands are also destroyed. Despite the undoubtedly importance the mining sectors adds to the growth of a country, governments play a major role in development through policies. There is a need to implement and strengthen policies in pursuit of sustainable development.

2.1.1 Mining in Africa

According to Yachir, Africa is noted as the birthplace of mining activities, where the oldest mines were discovered in an iron ore site in Swaziland 45,000 years ago. Although traditionally gold was used as currency, it had diversified purpose in other places before extended to Africa (Yachir, 1988). The trend of mining activities in Africa has faced a tremendous change. After the twentieth century up to 1930s, mining activities were concentrated in the southern part of the continent with the exception of Ghana (gold) and Sierra Leon (Diamond). The search of minerals and slaves was no more the focus during the colonial era but rather land occupation, food production and more generally the recovery of large areas of influence by the Europeans (Yachir, 1988). During the twentieth century the whole of the continent was under colonial repression with the exception of Ethiopia. Mining had a considerable impact on the domestic society by attracting enormous amount of capital and increased labourer in the industry. The primary minerals mined before 1930 was gold and diamond; and it contributed to the rapid needs of international monetary system. Amid 1930 several changes occurred, the exploration of the mining industry became intensive. Most countries began to discover their potential in other minerals, for instance, copper in Zambia, iron ore in Liberia, bauxite in Guinea and Uranium in Namibia and Niger. All these countries reached high increase their production. Other economies were compelled to rely on mining in order to meet the demand on the international market.

The continent is well enriched with mineral resources, as Africa is been recognized and rated by the US Geological Survey as the second largest world reserves. There are 34 gold producing

countries in Africa, though it has been recorded that 20 countries produce more than a tonne per annum (US Geological Survey, 2011). The main producers of gold in African are Ghana, Tanzania, Mali, Guinea, whereas globally China, US, South Africa and Russia are identified as key players in the industry.

2.1.2 Mining in Ghana

The history of mining in Ghana has been well reviewed and documented. In Africa Ghana is noticed to have the oldest mining operation with large rich natural minerals deposits such as gold, diamond, bauxite and manganese. Small scale mining operations and the trade of gold previously was with Moors and the Phoenicians on the trans-Saharan route and predates the arrival of the Portuguese and other Europeans in 1471 (Aryee et al., 2003). According to Ofose Mensah, the historian, the precolonial days gold deposits could be found on the surface in Asante, Denkyira, Akyem, Wassa almost all auriferous Akan states in Ghana. The accustomed tradition in these areas were that chiefs were entitled to one third of gold won, so they sought to encourage legitimate organisation of this operation (Anin,1990). In view of this, small scale mining activities have been under the surveillance and control of chiefs. Although modern exploration and mining methods were introduced in 1870 by Pierre Bonnat Frenchman, the activities of small scale mining continued. Method used for mining during that era were artisanal and processing where lode gold was mined by excavating pits into levels where dark colored stoned blocked with gold was reached (Aryee et al., 2003). The gold was found by grinding the stone powder and the washing. In 1990 diverse form of legislation sought to ban the operation of small scale mining and large scale mining. This resulted in the dominance of English owed large scale mining operation in the field of mining in Ghana and nearly eliminating small scale mining (Aryee et al., 2003). Prior to 1989 related output from activities of artisanal mining were regarded as illegal.

Gold is among the most significant mineral resources produced in Ghana. Production of gold in 2014 was approximately stable with 2013 figures. There was an impressive 50% increase in diamonds production in 2014 over the preceding year. Although Bauxite and Manganese minerals registered a slow production of about 12% and 11% respectively over 2013 figures (GHEITI report, 2014). Table 1 shows the production figures for 2013-2014.

Table 1 Production figures from 2013-2014

Mineral	2014	2013	% Variance
Gold (oz.)	4,397,304	4,396,897	0.01
Diamond(ct)	241,235	160,821	50
Bauxite(mt)	798,114	980,586	12.16
Manganese (mt)	1,531,394	1,724,417	11.19

Source; Minerals Commission

2.1.2.1 Major mining operations in Ghana

Ghana is well endowed with mineral deposits and has considerably be a pillar of the Ghanaian economy over the years. Today, Ghana is the second largest gold producer after South Africa and the 9th largest producer in the world (Aryee, 2012). This advancement is as a result of liberal macroeconomic policies for mining and attractive legal fiscal institutional frameworks by government. These measures have attracted investment into the country at large towards the mining industry (Amponsah-Tawiah & Dartey-Baah, 2011). In Ghana, among the minerals mined gold, manganese, bauxite, and diamond are largely mined. Gold is one of the biggest contributors towards government revenue it has contributed 95% of the country's total mineral revenue (Aubynn, 2009).

Notwithstanding the growth of the mining industry contributions towards the economy, in 2014, according to Ghana chamber of mines in the mining industry performance reports, gold expanded from 107.4 tonnes in 2013 to 108.2 in 2014 a margin lift of 0.7 percent resulting in a small growth performance in the industry (Ghana Chamber of Mines, 2014). The mineral output in the country is largely funded by members of Ghana Chamber of Mines is the main industry association in Ghana.

2.1.2.2 Economic importance of mining sector

The contributions of mining are varied across and within countries globally. In most case the presence of mining contributes to foreign direct investment and this is usually high among developing countries showing the ability to attract investors in the mining sector (Stern, 1995). Other benefits include employment, export, GDP, government revenues and national investment.

In Ghana, the mining industry is an important part of the economy especially gold. The sector directly contributed 38.8% of Ghana's cooperate tax earnings, 27.6% to government revenues and 6% GDP in 2011 (Aryee, 2012). The industry also contributes to employment in Ghana, where 28,000 local people are hired in the large scale mining whereas 1,000,000 are involved in small scale mining (Aryee, 2012). In 2011 Ghana mining industry recorded the highest gold production of 3.6 million ounces. Small scale contributed 28% towards the total gold produced in 2011. Foreign direct investment amounted to \$11.5billion from 1983 through to 2011 (Aryee, 2012). The trend of mining in Ghana by far has been progressive and granted economic support to the nation.

2.2 Key regulatory stakeholders

2.2.1 Mineral Commission

The coordination of policies and implementation related to mining is the responsibility of Mineral Commission. The development and management of mineral resources in Ghana is also the obligation of the Commission. As a body, they render technical advisory role to the government on issues pertaining to minerals.

2.2.2 Forestry Commission

The forestry commission was restored under the forestry commission Act, 1999 (Act 571). The Forestry Commission is subject to the utilization of forest and wildlife resources, management of resources and, conservation of policies associated to them. With reference to mining section 18 of Act 703 provides the holder of mining right permit from the forestry commission before undertaking mining activities. Mineral right issue is monitored by a set up committee consisting of members from forest commission, Ministry of Lands and Natural Resources.

2.2.3 Water Commission

The duty of duty water commission is to regulate and manage utilized water resource. This institution was formed under the water commission Act, 1996 (Act 522). Therefore they are obliged to grant water right under section 17 Act 703, a holder of a mineral right may for purpose of operation divert, obtain and use water from river underground reservoir or water course within the mineral right subject to obtaining the requisite approvals.

2.2.4 Land Commission

The judicious management of Ghana's lands is the responsibility of the lands commission. A division of the commission known as the land valuation board involved in the valuation of the land and other properties supports the mining industry in compensation.

2.2.5 Environmental Protection Agency

The Environmental Protection Agency is responsible for the enforcement of environmental regulations. This institution was formed under the Environmental Protection Agency Act, 1994(Act 490). The primary legal framework used by EPA for regulating and monitoring mineral operations is the Environmental Assessment Regulations, 1999(L.I.1652) of the EPA, a holder of a mineral right requires an environmental permit from the EPA in order to undertake any mineral operations.

2.2.6 Ghana Revenue Authority

This body is obliged for the collection of revenues accumulating to government.

2.2.7 District Assemblies

Supports the dissemination of the country's decentralized policies and dwells on the development and planning within the area mining operations takes place.

2.2.8 Precious Mineral Marketing Company (PMMC)

The agency renders and official marketing services for small scale gold and diamond miners. Also promotes the development of minerals and jewelry industries in addition they are responsible for exports of minerals.

2.3 Overview of law and regulations in mining industry

Mineral resource deposits are entitled to Ghanaians and the stewardship is entrusted to the president in accordance with the governing provision of the constitution. Therefore specific laws are made under the frame work by the parliament of Ghana (National mining policy of Ghana). New mining law has been developed by government of Ghana, thus Mining and Mineral Act, 2006 (Act 703) to replace the Minerals and Mining law 1986 (PNDCL 153). There are various responsible offices set up to help develop the mining sector of Ghana. The minister has the overall authority of Ghana's mineral resources and policy-making such as grant of mineral rights. Supported by minerals commission (established under mineral commission Act, 1993; Act 450) responsible for administration and performing specific duties and functions such as commending the minister on issues related to mining policies. The environment by Environment Protection Agency and the forestry is regulated by the ministry responsible for the environment and the Forestry Commission also water resources commission assist in regulating of the mining sector. The regulation of fiscal aspect of the policy is accomplished by the Ministry of Finance, Ghana revenue authority, the Bank of Ghana in collaboration with the minerals commission (National mining policy of Ghana).

2.4 Artisanal small scale mining laws and regulations

The legalities of artisanal small scale mining varies from countries while others support the operations by making provision of legal frame work in other countries it is considered as an illegal act (Macdonald, Lund, Blanchette, & McCullough, 2014) diamonds originally were the only minerals that perhaps be legalized on small scale in Ghana. In 1989, small scale gold mining was legalized, which, held better prospects from an economic perspective. The Ghanaian mining act (2006) specifies that Ghanaian citizens ie individuals or cooperatives consisting of ten people can apply for license to mine on a maximum 10Ha in area designated for small scale mining(Macdonald et al., 2014). Laws passed to regularize artisanal small scale mining back then included the Small-scale Gold Mining Law (PNDCL 218) for the registration of activity; the granting of gold-mining licenses to individuals or groups; the licensing of buyers to purchase

product, the Precious Minerals Marketing Corporation Law (PNDC Law 219) providing authorization to buy and sell gold from artisanal small scale (Hilson, 2001). These created the congenial environment for flourished ASM activities in 1990s and early 2000s. Minerals and Mining Act, 2006 (Act 703) and its accompanying regulations provide present legal basis for mining with Sections 81 to 99 applying to small scale mining operations only. Despite the efforts made to legalize artisanal small scale mining, illegal mining operation continue to increase as a result of lack of permit, mine concession rights and the misuse of uncontrolled use of mercury and cyanide (Macdonald et al., 2014).

2.5 Legal policy framework

Despite the major contributions made from mining, the sector is confronted by various challenges which require considerations. Both domestic and international policies are set up to ensure the expected benefits and enhance the industry to remain internationally competitive.

2.5.1 International law and policy

In order to achieve the balance between mining and the environment there is a need to establish international standards legislations and regulations.

Ghana ratified the Kyoto protocol in May, 2003, and preferred convention agreement which included and overarching decision with number of decision in the case of convention, and one decision in the case of Kyoto protocol (Breidenich, Magraw, Rowley, & Rubin, 1998). Kyoto protocol requires the rich, industrialized in Annex 1 of the United Nations Framework Convention on Climate Change (UNFCCC,1997), to reduce their collective greenhouse emissions to at least 5.2% below their emission levels during the first commitment (UNFCCC,1997).

Millennium development goals which emanated from the United Nations summit in 2000 in determination to achieve standards of living was endorsed by Ghana in September, 2001 and submitted reports on its progress and achievements towards human development. Goal seven: ensure environmental sustainability although the target to an extent achievable absolute numbers of dwellers living in slums grew. Sustainable Development Goals was endorsed in 2015, goal six is to ensure water and sanitation for all. The country endorsed Extractive Industries Transparency

Initiative in 2003, and is now working on enhancing communication efficiency to ensure mineral revenues and mineral expenditure is available timely as part of EITI objectives.

Presently, there is the Aichi biodiversity targets; under its strategic goal B which aims to reduce direct pressure on biodiversity and promote sustainable use, enhances the locus to authorities to fight off galamsey practice in Ghana. In order to achieve and enhance the international standards set to sustain the environment, strict measures should be in place to curtail the activities of illegal miners.

2.5.2 Domestic law and policy

In 1983 the mining industry in Ghana supported by the World Bank and IMF initiated the Economic Recovery Program (ERP) governed by the Structural Adjustment program. The primary objective of the policy was to restore the value of the local currency. In order to achieve the agenda the mining sector was identified as the prime industry and a complete mining law was developed (Minerals and Mining Law, 1986, PNDCL 153) to guide large –scale investment in the industry. In 1989 consequential efforts were made to regulate the small- scale gold industry which attracted investment activities.

Consequent amendments towards mining laws and regulations were made in order to improve investment. Mineral and mining laws, 1986, PNDCL 153 was replaced with Minerals and Mining Act (Act 703) in 2006. Further amendments were made in 2010 with the Minerals and Mining Act (Act 794). In 2012 Minerals and Mining (General) Regulation (L1 2173) was set up to strengthen local involvement in the mining sector. Presently development policies set up indicate the interest of government promoting and regulating the small-scale mining industry.

Table 2 Legalisation and reforms governing the mining sector over 1986-2012

Reforms	Date
Minerals and Mining Law, PNDCL 153	1986
Establishment of the Minerals Commission, PNDCL 154	1987
Minerals (Royalties) Regulations, LI 1349	1988
Small-scale Gold Mining Law, PNDCL 218	1989
Precious Minerals Marketing Corporation Law, PNDCL 219	1989
Establishment of Precious Minerals Marketing Corporation	1989
Establishment of Environmental Protection Agency	1994
Drawing up of mining environmental guidelines	1994
Minerals and Mining (Amendment) Act (Act 475)	1999
Review of mining environmental guidelines	1992-1999
Divestiture of state-owned mines from 1992 to 1999	2006
Minerals and Mining Act (Act 703)	2010
Minerals and Mining (Amendment) Act (Act 794)	2012
Minerals and Mining (General) Regulations, LI 2173	2012
Minerals and Mining (Support Services) Regulations, LI 2174	2012
Minerals and Mining (Compensation and Resettlement) Regulations, LI 2175	2012
Minerals and Mining (Licensing) Regulations, LI 2176	2012
The Minerals and Mining (Health, safety and Technical) Regulations LI 2182	2012
Minerals and Mining (Explosives) Regulations LI 2177	2012

Source: Akabzaa and Dramani 2001 and Ibrahim 2013

2.6 Land use

Land is finite. Land resource is prone to competing pressures from increased food, fiber and fuel production, infrastructure and urbanization. Population and high demand of resources results in shrinking of natural resources an estimated 1000 Km² of agriculture or natural resources disappears annually (Koellner et al., 2013).

Globally land use change is linked with alteration of land cover, deprivation of natural capital including degraded soil functions and fertility it can also be associated by the expansion of urban and infrastructure areas at the expense of agricultural land and the expansion of savannah forest (Bruce & Subramanian, 1996). Deforestation over the last five decades reached the rate of about 13 Mha per year on an average with cropland expansion being the major origin worldwide. In 2000, primary forest area decreased by 40 Mha, whereas forest plantation increased by 5 Mha per year since 2005 this eminent in the tropical region where 6-7% of natural forest are converted especially in Indonesia (Smith & Bryant, 1975). Presently cropland consist about 10% of the world area whereas agricultural area in total comprises around 33% land use from 1961- 2007 has increased by 11% or 150 Mha globally (Koellner et al., 2013).

The second largest continent after Asia is Africa, with a total land size if 3025.8 million ha. Sudan is the largest land covering size among the 53 countries covering 250.39 million ha and Seychelles occupies the smallest land size only 45600ha (Chenje, 2004). Africa's landscape is well endowed with woodlands, forest, and arable land, fresh water mountains resources to help maintain and improve human development. According to FAO, forest and woodlands covers about 650 million ha or 21 percent of land area (FAO, 2003) whereas arable land 630 million ha of land backs the mass through subsistence farming and commercial agriculture (Chenje, 2004). Environmental factors including soil quality and water availability contributes towards agriculture productivity. According to Pritchard (1979), land use in Africa has evolved from hunting and collecting practiced by the bush men in the Kalahari desert through shifting cultivation which is widely practiced in sub-Saharan in Africa. Agriculture is relevant and contributes earnings in Africa. Land use in Africa is multifaceted including agriculture, and

forestry, mining infrastructural development. Lands contributes to the basic needs of man from the cradle to the grave, provides food, health and security against environmental shocks (Chenje, 2002).

Land resources symbolically contributes to sustainable development in achieving the target under all the eight millennium Goals (MDGs) degraded lands can be restored to contribute to development (Chenje, 2002). The relevance and major opportunities of land resources grants governments and stakeholders in influencing regulations and policies towards resource sustainability (Botchie, 2007).

In Ghana farming is among the dominant land use system, crops initially cultivated are cassava, maize, yam, and cocoyam plantain whereas the alternative land use thus gold mining in the forest area which contribute immensely towards national and household growth (Oku-Afarie, 2015). Presently land use choices fuels negative co-operation among farmers and miners. Several policies and regulations are binds miners expecting their cooperation to conform to the regulations in order to restore viable socio-economic development.

2.6.1 Research and development

The mining industry is of great interest to the government of Ghana, therefore several investments has contributed towards research and development specifically the small scale gold mining in improving geodata, winning processing and downsizing environmental degradation.

Securing technical assistance from local researchers and academic industrial minerals is the focus towards large scale mining to combat environmental related mining issues and it is impact.

2.7 Institutions of mining industry

2.7.1 Large - scale mining

Ghana is endowed with variety of mineral resources including silica sand, limestone, Kaolin, salt. The prime mineral mined on a large scale are gold, bauxite and manganese while the other minerals are mined on a small scale. Gold contributes more than 90% of the total value of minerals won in the country and this has attracted large number of large investors. The capital

intensive nature and large production size of the industry has attracted foreign investors as the main owners of large mining firms in Ghana. The Government and private Ghanaian investors hold less than 15% shares in these mines. In Ghana there are 19 large mine companies, 16 gold mines and one bauxite, one diamond and one manganese mine. Presently all other mines operate on the surface with the exclusion of Ashanti Goldfields company Obuasi mine. The Obuasi mine of Ashanti Goldfields Corporation (AGC), which started in 1890, is presently the largest and oldest operation in Ghana. It's estimated more than 50% of the country's total annual gold production (Mensah et al., 2014) and Prestea Resource Limited.

Table 3 List of mining companies in Ghana and commodity mined.

Mines Company	Location	Commodity Mined	Government Share
Adamus Resources	Teleku-Bokazo Nkroful (Western Region)	Gold	10%
AngloGold Ashanti	Obuasi (Ashanti Region) and Iduapriem (Western Region)	Gold	1.7%
ChiranoGold Mines	Chirano (Western Region)	Gold	10%
Ghana Bauxite Company	Awaso (Western Region)	Gold	20%
Ghana Manganese Company	Nusuta (Western Region)	Gold	10%
Gold Field Ghana	Tarkwa and Damang(Western Region)	Gold	10%
Golden Star	Prestea Wassa (Western Region)	Gold	10%
Newmont Ghana	Kenyasi (Brong Ahafo) and New Abirem (Eastern Region)	Gold	0%
Perseus Mining	Ayanfuri (Central Region)	Gold	10%
Prestea Sankofa	Prestea (Western Region)	Gold	10%

Source Ministry of Finance Ghana Extractive Industries' Transparency Initiative (GHEITI) 2014 and company websites.

2.8 Anglogold Ashanti (AGA)

AngloGold is a South African based company that is independently managed by Anglo American. The Anglo American is among the world's largest mining and natural resource sector companies. AGA is involved in Extractive Industries Transparency Initiative AngloGold is listed on the London Stock Exchange and majorly owned by institutions including PLC Nominees, Old Mutual Nominees and Legal and General Investment (Bringezu et al., 2014).

AGA was established in April, 2004 after a merger between AngloGold limited and Ashanti Gold Fields Limited (AGC). Currently AGA operates 22 mines and plants in 10 countries. In Ghana AGA operates in Iduapriem in the Western part of Ghana and Obuasi in the Ashanti region approximately 60km south of Kumasi. Main mining operations are dominated by underground, to a depth of 1.5 km. Although AGA provides employment and support local people through developmental projects, AGA has to an extent been a cost the people of Obuasi community. Considerable damages affecting water resources, land degradation and crops produced within the area were traces of high measured ions in crop samples (Action aid).

2.8.1 Small scale mining

Small scale mining has contributed to the Ghanaian economy. The operation of small scale miners predates to the 14th century. Currently there are three hundred (300) registered small scale mining group (Mensah et al., 2014) in Ghana. The activities of small scale miners demand less capital and low skilled labour which resulted to low productivity. In 1905 during the colonial era small scale miners were traditionally the only miners of gold and diamond, through legislation their operations were considered as illegal (Akabzaa & Darimani, 2001). Until 1989 (PNDC Law 218), the activities of small scale miners became legalized by the government, and reserved for Ghanaian nationals. In Ghana small scale miners are grouped into two different section, specifically licensed and unlicensed small scale mining operators (Kessey & Arko, 2013). Although theoretically there is a distinction between the groups of mining operators, that is, the technological use and security of tenure on demarcated mineralized concession for a given period mineral for licensed small scale miners, it has been observed that their form of operation is blurry. (Hilson & Potter, 2005) The operation of small scale mining is mostly in remote regions of the country where agriculture is largely practiced. Although the operation if properly managed will generate jobs and also serves as a source of income for many livelihoods but with

the poor management of the Illegal small scale mining, their activities turn to pose diverse challenges to the community, industry and the country at large. The nomadic nature of their operation of illegal small scale miners has leads to illicit activities of encroaching concession owned by large scale miners, depriving duly licensed companies of the opportunity to exploit deposited mineral more safely and prudential, while it bequeaths large scale companies additional cost to rehabilitate lands (Reports mining industry, 2014). In addition water bodies gets destroyed and polluted, foot path leading to farm lands are also destroyed, leading to farmers facing the challenge of working on their farmlands

2.9 The importance of small scale mining in Ghana

The existence and operation of small scale artisanal mining is of great interest to the government of Ghana and Ghanaian's at large, since it contributes to the mineral exports and foreign exchange hence the legalization and regularization of the activities (Ofei-Aboagye, Thompson, Al-Hassan, Akabzaa, & Ayamdoo, 2004). Small scale contributes to the total gold produced in Ghana and also as a form of job creation for the unemployed in the rural areas (Twerefou, Aryeetey, & Bafour, 2007). Small scale mining by artisanal means formed the basis of the Ashanti Empire and facilitating the opening of Trans – Saharan route prior to European contact, gold mining largely contributed densely to large projects in Ghana. ASM also generates economic and social importance by contributing towards house hold income. Small scale mining has contributed towards the wealth creation and reducing poverty. It has promoted the provision of social and business to local communities. Largely the employment generated in this sector is rendered illegal, Appiah,1998 posits that the sectors provides about 20,000 Ghanaian job opportunity of whom majority are rural dwellers and 60,000 dependent on their existence of their livelihood(Appiah, 1998). Gold is widely mined because its deposits are found in one sixth of the country (Ofei-Aboagye et al., 2004). Although the study focuses on small scale gold mining, the existence of other mined minerals such as salt and diamonds are defined in a certain part of the country and contributes towards national mineral production. According to EITI report 2014, ASM gold and diamond Exports in 2014 was about US \$ 2bn. It contributed an impressive 14.7% of the total Merchandise Export in 2014 (EITI, 2014).

Table 4 ASM contribution to national export.

Item	2010	2011	2012	2013	2014
A.Total Merchandise Export	7,960.09	12,785.40	13,541.40	13,017.80	12,983
B. Mineral Export	4,900	5062.8	5768.8	5138.89	4,516
C. ASM Export	951.2	1553.64	2,283.30	1,919.90	1,913
Mining% (B/A)	62	39.5	42.6	39.4	42.3
ASM (Mining Sector) (C/B)	19.4	30.6	39.50	37.40	42.3
ASM (Total Exports) (C/A)	11.9	12.2	16.9	14.7	14.7

Source: Mineral Commission/Bank of Ghana

2.10 Benefits of gold mining in selected countries

2.10.1 South Africa

In 1886, the discovery of Witwatersrand Goldfields contributed to the development of South Africa's world – class gold mining industry. Which has influenced the global mining industry for 120years(Janisch, 1986). Gold mining in South Africa predates to the 4th millennium BC until now the demand and use of gold is steadily increasing.

The rapid development and industrialization of the country is as a result of the gold mining sector and by far reorganized as the most industrialized country in the Sub-Saharan Africa. The existence of gold mining operations motivates development for key infrastructure including water, road and electricity.

South Africa mining sector is divided into four sections the first section largely public –listed gold mining companies. These companies include AngloGold Ashanti, Gold Fields, Harmony, DRDGOLD and Western Areas. These companies account for 91% of the gold produced in South Africa(Janisch, 1986). The second section comprises of publicly large gold mining

companies producing gold as a byproduct of other metals. The third section companies produce gold as a by-product of other metal mining. Tailing retreatment operations operated (either by large listed companies or by small – scale companies forms the last sections of the mining sector.

The informal gold mining sector mining activities under the informal sector occurs in areas where the old mine areas. Informal mining in South Africa is distinct from illegal mining. Informal mining is usually carried out by one person working on abandoned sites and dumps it is also indicated that these informal miners are transitory.

In 1970 it is estimated 1,000t (67% of global mine supply) was the peak production, presently the industry is in a mature declining phase with the production having reduced to 342t. With the consequent rise in demand of gold contributes positively to the main growth of global economic growth it was estimated in 2012 at least US\$210 billion of by the gold industry and added to the Gross Domestic Product(Janisch, 1986).South Africa the mining sector attracted and presented opportunities to diverse professions globally. The impact of employment critical when indirect employment and dependency ratios is taken into account. The mining sector has been the primary foreign exchange earner. In 1980 gold export earning accounted over 50% of South Africa's merchandise export; with the consequent rise in demand of gold. In 2012 gold mining also contributed over US\$ 78billion to the economies of the top 15 mining.

2.10.2 Australia

Australia gold deposits comprises about 10% of the world's economic gold resources and is ranked third after South Africa and U.S.A. and also the world's third largest producer accounts 11% of the world output(Cleary, 2011). Gold has played much importance in Australia's history. In 1851 was the first gold boom found in Bathurst. This discovery led to Victoria gold minerals. The presence of gold increased population, it drew immigrants to the country.

In the Northern and Australian states gold are mined. Gold is the major output of about 70 operations in the nation. Western Australia accounts for 69% of gold mined followed by New South Wales 12%, Queensland 6% and Northern territory 5% (Cleary, 2011).

Gold discovered urged development in the transport, communication and foreign trade sector however in the 20th century as other minerals became of greater importance. Gold mining underwent resurgence

In 1970 and 1980 increase in gold price served as the catalyst for renewal in the Australian gold sector. Over the decade between 1981 and 1990 flourished from 18 tonnes in 1981 to 244 tonnes in 1990(Cleary, 2011). Price of gold trended downwards over 1980 and 1990s beside prices of commodities. However in the mid1990s, the industry maintained profitable through the use of upgraded technologies.

Currently although gold is no longer Australia's biggest export earner, it remains relevant section of Australia's export earnings. Gold contributes a number of flow-on benefits. In 2014 according to the United States Geological survey, Gold reserves were 9,800 tonnes almost 18% of global reserves.

Mineral resources development is dependent on land; in this regard the Australian government is committed to improvement beyond regulatory requirement. Ensuring land availability is among the key objectives of the gold sector.

2.11 Agriculture

The agriculture sector is vital to many livelihoods in most African countries since it serves as a means of survival and well-being. Agriculture sector contributes towards the economic activities according to FAOSTAT, approximately 203 million people or 56.6 % of the total labour force is involved in agriculture labour (FAOSTAT, 2004). Hence livelihoods may be affected directly or indirectly by climate and other factors that may distort the productivity of agriculture. In Africa approximately 70% of the rural indigenes own livestock (ILRI 2004) granting significantly to household and community resilience to disasters, specifically arid and semi- arid zones(Chenje, 2000). Although the continent produces much it is reviewed by researchers that it is unable to feed the growing population. In Central, Eastern, Western and Southern Africa 20 – 75 percent of the entire population was reported undernourished (WFP 2003). Usually women and children are at a disadvantage from food insecurity. In Africa it is estimated 70 percent of poor and two-thirds of its population live in rural areas and solely depend on agriculture and natural resources for their livelihood(Chenje, 2000) agriculture helps to mitigate against poverty.

2.11.1 Food and agriculture in Ghana

Agriculture is a leading sector that contributed 23 percent of the national GDP in 2012 (FAO 2015). Its estimated agriculture accounts for about 40 percent of national economy and employs 60 percent of the labour force (Quiñones & Diao, 2011). The agriculture sector is largely practiced on smallholder, family-operated farms with the use of rudimentary technology to produce approximately 80% of Ghana's total agriculture output (Johnston & Mellor, 1961). According to the 2000 census the agriculture sector employs 50.6% of labour force are directly involved in agriculture (Johnston & Mellor, 1961).

Agriculture is among the relevant sector for poverty reduction and has helped the country become the first Sub-Saharan African country to achieve the first objective of Millennium Development Goals (MDG1) by halving the country's 1990 poverty rate before 2015 target year (Quiñones & Diao, 2011). Although it is assessed that rainfall is largely depended on in Ghana's agriculture in 1999 approximately 6,000 farm enterprise nation-wide used means of irrigation, described by smallholder activity farming of plot less than 1.5 ha (Quiñones & Diao, 2011). Productivity is usually low as a result of low-input traditional farming systems and the irregular nature of rainfall pattern in the country. Improved irrigation and water management technologies for smallholder system would increase unit area for crop production significantly (Ministry of Food and Agriculture (MOFA) 2005).

In Ghana food crop production is mainly through shift cultivation (Nye, 1960) in which farmers "slash and burn" and allow the piece of land grows crops in poly-culture between 1-3 years and allow the land to fallow (Quiñones & Diao, 2011). Typically the fallow period restores nutrients and improves soil quality, notwithstanding the growing population the normal fallow period is cut down emerging low crop yields (Seini, 2002). Generally the use of chemical fertilizers and other agro-chemicals and technology is used to improve crop produced to meet the demand of growing population also the means to acquire is limiting.

2.11.2 The role of agriculture

Generally the agriculture sector role is multifaceted and contributes socially, environmentally and culturally. Agriculture basically aims at producing food and supply of raw materials and serves as a means of employment for livelihoods (FASDEP, 2007). Agriculture militates against

poverty and contributes toward the GDP of a country. The sector boosts development and sustains the environment.

Agriculture supports greatly during economic shocks within a country, in the case of Nigeria, in 1980's agriculture became an alternative livelihood for many displaced (FASDEP, 2007) also during uncontrollable demonstrations and crisis it supports the local people. Agriculture has increased movement of population between sectors and contributed to rural- urban migration.

Natural resources including water, forest, and land are altered by agriculture also poor farming practices degrades land leading to low productivity. The role of agriculture in a nation makes agriculture policy an essential portion of the national policy and its effective implementation generate growth and development.

2.11.3 Constraints in agriculture

The agriculture sector is faced by several contributing factors including lack of infrastructure, illegal mining, food insecurity and irrigation among other challenges. Considering the fact that major agriculture operations are under taken in the rural areas and also long distance of farmlands in Ghana, transport service should be made available and adequate in order to easily move agricultural commodities and inputs. Limiting and inadequate transport infrastructure slow down productivity and deteriorate crop produced.

Food insecurity also emerges as a form of constraints, although Ghana is may be considered as food secured pockets food insecurity occur in certain part of the country's population. Food insecurity is dominant in population density areas among women and children have specific dietary preference.

Farmlands and vegetation's are destroyed as a result of illegal mining operation within a farming community. Water sources which could have helped irrigation are also polluted, in the long run agriculture productivity is limited. Many challenges face the agriculture sector therefore the need to strengthen agriculture policies is of relevance.

2.11.4 Agricultural policies

Agricultural polices are enhancing agriculture productivity and sustainable development through stable nation and good governance in the agriculture sector.

The Ministry of Food and Agriculture (MOFA) among its objectives is focused on modernizing agriculture in structurally transformed economy and eminent in food security and employment opportunities. The adopted approach is to follow a market driven logic and engagement of private sector. Food and Agriculture Sector Development Policy (FASDEP II, 2007) is the modernization of agriculture and it seeks to increase productivity also National Social Protection Strategy focuses on the empowering society through sustainable mechanisms. Ghana's agriculture trends in crop development are to promote food, horticulture and industrial crops through programs.

Producer oriented policy programmes were developed to support agri-food production and exports in 2007 specifically agricultural modernization including fertilizer subsidies. In 2008 reintroduction of input of subsidies national fertilizer subsidy programmes were introduced as a temporal solution toward price increase in domestic food prices. Due to reduced crop production government enrolled Agriculture Mechanization Service Enterprise Centers (AMSEC) a credit facility to support private sector companies in purchasing agricultural machinery. Block Farm Programme in 2009 was launched as a component in youth agriculture programmes to generate employment for the deprived youth. As part of these programmes, the Ghana's school feeding programme was enrolled to enhance school enrollment and improving of health status of school children.

For crop productivity to be enhanced there is a need to ensure integration and sustainable exploitation use of natural resources in the crop sub- sector in association with government and non-governmental agencies.

2.12 Agriculture and mining

In Ghana gold mining operations are located in fertile agricultural and rural areas. The existence of mining and agriculture may co-exist and interact to generate economic and social benefits, but at the same time compete for natural resources including water, land and labour as industries they also rely on each other (Djurfeldt, Holmen, Jirstrom, & Larsson, 2005). Mining to an extent is associated with negative effect on agriculture including pollution, land grabbing and having a direct impact on rural income and living (Aragon & Rud, 2012). Despite the importance of

mining and agriculture in socio- economic development there's a need for the two sectors to operate in a positive and balanced manner with disturbing the livelihood of rural inhabitants. Across Africa, agriculture is recognized as the most important economic sector employing high portions of labour market (Moomen & Dewan, 2015). However gold deposits and other rich minerals have greatly contributed towards the growth of the economies across Africa, For instance Ghana's GDP grew by 14.4% and Mozambique by 7.3% this growth was predominantly driven by investment (OECD, 2013). For the two key sectors to be appreciated there is a need to mitigate the negative consequences by maintaining a balance coherent policies frame work strategies must be adopted. Besides, the economic growth of these sectors rural – urban migration and all manner of migration in order to improve the living standard of local people.

2.13 Mining and migration

Labour migration is defined ILO as “a worker who migrates from one country to another with a view to being employed otherwise than of his own account, and includes a person regularly admitted as migrant for employment (International Labour Migration)

Migration in Africa has a long history of population movement aimed at restoring ecological balance most essentially search of security and food occurred over a wide area (Hance, 1970) In Africa various forms of movements within and across were influenced by natural disaster, commerce, pastoralism and the search of employment and other circumstances characterized movements (Adepoju, 1995).

As part of Ghana's history mining and mineral industry in predates over a centuries when ethnics used gold as an embodiment of power and influence of various tribal groups (Nyame & Grant, 2007). The introduction and expansion of the mining sector towards export product created high demand of labour which indigenous people could not satisfy (Adepoju, 1995).The mining industry in Ghana attracted labour migration during the pre-independence era, migrants from Nigeria, Burkina Faso, and Mali engaged directly or indirectly in the mining sector with their skills ranging from skilled to semi- skilled(Nyame & Grant, 2007)also many indigenous shifted into the mining industry

The existence of mining activities has attracted and generated a source of income for many. Comparatively the attractive and well equipped nature of mining communities to other parts of Ghana has provided spatial environment of immigrants (Nyame, Grant, & Yakovleva, 2009). Migrants settle in particular mine area due to the concentration of mineral reserves that is volume and grade. The nomadic nature of illegal miner's activities results in galamsey operators hoping from one mine to the other. Accordingly the varied skills needed at the mine, mining operations does not only attracts Ghanaians but mainly across border migrants including Togolese, Burkinabe's etc. (Nyame et al., 2009) operate in the mine.

Both mining and migration contributes towards the growth of a nation. Migrant workers contribute towards the development of their countries of destinations whereas countries of origin largely benefits from their remittance and skills acquired during migration experience (ILO, 2012) presently according to ILO factors such as globalization, demographic shifts, conflicts, income inequalities and climate change will enhance more workers and families to cross borders in search of employment and security (ILO 2012).

2.14 Mining and health

Despite the benefits mining operations adds to the people in mining communities the negative effects of health is immeasurable. Mineral deposits in the soil does not guarantee the wealth of miners (Conant & Fadem, 2008). The nature of mining operation is to exploit therefore it exploits not only the land but rather the human resource involved. The earth is mined for minerals all forms of mining is threatening, there is effect on the human health in both large and small scale mining. Understanding the long term implication of on the well-being of miners will help improve and mitigate the harm associated with mining.

World Health Organization defines health as a state of complete physical, mental and social well- being and not merely the absence or of the disease infirmity (WHO, 1946). This definition indicates how productive one will be if one is physically fit.

Health matters related to mining can be very sickening, the activities of mining mostly causes fire outbreak, explosion or collapse of buildings and mine tunnels. Miners usually get poisoned as a result of inhaling of dust, this causes the disease black lung causing sever breathing problem

usually underground miners separating minerals from the rocks mostly women and children are mostly involved in this section of mining and it exposes them to these diseases. Chemical spills and heavy metals in the long term lead to death. Again heavy lifting, use of vibrating machines can affect the nerves and blood circulation. Working in a very hot environment without water can cause stress (Conant & Fadem, 2008). Children used for mining also have a high chance of getting affected from the dust from the mines.

2.15 Mining and land degradation

Land degradation has a long-term loss on ecosystem and overburden the land surface. Land degradation also directly affects losses of soil, organic carbon nutrients and regulation and indirectly affects loss of productivity and wildlife habitat. Threats to sustainable development posed by land degradation has been considered by 1992 Earth Summit and the 2002 World Summit on Sustainable Development however response has been crippled (Herzog & Lausch, 2001). Activities of mining and its consequents is recorded as degrading to the land and other resources significantly. The excessive removal from the mine area accounts to the reduced rain forest and rich top soil for cultivation also among mining operations blasting or sophisticated machines results in destruction and generating of waste (Sahu & Dash, 2011).

In Ghana most lands are classified as poor fertility and are subject to degradation factors influencing the degradation includes population, increased urbanization and climate change (Economy wide & Assessment, 2007). These causes reflect in crop production that contributes to soil erosion, overgrazing, pollution, and desertification from deforestation (Economy wide & Assessment, 2007).

To sustain and restore crop production proper soil management and other natural policies should be enrolled to protect and preserve development. Ghana's endorsement and participation in the Stockholm conference in 1972 and the Earth Summit in Rio signified environmental efforts toward sustained living conditions (Akabzaa, 2001). Environmental policy was adopted in 1995 in Ghana's constitution focused on protecting the environment.

2.16 Theoretical framework

The resource curse theory stipulates that the abundance of minerals and fuel in less developed countries (LDC) contribute to generate negative developmental outcomes including poor economic performance, growth collapse, high levels of corruption, ineffective governance (Di John, 2010). Natural resources in most poor countries are considered as a curse than a blessing. According to Siegel, 2008 naturally resource endowed countries experience worse economic and political outcomes than countries with no endowment. The resource curse phenomenon results from variety of reasons such as Dutch disease, rent seeking, crowding out of human capital and crowding out of social capital (Van der Linde, 1994). The Dutch disease is another form of resource curse. The Dutch disease an economic concept coined in 1960 in the Netherlands. Dutch disease refers to the potential negative effects natural – resource windfalls and accompanying appreciations of exchange rate can have on the entire economy for instance potential dangers of oil booms (Di John, 2010) following a sizeable natural-gas discovery in the Netherlands, the value of Dutch currency increased rendering exports from other sector uncompetitive. As an outcome real exchange rate appreciated as resource revenues entered the economy. Exchange rate consistent relationship with oil and gas revenues makes it difficult for countries discovering such resources to accumulate the foreign currency required for trade (Korhonen and Juurikkala 2007). There are many other large endowed countries which perform worse than significantly endowed ones, Netherlands situation is not unique (Auty & Gelb, 2001). Generally the existence of natural resource should be a source of wealth enhance the development and economic growth within the region(Collier, 2006). Countries such as Malaysia, Botswana, Indonesia and Thailand have proven that natural resource- rich countries can sustain economic growth and attain economic development(Demissie, 2014). The Dutch disease theory explains macroeconomic consequences of resource boom. Resource boom is associated with temporal increase in mineral resource discoveries may serve as an opportunity for developing countries, however market force may not lead an economy in the right direction(Polterovich, Popov, & Tonis, 2010). This study uses the tents of resource curse theory to identify how well-endowed resource can be expletive. The case of Amansei central is not unique the district is endowed with abundance of mineral deposit but yet lacks development and economic growth. There are several pointing factors

revenues tends to corrupt officials as it may be easier to bribe officials rather than invest in project and industries affecting development(Barbier, 2007). In addition abundant natural resource crowd other economic sector such as human and social capital (Demissie, 2014)

Table 5 Receipts from mining industry/ total collection.

Year	Total Income (GH)	Total Collections (GH)	Total GRA Mining/Total	
			GRA Collection	%Mining to GDP
2013	1,104,047,314	5,880,322,065	18.78%	1.20%
2014	1,192,692,542	7,426,082,366.05	16.06%	0.08%

Source; Minerals Commission

2.17 Overview of revenues from mining activity

2.17.1 Mineral royalties

In Africa the process of revenue distributions from mining activities extensively differs. Ghana and Namibia has created Minerals Development Fund (MDF) for distribution purpose(Otto, 2006) South Africa alternative mineral royalty distribution is its newly published Mineral and Petroleum Resources Development Act (MPRDA) funds are distributed to pays for services and for allocating to lower levels of government(Otto, 2006). In Mozambique mining laws provides for a percentage of royalties to be paid directly to lower levels of government(Otto, 2006). In Ghana Mineral Development fund was formed in 1991 was to make available a portion of mineral royalties to be used directly for the benefit of mining communities, for research and other projects related to mining. In addition part of mineral royalty income generated from mining development are returned to communities precisely affected by mining(Otto, 2006). The mineral companies lawfully are required to pay mineral royalties (a range of between 3 and 6% of the value of gold they mine) to the state immediately they commence mineral production in the country. Payments are sent to the Large Tax Unit of the Internal Revenue service who then pays into the consolidated fund. Mineral royalties payments are made quarterly by mining

companies, 80% of the mineral royalties paid by mining companies to internal revenue service is retained by government in the consolidated fund (GHEITI report, 2012). Therefore 10% is paid from the consolidated fund to the Minerals development fund 10% is paid to the Office of the Administrator of Stool Lands (OASL).

2.17.2 Ground rent

This a form of funds paid by mining companies and other companies to the owners of the land. In Ghana mining activities made by companies are done on stool lands. Accordingly companies pay ground rent to the accountable office thus the office of the Administrator of stools Lands. Customarily amount paid as ground rent depends on the size of the concession (GHEITI report, 2008).

Table 6 Disbursement of ground rent paid by mining companies received by the OASL

Beneficiary	Share %
The Administrator of stool Lands (takes 10% of the amount received to cover administrative expenses). The remaining amount is shared as per the percentages below	10
District Assemblies-55%	49.50
Stools-25%	22.50
Traditional Councils-20%	18.00
Total	100

Source; GHEITI, report 2014

2.17.3 Property rate

Property rate are levies are demanded on buildings, plants and other immovable structures to the ground. This fund is independently determined by the District Assemblies after applying a formula (Rater impost) to valuation figures (GHEITI report, 2008). The district valuation board with approval from the regional valuation board further determines figures for properties. Funds from the mining companies are applied as internal generated funds by the District Assembly used for recurrent expenditure. Property rates are precisely collected from the mining companies,

payment mode are however determined by the mining companies where some may prefer to pay in installment.

2.17.4 Cooperate tax

Corporate tax presently is fixed at 25% of Net Profit (GHITI report, 2008). Mining companies are required to submit their yearly returns four months after the end of accounting year. Self – assessment are permitted to estimate profits for the year and pay deposits based on their assessment. The country has changed the capital allowance rules in 2012, for the mining sector. Therefore capital allowance is 20% per annum on a straight line basis. In 2016, cooperate tax was the biggest revenue paid by six participating mining companies namely Ghana Manganese Ltd, Newmont Gold Ghana Ltd, Chirano Mines, West Africa Quarries, Gold Fields Ghana Ltd and GSR Wassa (GHEITI, report 2014)

2.17.5 Dividends

In every mining lease holder the government retains 10% non- contributing shareholding. The 10% rate of government holding may be modified in a condition where exceptional agreements exist. Non Tax Revenue unit under the Ministry of Finance and Economic Planning formally collect the government’s share of dividends when declared by mining companies.

Table 7 summary of mineral output and Revenue (2013-2014)

Company	2013		2014	
	Production	Revenues	Production	Revenue
AGA- Obuasi	239,052	414794330	243223	313666710
AGA- Iduapriem	220,658	301,112,215	176,930	234,604,046
GFG- Tarkwa	632,244	893,149,334	558,222	590,393,835
GFG- Damang	153,117	216,444,000	177,741	224,652,540
GSBPL	144,997	204,743,250	147,957	186,181,634
GSR- Wassa	185,808	263,072,401	112,835	142,734,191
Chirano	274,683	385,457,028	286,326	354,691,899
Newmont- Ahafo	570,155	793,670,767	442,020	565,732,824
Newmont- Akyem	129,211	163,888,151	471,658	595,474,578
Adamus	105,215	143,205,706	88,476	144,592,629
Perseus	198,608	279,883,073	187,363	238,110,562
PMMC - gold	216,381	387,601,517	265,350	238,110,562
ASAP VASA	122,518	163,262,284	9,652	12,633,028
PMMC - diamond	159,074	8,030,808	241,120	10,700,962
Ghana Manganese Company	1,997,911	135,475,951	1,353,486	91,147,458

Source: Report on the performance of mining Industry 2014

2.17.6 Small scale mining process

Small scale mining is by far reorganized as informal and unstructured from the development perspective (GHEITI, 2014). Majority of the techniques used by the unlicensed miners are used by licensed miners but rather in a controlled way. The adapted mining method used often

depends on factors such as the type of mineral deposits mined and location. In general there are 3 traditional or manual methods used to mine for minerals are shallow alluvial mining deep alluvial mining and hard rock mining.

The study reveals that some unlicensed miners clear the vegetation and excavate the soil until gold rich layer is reached, the deposits usually are found in low lying areas. The mineral is then taken out and transported to a nearby water body for sluicing to recover the gold this process is known as the shallow alluvial mining or dig and wash. The other form of mining method used is deep alluvial mining this method is applied when deep alluvial deposits are found along the banks of rivers, involving deep digging until gold bearing gravel horizon which is about 7-12 meters is reached the gold bearing is further removed and sluiced to recover the gold(Corral & Earle, 2009). Hard rock is mining the method applied to mine gold bearing reefs. Holes are sunk to intercept the reefs and when completed the reefs work along the strike. Small scale miners often use hand tools such as chisel and hammers to break the ore , explosives are commonly used when is too hard (Aryee et al., 2003). The operation of small scale miners is labour intensive however the low capital nature of the operation becomes attractive to the rural poor who cannot afford the price of license and sophisticated equipment's.

2.18 Impact of illegal mining on crop production

Generally agriculture is the dominant activity carried out where mining operations occurs. The rampant spillage of chemicals such as cyanide and mercury affect crops and health threats to farmers, this resulted in unproductive farmlands (Ontoyin & Agyemang, 2014)The destruction of vegetation and farmlands by miner affect food security and also drives farmers from sustainable livelihood to rather an alternative income generating businesses (Hayes & Wagner, 2008).In this regard the alternative livelihood poses more environmental threat(Banchirigah & Hilson, 2010). The economic aspect, although high proportions of idle youths find solace at such mining site, the negative effect on the food security is enormous (Dukiya J. Jaiye, 2001)Fertile expanses of land that are devastated and rendered uncultivable for long period of years deny the farmers' access to such scarce land, hence a general decrease in food production. Even after the mine has been abandoned and re-cultivated, the residual changes in soil physics and chemistry, available

water resources, etc. can lead to the appearance of different plant constituting an irreversible alteration stemming from the mining disruption.

2.19 Impact of illegal mining on the environment

According to Sanborn, its estimated that 20% of Peru's \$ 10 billion gold export comes from illegal mining (Sanborn & Yong Manrique, 2013). In Ghana the main environmental problem caused by small scale activity are mercury pollution from gold processing and mercury amalgamation method which is largely depended on since it is cheap, dependable and dependable (Hilson, 2001) regardless of all the policies and institutions. Also notwithstanding the great benefit earned from the mineral gold the extreme environmental degradation in most mining communities in Ghana is a major threat which certainly cannot be overlooked (Mensah et al., 2014). Galamsey operations is highly practiced in the rural part of Ghana since their activities is illegal gold is extraction begins mostly in the evenings. The results of their activities are enormous on the environment such as the loss of farmlands (Djurfeldt et al., 2005). Artisanal miners clear vast expanses of forest, digging trenches and upturning of vegetation which turns land bare and exposes to erosion (Hilson, 2001). It is estimated 15,000ha of land are potentially affected by farmlands (Iddirisu & Tsikata, 2015). Excavated lands and trenches are later unsuitable for any other purpose rather become a breeding area for malaria –infested mosquitoes and filled with stagnant water (Hilson, 2001) resulting in disproportionate damage to land. The impact is also seen on the cracks and collapsing of buildings due to the resort to blasting in order to reach targeted mineral deposit (Jaiye, 2013). Deforestation involves cutting down of trees and plantations permitting galamsey operators to extract the minerals. The high risky nature of the job has led to fatalities in the mine sites, due to uncovered pits, bad weather and also the ground caved on them. Generally galamsey operators are not educated and ill-informed about the procedural approach to mining activities with the country (Jaiye, 2001) making them deficient on the health threats that poses to them also the unskillful nature of their activities poses a concerns. Environmental related problems from galamsey administratively have gained little attention efforts were made to curb and disseminate mercury retort in the 1990s(Corral & Earle, 2009). To enable recycling spent mercury and reduce emission of the chemical but a refusal to subsidize the equipment lead to the project failure (Hilson, 2001). Mineral commission also introduced a

reclamation fund this was created in attempt to implement policies for reclaiming small scale mining sites which requested certain percentage of revenue from small scale mining to be held by government and used to finance reclamation programme however this initiative has been abandoned as a result of challenges associated with extracting funds from small- scale mining parties (Hilson, 2001).

2.20 Water pollution

Mining industry wastes contains high concentrations of metals and metalloids which results into groundwater and surface water pollution (UNESCO, 2012). Mining operation uses large quantities of water resulting in large amount of contamination. Polluted surface water bodies remains stagnant for years. Long term damage of water affects the economic benefits of a nation.

In Ghana the search of minerals are often extracted on the rivers and water bodies. Its estimated 75% of waterways are polluted. The Offin River in Ghana is an example of the rivers polluted leading to reduction of flow and access of water by residents. River Fena in Amasei central district is also polluted as a result of wide the operation of galamsey activities and also the Tano River in the Brong Ahafo region, the primary source of water for more than 60% of the population bears the brunt of illegal miners. In Prestea a mining area, loss of aquatic organisms, removal of vegetation's, depletion of soil resources and loss farmland are all as a result of illegal mining activities (Mensah et al., 2014). There's increased floods which destroys farmlands and plantation fields. The use of mercury to extract gold particles infects fish species mainly consumed by humans.

2.21 Social impact

Galamsey operation is associated with moral and social problems. The social orientation of every community is guided by certain norms and principles. Concentration of mining activities in mining communities has adverse impact on the society and its cultural values (Hilson, 2006). The practice of prostitution, drug abuse, inadequate housing and school drop is at a result of the upsurge of illegal mining in the area.

2.22 Drug abuse

The abuse of alcohol, addictive illicit use of marijuana and other hard drugs like cocaine and heroin are consumed with the beliefs to stimulate the miners to work hard. Incidence of armed robberies, falling educational standards in the affected communities and blatant disregard to laws, order and customs are exhibited at the highest levels.

2.23 High cost of living

Communities near mines experience outrageously high cost of living every aspect of their daily life expenses there is a high price tag beyond the reach of an average person including food, accommodation, health, water (Akabzaa & Darimani, 2001) . Several factors contribute to high cost of living in mining communities the salaries. Ghanaian staff in the mines are indexed to the US dollar, which raises their income far above their counterparts in the public sector. In addition, the expatriate staff of the mines is paid internationally competitive salaries, which further widens the income disparities in the town(Akabzaa & Darimani, 2001). This section of high earners living in the community have influenced Prostitution.

The concentration of large mines and small scale – scale mining has attracted both foreigner's and expatriates. This has influenced high sex trade in the community eroding the social values.

3 Methodology

This chapter describes the method applied in the research. This shows the criteria for selecting farming and mining community. The chapter further rationalises the methodical process used qualitative and quantitative for the research. Also describes the sampling method and the data method adapted for analysis. The data used for the study is primarily centered on both primary and secondary data.

3.1 Introduction and background of study area

3.1.1 Ghana

Ghana is a West Africa country former British colony and became the first black nation to gain in sub-Saharan Africa its independence 6th march 1957 by Dr. Kwame Nkrumah. The country is located on the boarder by Burkina Faso on the north, Togo on the east, south by Atlantic Ocean and west by cote d'Ivoire. The population of Ghana in 2012 of is 24,652,402 (51% females 49% males) given the entire population density of 78 per sq. km (201 per sq. mi). The densely populated areas are the coastal areas, the Ashanti region and two principal cities Accra, and Kumasi.

3.1.2 Economy

Ghana is well endowed with natural resources. The country formerly had firm economy, however failed development plans and series of military coups have contributed to the unstable economy. The Ghanaian economy is enhanced by competitive business environment. The country has a market – based type of economy with relatively few policies to trade and investment in comparison with other countries in the region. It is estimated agriculture accounts for approximately one – quarter of GDP and employs more than half of the work force, primarily small land holders. Gold and diamonds are the main mineral exports. There are large reserves of bauxite and manganese. The service sector report about half of GDP. Resources such as Gold and cocoa exports and individual remittances are the main source of foreign exchange. Ghana's burgeoning oil which was discovered offshore in 2007. In 2010 oil production began at the rate

of 55,000 barrels a day, in 2013 increased at 99,000 barrels. This has sustained the economic growth.

Table 8 This shows the standing of the Ghanaian economy

GDP (\$ US)	37.68 billion
GDP PPP	11.3.3 billion
GDP growth %	3.50%
Inflation rate%	16.90%
Unemployment rate %	5.20%

Source, World fact book (2013)

3.1.3 Ashanti and Amansei Central

The Ashanti region is one of Ghana's hubs in Gold mining industry and food basket. Kumasi the regional capital with its dwellers 1.625 million is the leading domestic gold market (Kumasi Metropolitan Assembly, 2006). The Ashanti region geographically lies between longitudes 0.15W and 2.25W, and latitude 5.50 N and 7.46 N, thus centrally located in the middle belt of the Ghana. The region is bordered by Brong-Ahafo in the north, Eastern region in the east, Central in the south and Western region in the south west (Ghana Government). Ashanti land size occupies 24,389.sq.km with population density 148.1 persons per square kilometer as in 2000 (Ghana Districts, 2016). Ashanti is divided in to 27 districts; the proportion of the economically active persons varies with districts the preeminent economic activity in the region is Agriculture (excluding Fishing) and Forestry while others are engaged in other branch of sector.

Amansei Central district and four selected villages within the district is the focused area of study. The district is located in southern part of the Ashanti region in Ghana Jacobu the administrative capital of the district

3.1.4 Location

The district lies latitude 6000N and 6030N and longitude 1000w and 2000W the total land area size is 710 square kilometer. The district shares its border with Amansei east to the north east, Amansei west to the west, Obuasi municipal to the south east, Adansi north to the east and upper Denkyira in the Central region to the south.

3.1.5 Climate and vegetation

The climate type of the region is semi-equatorial. This is defined by two rain seasons. The annual rainfall is between 1600mm – 18000mm, with the major rainfall period starting in March and ending in July while the minor season starts in September and ends in November (Amansei District, 2016). December to February is the start of the dry season with a mixture of hot and dusty weather with the relative humidity between 70 -80 percent. The annual rainfall is between 1,600mm-1800mm. The temperature ranges between 20₀C and 32₀C with a mean of 28₀C. The relative humidity ranges from 70 and 80 percent in the dry season. The vegetation in the area is semi-deciduous forest. The forest is fragile prone to activities of humans such as illegal mining, bush fires, poor farming practices. This has disturbed the vegetation of the region with some parts of the region becoming a savannah as a result.

3.1.6 Topography

The district is situated between 150 – 300 meters above sea level within a forest region. The district is endowed with forest reserves and spectacular lakes. Topographically the district is relatively flat with occasional 240 meters to 300 meters above sea level (Amansei District, 2016).

3.1.7 Economic activities

In the district the primary economic activities are farming, industry and service (Census, 2010). Farming is the main economic activity within the district with 80 percent of the population employed in small and large scale farming, (UNO, 2014). Comparably cropping is the essential agriculture activities to fishing and other sub sectors. The proportion of economically active persons engaged in other branch sectors such as production, sales and service are less. The industrial sector is more focused into wood based industries and the service sectors involve the sale of manufactured farm produce, hairdressing, communication, public and civil servant (Census, 2010). The economic engagement of the district may be The main crop cultivated is cocoa while food crop

cultivated is plantain, Cassava, Maize and coco yam. The district is endowed with natural resources and this creates varied economic opportunity for the indigenes. The blend of mining and farming activity within the district has long history, often time during the dry season between the months of November to April farmers engage in the activities of illegal mining while others harvest their cocoa.

3.1.8 Agriculture sector

Amansei central is split into four agricultural zones, each zone consist of 3-4 areas. In all the areas the total of 15 operational areas in the areas is formed. The operational areas are headed by agricultural Extension Agent (A.E.A) who works and relates directly with farmers. Crop farming is the primary enterprise then livestock (Census, 2010).

3.1.9 Industry

This sector employs 0.5% of labour force. Wood and agro-based industries form this sector. Agro-based industry is made up of food processing and alcohol distillery. Small-scale sawmill and carpentry make up the wood industry, majority of the industries employs labour intensive methods of production and run on small scale. Most people are hired as apprentices.

3.1.10 Service

The central activities in this sector are by commercial operations, the second largest industry after agriculture. Service rendered includes telecommunication, postal, tourism, banking services etc.

3.1.11 Relief and drainage

Amansei is located within the forest dissected plateau region with an average height between 150-300metres above sea level (Census, 2010). The relief of the district is generally undulating with few hilly areas. The relief and drainage support farmers in irrigating their food crops during the dry seasons. There are three main rivers in the district specifically Oda, Offin and Fena rivers. There are number of perennial and seasonal streams in the district. River Offin flows along the south eastern borders and also forms the boundary between the Ashanti and Central Region. Human activities such as dredging for gold and farming activities along the banks of these water bodies have results in the drying up of these rivers. The existence of several streams streams/water bodies in the district enhances irrigation and promotes continuous farming therefore providing favorable food security situation in the district (Census, 2010).

This section of the study presents on the background of Ghana and Amansei Central geography and economic activities in the study area. Amansei central district in the Ashanti region is among the newly created district assemblies in Ghana, the administrative capital is Jacobu consist of 206 settlements.

3.1.12 Social and culture

The area is dominated by the Akan's of the Ashanti origin, strong belief traditions and customs are upholder for instance beliefs in certain taboos "Dabone" (bad days) activities on these days are forbidden. In the district there is homogenous culture among the people.

3.1.13 Traditional set up

The communities are headed by local chiefs and assisted by their elders including various family heads. Major roles in decision making in the community is also played by the queen mother. All the chiefs owe allegiance to the paramount chief of Bekwai. The highest traditional authority in the district is the Bekwai Traditional council headed by "omanhene" paramount chief. The chiefs serve as custodian of the stool lands within the communities and also ensure peace and order. Development decisions are made by traditional authorities and unit committees.

3.2 Materials

In order to review the effects of mining of agriculture at the district and national level. Different source of materials from subject textbooks on mining and agriculture and published and unpublished journals, reports were among the relevant secondary sources applied in this study. Mining and agriculture websites were also used to support the secondary data.

3.3 Tools

Mainly MS Excel was used in cleaning , calulating and graphing results from primary and secondary data. Statistica tool was also used for other analysis such as box plotting and variability tests of main crops produced in Ghana.

3.4 Selection of the study areas

The study areas are located in the south western part of the district and also known as the lower middle belt in the Ashanti Region of Ghana. The total land size of Amansei district is 710sqkm the population of 100,000 (Ghana Districts, 2013). The district is endowed with rich and fertile soil. Crop and cash crops are cultivated in the area mainly cassava, plantain, orange, palm, cocoa etc. The primary production characterized in the area is agricultural and industrial. The outcome of this production is mostly for commercial purposes. The area is endowed with mineral resources with many livelihoods depending on mining both formal and informal operation. The abundance of large mineral deposits and water bodies has resulted in the boom of illegal mining activities. This has resulted in several environmental degradations and thus, having impacts on food produced.

Three rural communities were selected in the district namely Hia, Mile Nine and Mile Fourteen for the field work. Although there are many economic activities, the districts vary. The informed decision to select these communities was because the focus was to study towns with both illegal mining and farming activities ongoing simultaneously. And also field work was impossible to carry out research in all the sub towns in the district.

Age was also a criterion for selecting these communities, since Amansei district central emanated from Amansei west through a spilt in 2003, the recent surge in illegal mining activity has become a great concern. Generally, the years of galamsey commencement provided by the residents vary, the impact of these activities of increase. For instance the community Ewiase the influx of galamsey operators emerged in 2012, while in Hia and Mile Nine communities galamsey operations started in 2010.

Kind of galamsey operators was also a criterion for selecting this particular community, these communities are food hubs of the district and also since galamsey operation is a young business and after considering the intensity of damage in these communities, the study sought to investigate whether indeed these mining squatters were natives of these communities or foreigners partook also in this illegal engagement. This therefore grants the study the convenience to ascertain the effects of galamsey activities on crop production.

3.5 Method of data collection

Data collection techniques adapted allows the researcher to systematically collect information about the study for instance the people, object, phenomena and the settings in which they occur (Chaleunvong, 2013). There are varying methods used for conducting a qualitative research such as observation, focus group discussion, participant, structured interview, interviewing in-depth, observation etc a few of these methods was used in this study. Secondary data and specialized data method served as a supplement in the study.

3.6 Type of data

The study used both primary and secondary data. Observation and conversation semi structured methods were the main means of collecting the primary data for the study. Secondary data was sourced from World Bank and Food and agriculture website, Ghana statistical service. Reports of Amansei central district, published journals and articles.

3.6.1 Primary data

Questionnaires were administered in three (3) communities selected within the Amansei Central district all these communities are actively engaged in mining and farming namely Ewiase, Hia, and Mile Nine. In this study 150 questionnaires were designed with the aim to sample 25 respondent each from farming and galamsey groups for each community. The respondents were randomly sampled and interviewed.

3.6.2 Secondary data

Data was sourced from World Bank (<http://data.worldbank.org/>) the data identifies indicators to measure agriculture production in Ghana. The selected variables includes crop production index, arable land. The data span from 1961-2014. Data was also sourced from Food and Agriculture Organization (FAO) on annual crop production selected crops were Cassava, Plantain, Maize and Tomatoes data span from 1961 – 2014.

3.7 Sampling method

Randomly 150 selected residents of Amansei District of the Ashanti Region of Ghana were preferred. The sample constituted individuals of different gender, income, occupation, age, geographical location and educational level. The communities selected in the district were three; this is to ensure some level of variation in the sample. Means of data collection was through face to face interview.

3.8 Overview of workflow

The study relied on the questionnaire, to determine the initial farm size acquired by farmer and the current farm land size under cultivation. The stated closed ended options for the initial farm size was (1.5 acre, 6-10 acre, 11-15 acre and >16 acre) however the average was calculated for the ranges (8 acre, 13 acre, 18 acre) respectively. The given range for the question current farm size under cultivation was 1.3 acre, 4-6 acre, 7-10 acre and >11. Also an average was calculated for the range (5 acre, 8.5 are, and 13.5 acre) the average was calculated for the given ranges because it helped to measure the center of the numeric data set.

The data was then classified into initial and now groups, where acres provide by each respondent was entered into excel. The COUNTIF function was used for counting the cells within the specified range in order to meet the criterion.

The difference in the outcome total results served as a guide, to further group the numbers into increase, decrease and no change.

The change between initial farm size and current farm size was analyzed using t-test. In this test thirty-one farmers were sampled.

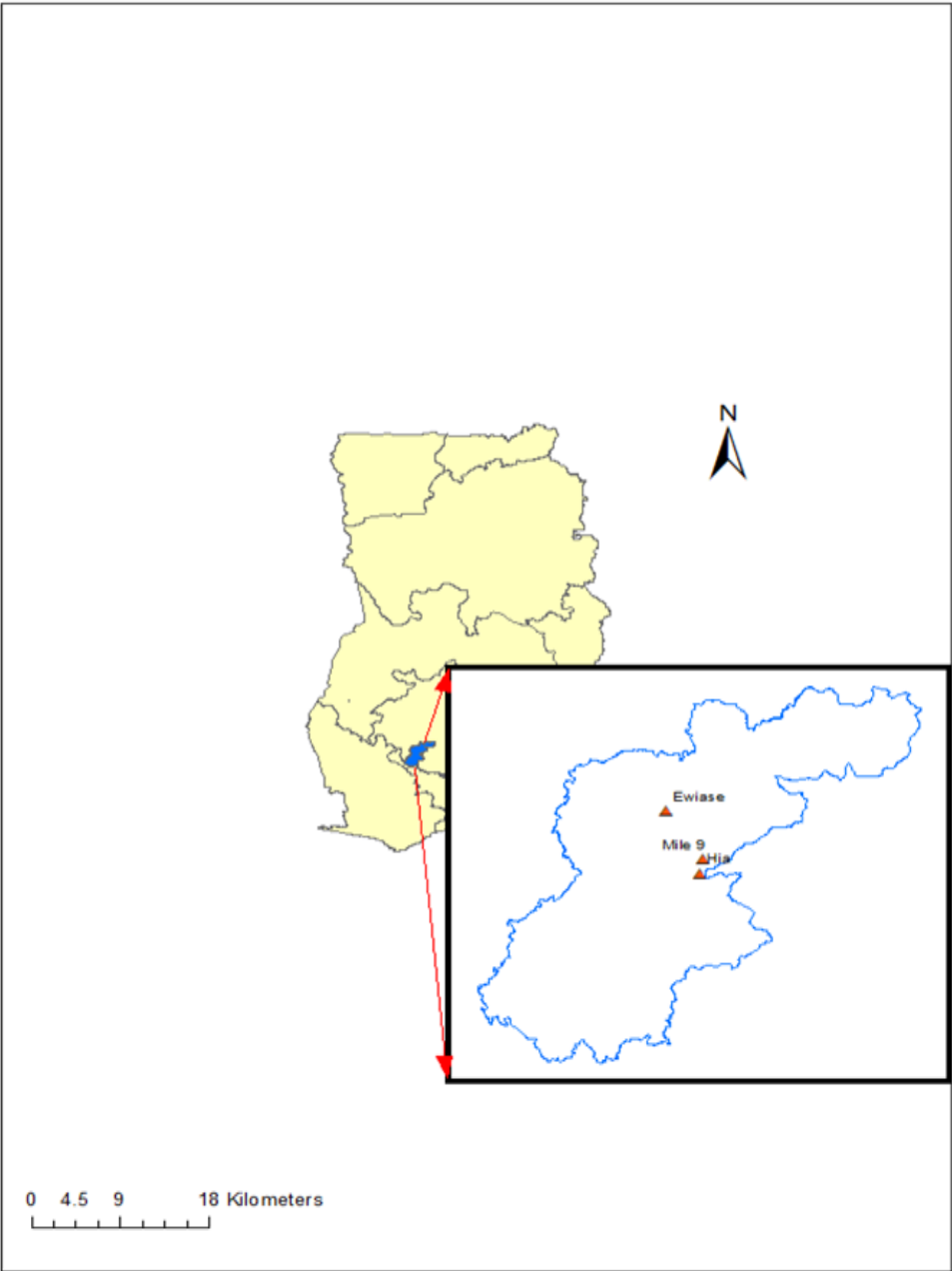


Figure 1 Location of the study sites

4 Results

4.1 Distribution of farmers and galamsey operators

The study interviewed both individuals actively engaged in farming and galamsey in Ewiase, Hia and Mile Nine.

Table 9 represents the number of respondents actively engaged in mining and farming..

Communities	Farmers	Galamsey
Ewiase	25	31
Hia	25	25
Mile Nine	19	25

In terms of gender analysis, 83% of galamsey operators were men while 17% were females. Regarding crop production, 45% of farmers were males whereas 55% were females (Fig 2). The contribution of men and women in food crop production was not significantly different ($P>0.05$) (Table 10).

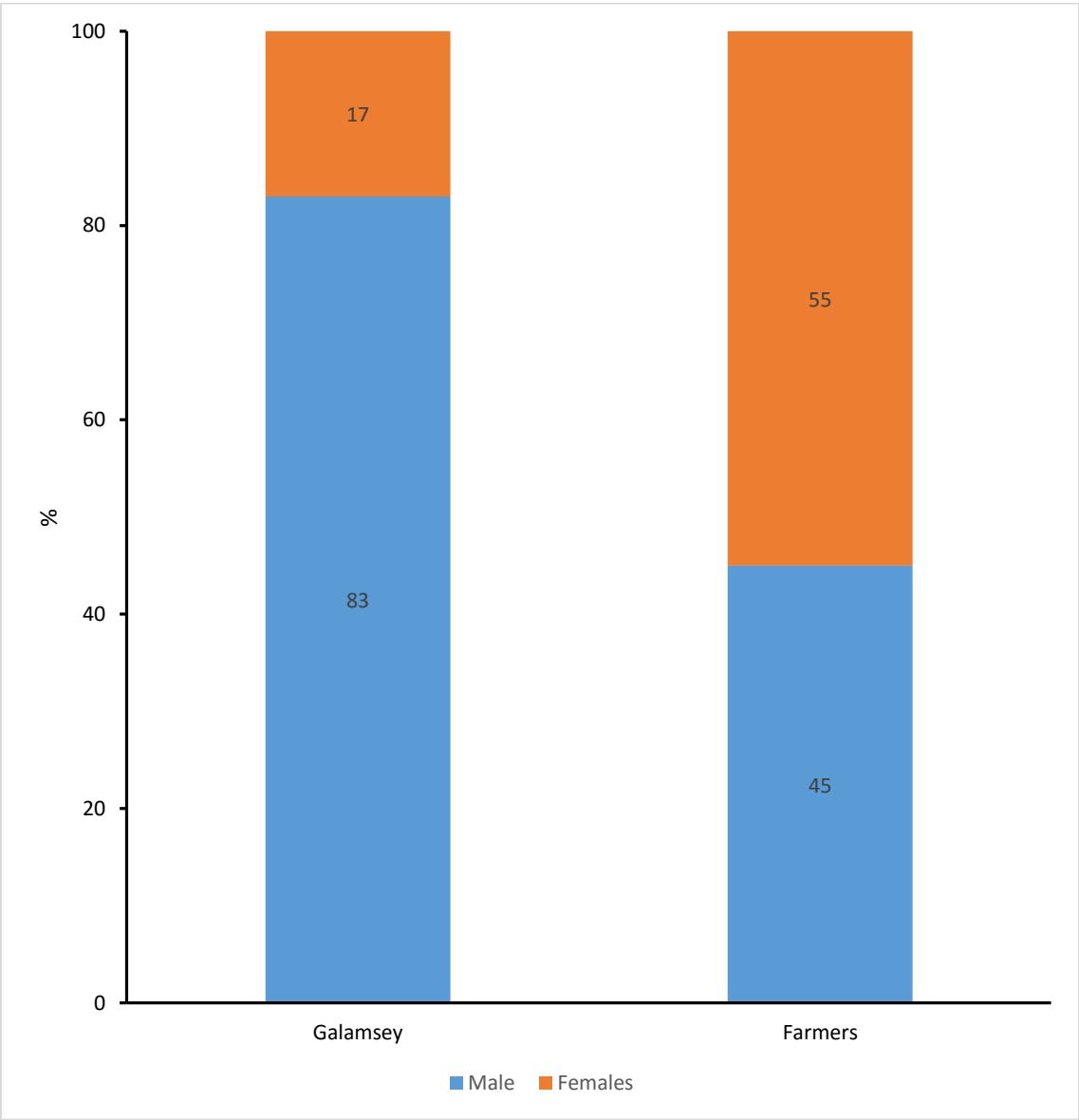


Figure 2 Gender of farmers and galamsey operators.

For galamsey activities 83% males whereas 17% are females. For farmers 45% activities are males whereas 55% are females.

Table 10 Analysis of variance for men and women involved in food crop farming.

The SS explains the sum of square, df is the degree of freedom, MS explains the mean square between group and within group whereas F crit provides the test statistic for the p-value. The p-value is used to determine the significance of the test statistic at a confidence level of 95%.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	12	2	6	0.61	0.60	9.55
Within Groups	29.5	3	9.83			
Total	41.5	5				

Both men and women are involved in galamsey operations. The contributions by these men and women involved in these galamsey operations are different. However, the difference in galamsey production by men and women is not significant ($p > 0.05$) (Table 11).

Table 11 Analysis of variance for men and women involved in galamsey activities.

The SS explains the sum of square, df is the degree of freedom, MS explains the mean square between group and within group whereas F crit provides the test statistic for the p-value. The p-value is used to determine the significance of the test statistic at a confidence level of 95%.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.33	2	0.17	0.00	1.0	9.55
Within Groups	467	3	156			
Total	467.33	5				

4.2 Effects of galamsey activities on farm size

Galamsey activities have affected farm size for crop production. The initial farm size either remained unchanged or changed over the years. The changed farm size was either an increase or decrease. Some of the farmers lost 23% of their farmlands to galamsey. However, 26% of farmers have been able to extend their farm size while 53% farm lands have remained unchanged in size (Figure 3).

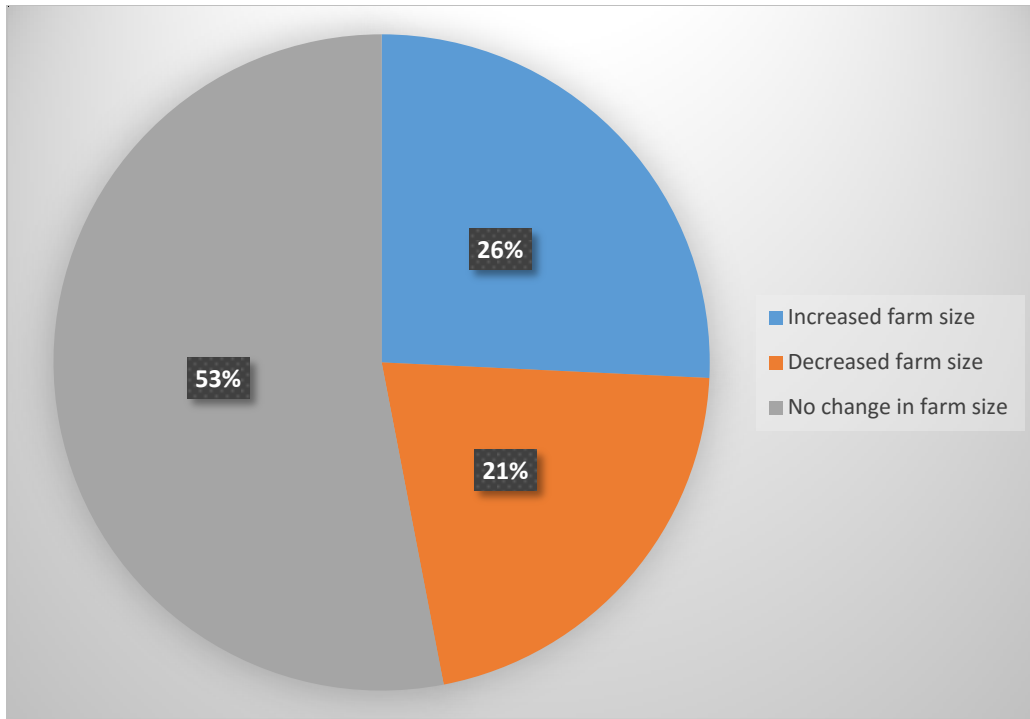


Figure 3 Pie chart analysis showing increase, decrease and no change in farm size of farming communities (Ewaise, Hia and Mile Nine).

The mean farm size at initial stage was 11.338 ± 0.866 and as of the time of this study the mean farm size was 7.906 ± 0.587 . The difference between initial farm size and the current farm size was thus statistically significant (Table 12).

Table 12 T-test analysis showing the differences between initial farm size and current size in Hia, Mile Nine and Ewaise.

Farm size(acres)	Sample size, N	Mean \pm SE	<i>p</i> -value
Initial	31	11.338 ± 0.866	0.0005
Now	31	7.906 ± 0.587	

4.3 Galamsey operations affecting availability of water for irrigation.

Galamsey activities have polluted water bodies meant for crop irrigation. In this study 84% of farmers indicated that in-land water sources they relied on for farming activities have been contaminated or polluted by illegal mining business. However, 16% of farmers have not had any problems with illegal miners polluting their sources of water for irrigation (Figure 4).

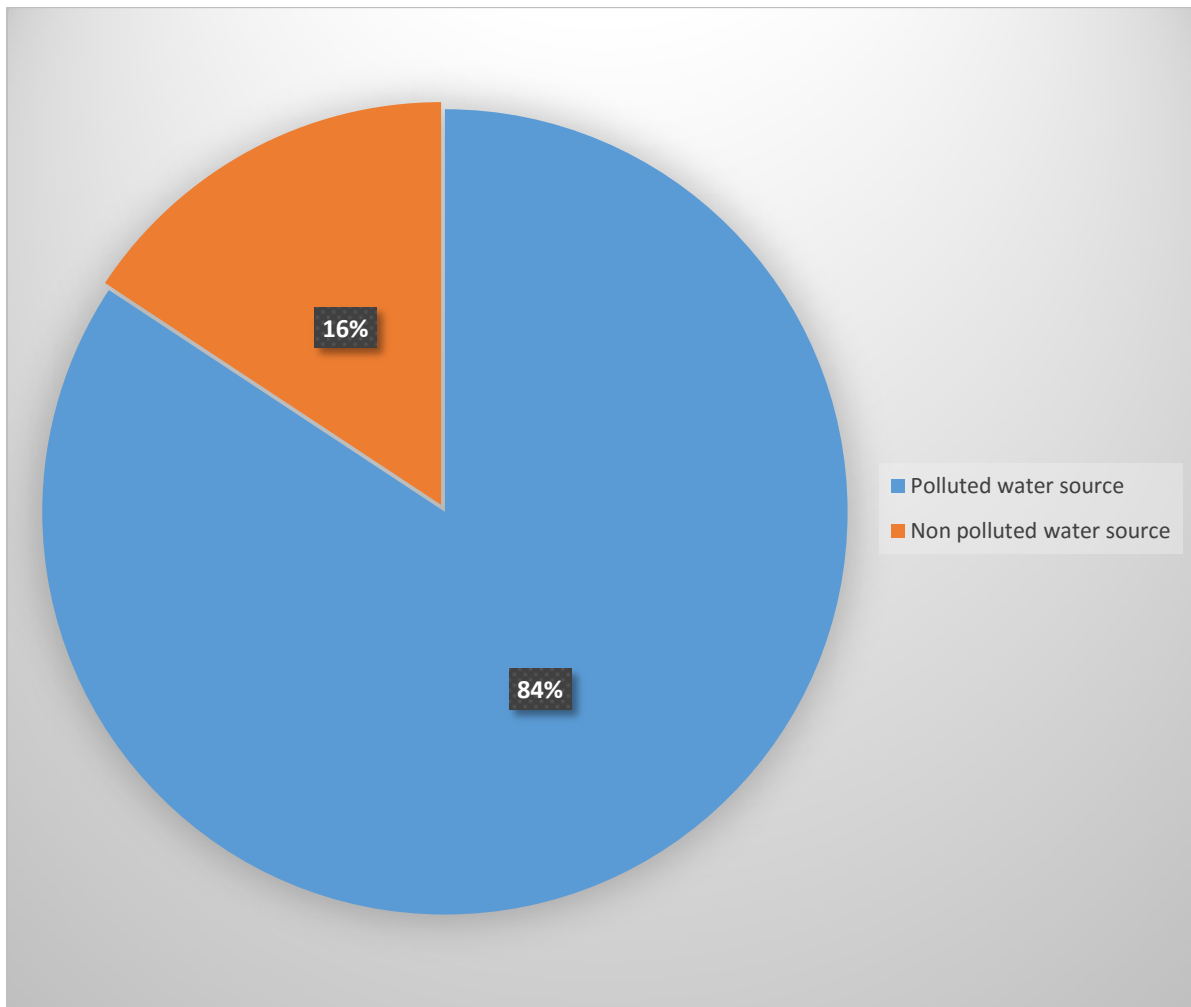


Figure 4 Pie chart showing response from farmers on the extent to which galamsey activities has affected the availability of water for irrigation purposes.

4.4 Natives and non-natives in galamsey activities

Galamsey activities are carried out by non-natives. In the study 68% of natives are largely engaged in galamsey operations and 32% non-natives are involved in galamsey operations (Fig. 5).

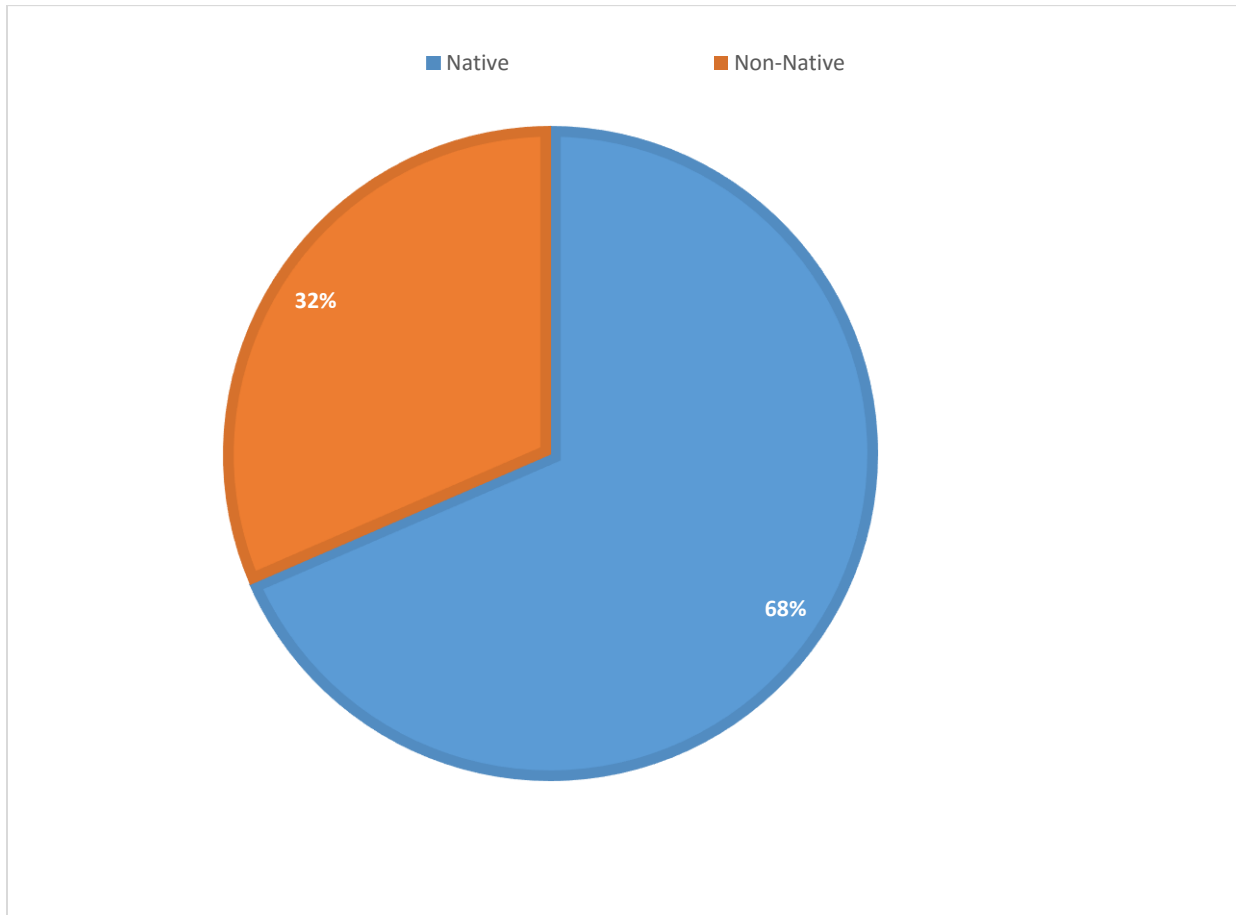


Figure 5 Representation of native and non-natives in galamsey.

4.5 Distribution of major food crops in Ghana

The production of maize and tomatoes over the years appears differently from cassava and plantain production. The year on year maize and tomato production did not vary much as the

range of production values was not wide; however, annual cassava and plantation production were highly varied (Fig. 6).

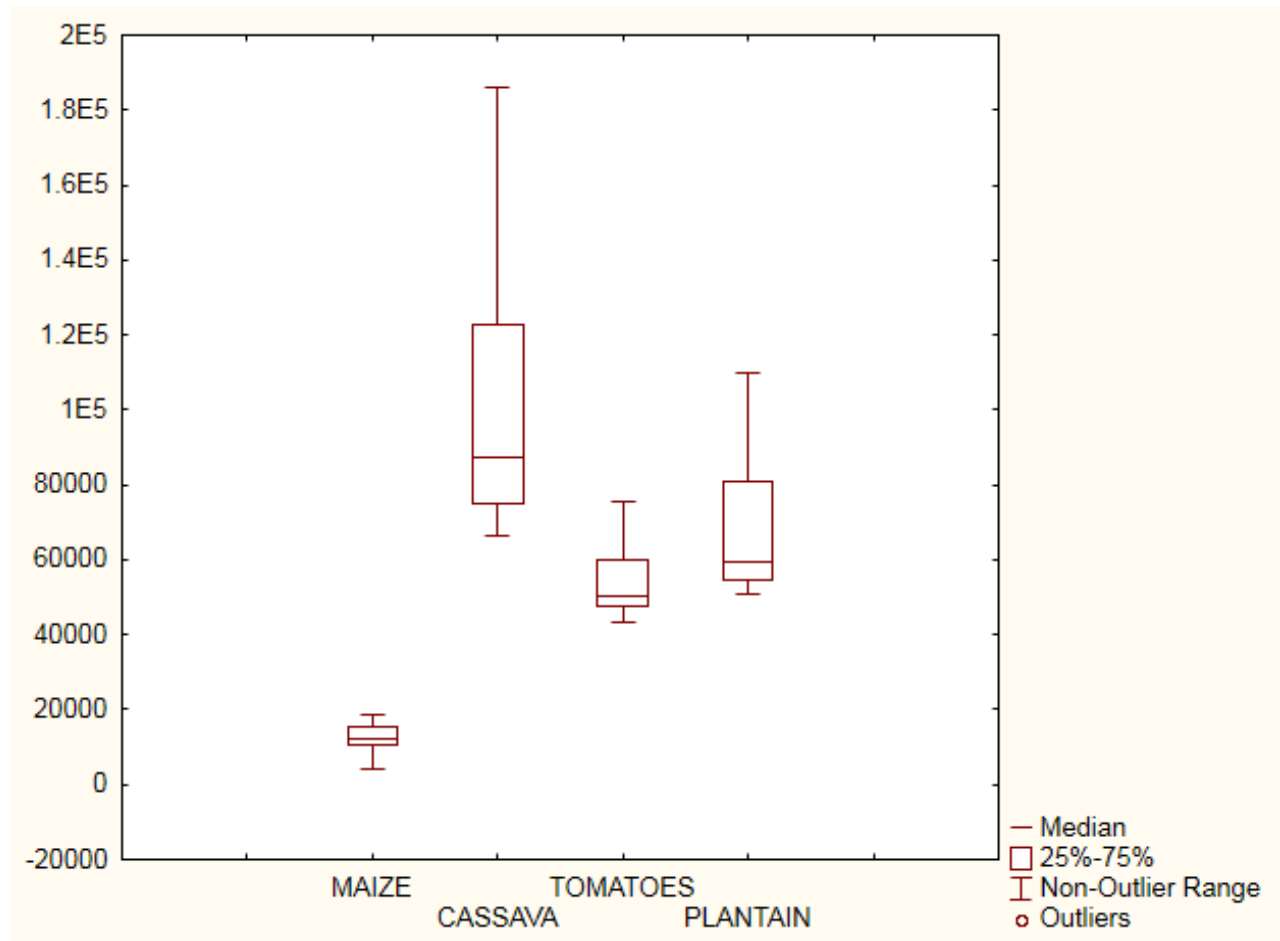


Figure 6 Box plot showing crop production for maize, cassava, tomatoes and plantain from 1961-2014.

In order to test the hypothesis that the mean level of crops produced had an effect on farming activities; analysis of variance statistic was performed. This analysis yielded a statistically significant effect in maize production ($p < 0.05$) (Table 13).

Table 13 Analysis of variance statistic for maize production over decadal intervals.

The SS explains the sum of square, df is the degree of freedom, MS explains the mean square between group and within group whereas F crit provides the test statistic for the p-value. The P-value is used to determine the significance of the test statistic at a confidence level of 95%.

Source of Variation	SS	df	MS	F	p-value	F crit
Between Groups	4.25E+10	5	8.5E+09	162.418	2.47E- 26	2.438
Within Groups	2.2E+09	42	52315735			
Total	4.47E+10	47				

Furthermore, the mean cassava production for every 10 years is significantly different (p-value <0.05) (Table 12). For tomato production the mean is significantly similar (p-value<1.2) (Table 13). For plantain production mean is significantly similar (p-value<6.0) (Table 15).

Table 14 Analysis of variance statistics for cassava production over decadal intervals.

The SS explains the sum of square, df is the degree of freedom, MS explains the mean square between group and within group whereas F crit provides the test statistic for the p-value. The P-value is used to determine the significance of the test statistic at a confidence level of 95%.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	4.25E+10	5	8.5E+09	162.418	2.47E-26	2.437693
Within Groups	2.2E+09	42	52315735			
Total	4.47E+10	47				

Table 15 Tomato analysis of variance statistics for cassava production over decadal intervals.

The SS explains the sum of square, df is the degree of freedom, MS explains the mean square between group and within group whereas F crit provides the test statistic for the p-value. The P-value is used to determine the significance of the test statistic at a confidence level of 95%.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	4.9E+09	5	9.8E+08	8.561	1.28E-05	2.443429
Within Groups	4.69E+09	41	1.14E+08			
Total	9.59E+09	46				

Table 16 Plantain analysis of variance statistics for cassava production over decadal intervals.

The SS explains the sum of square, df is the degree of freedom, MS explains the mean square between group and within group whereas F crit provides the test statistic for the p-value. The P-value is used to determine the significance of the test statistic at a confidence level of 95%.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1.52E+10	5	3.03E+09	78.9308	6.04E-20	2.443429
Within Groups	1.58E+09	41	38446105			
Total	1.67E+10	46				

For maize crop production the yearly production within a decade is not same. For instance the yearly productions in 1970's were similar; this means there was not much variation in annual production (Fig 7). In 1960's and 1980's shows much variation in annual maize production whereas the other decade yearly maize production has similar variation.

Furthermore for cassava crop production shows less similarity with a decade. For instance 1960's and 1970's looks similar. In 2014 explains much variation (Fig 8).

For tomato crop production, 1990's and 2000 explains much variance where as in 1960's and 2014 has less variation (Fig 9). Plantain crop production in 2000's explains much variation as compared to 1960's and 1990's explains fewer variations (Fig 10).

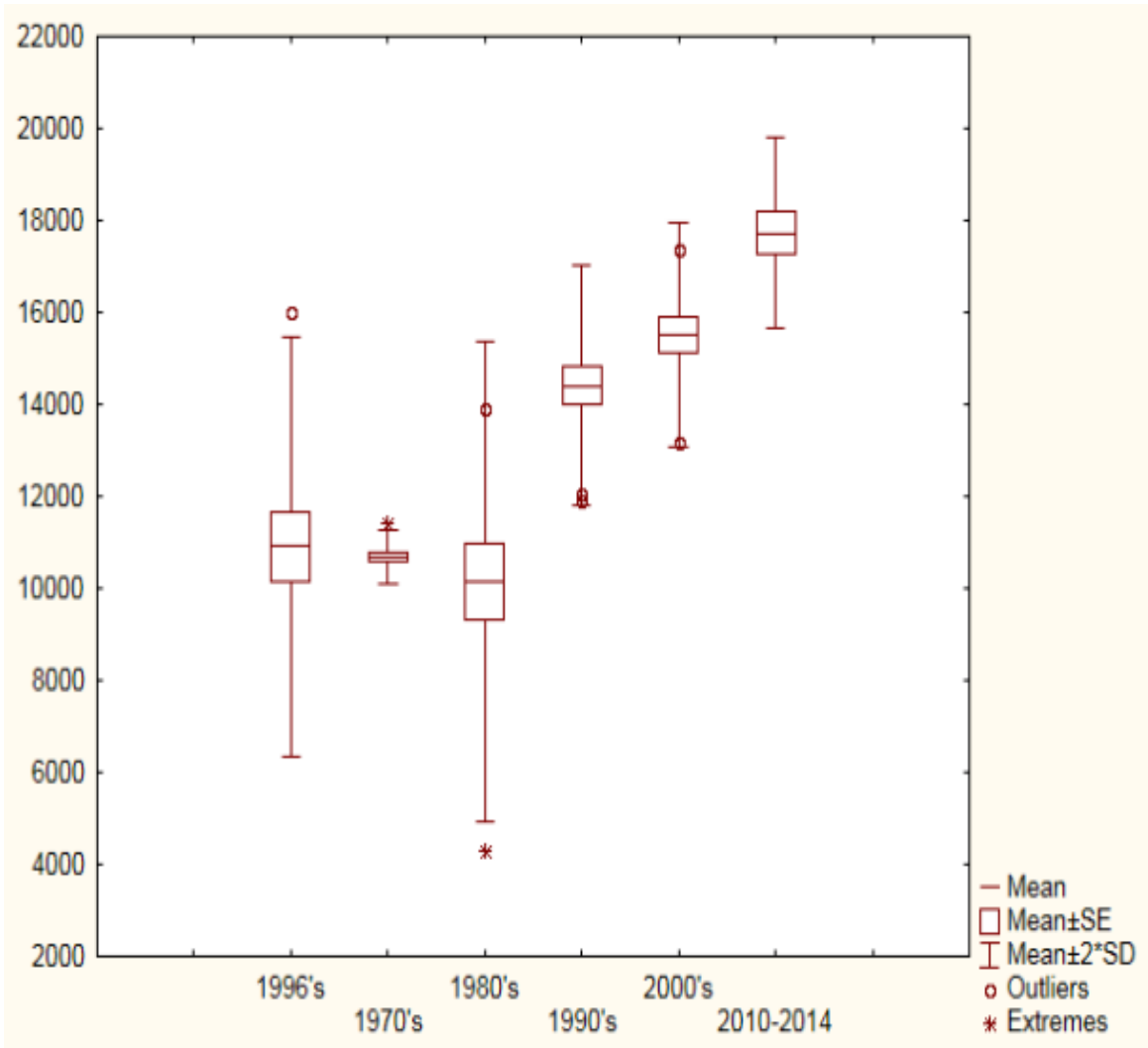


Figure 7 Box plot showing maize production from 1960-2014.

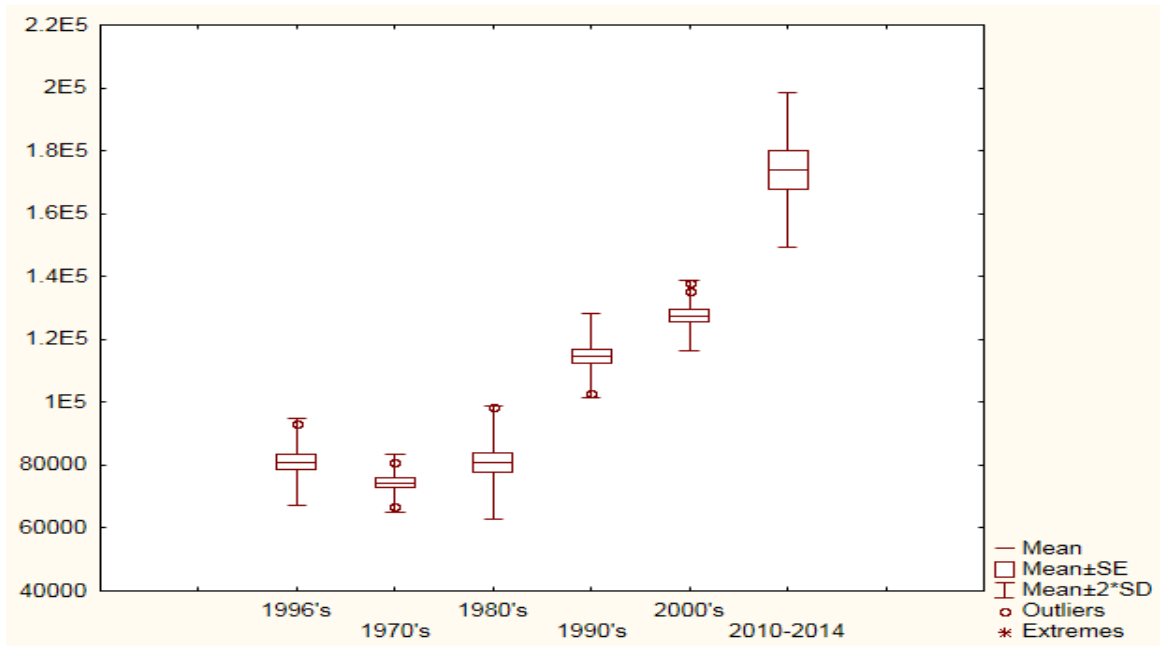


Figure 8 Box plot showing cassava production from 1961–2014.

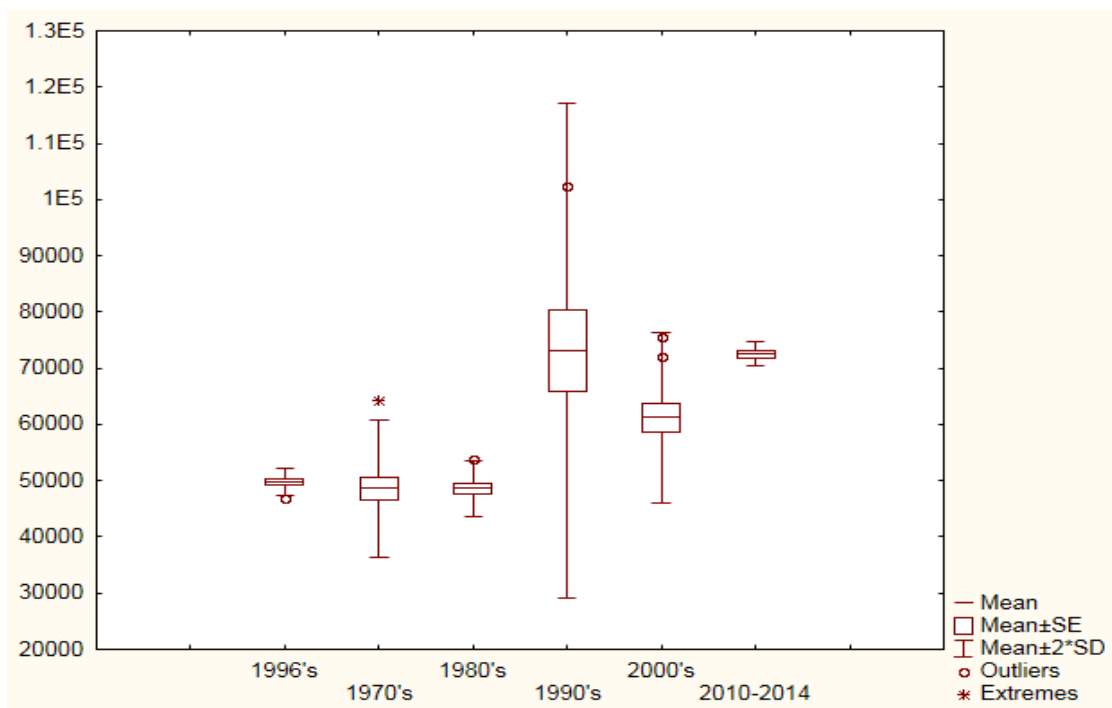


Figure 9 Box plox showing tomoato production from 1961–2014.

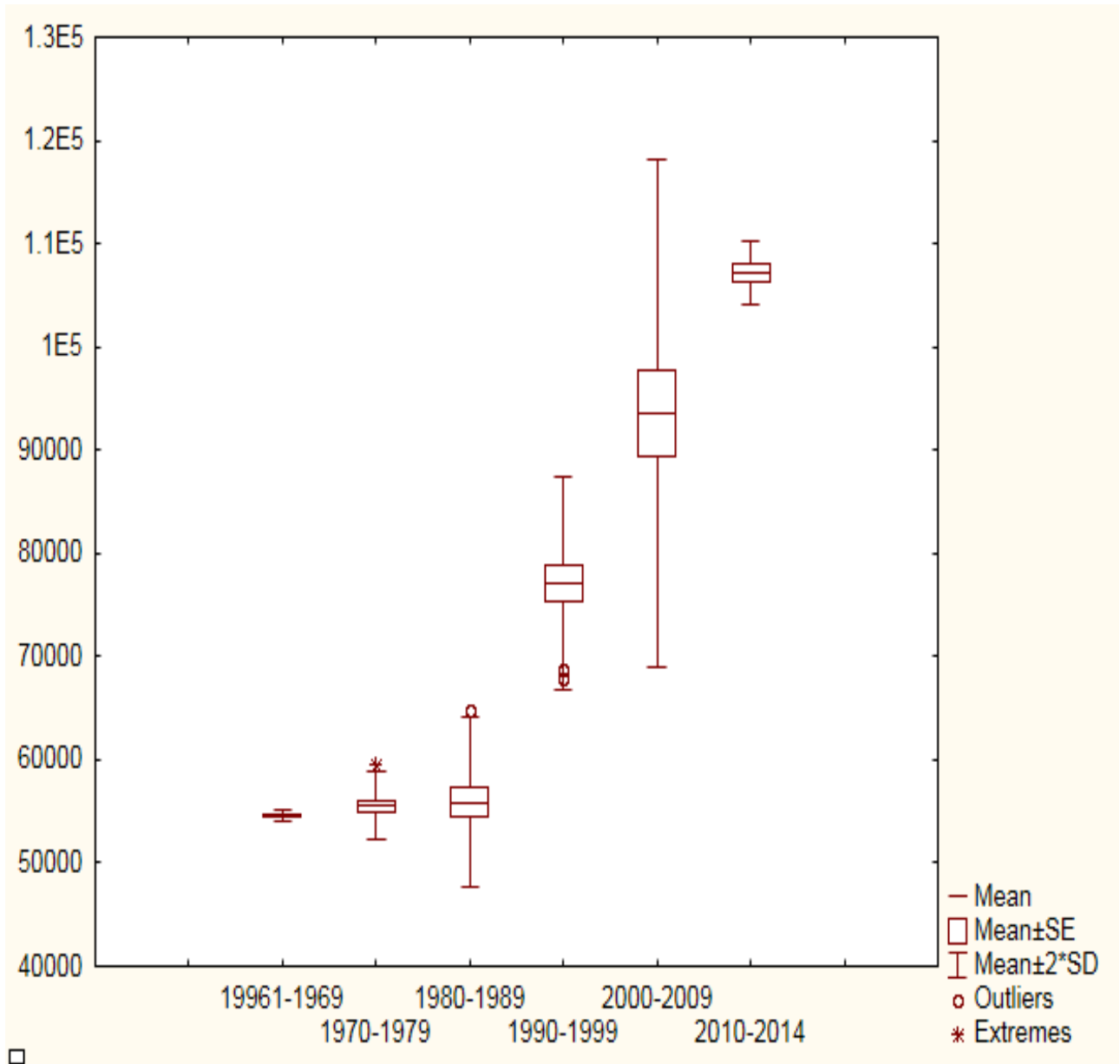


Figure 10 Box plot showing plantain production from 1961–2014.

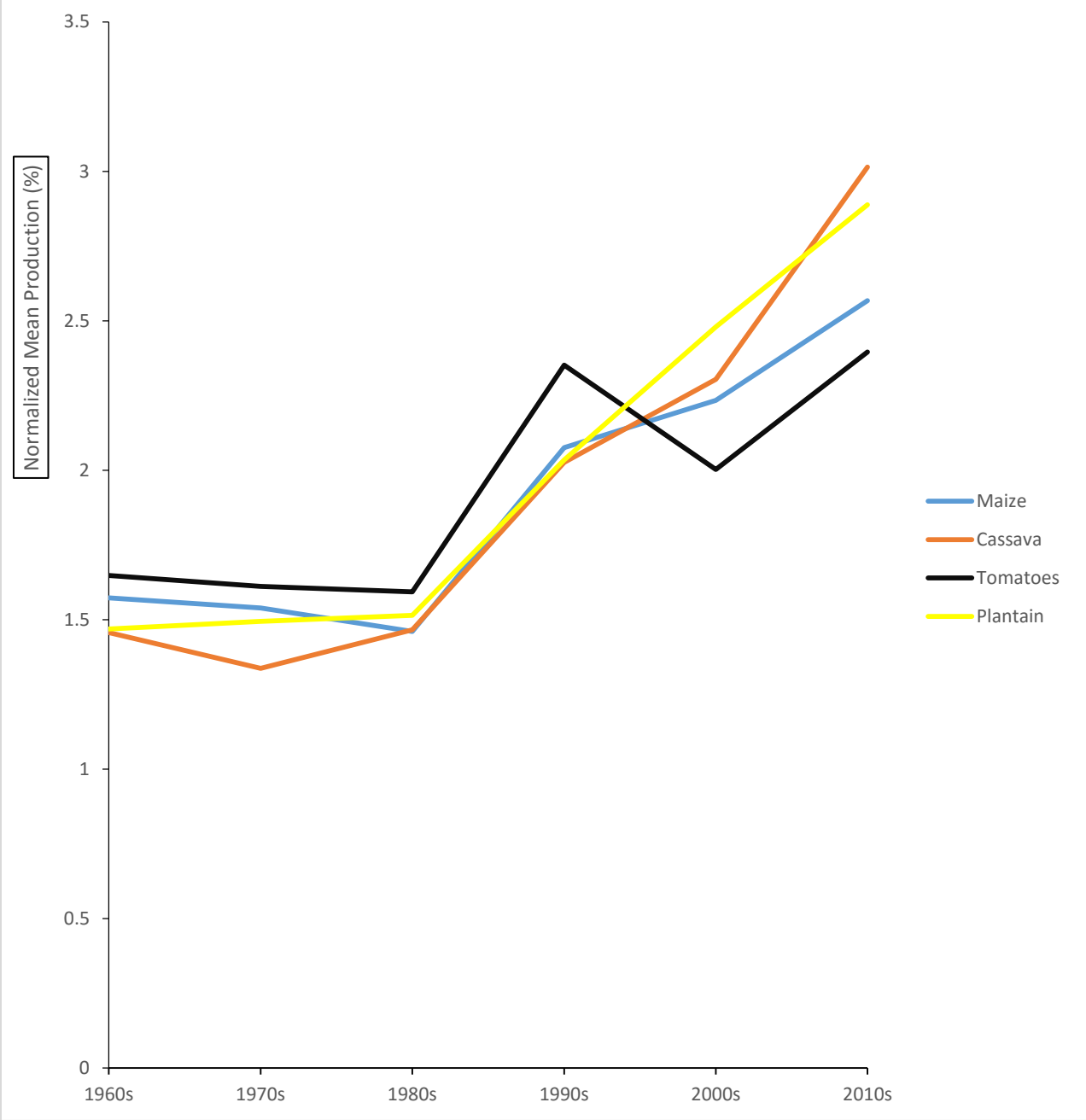


Figure 11 Normalized crop production indicating trends 1960-2010.

5 Discussion

5.1 Variation in farmers and galamsey operators

In Ghana, farming and galamsey activities commonly take place in rural parts of Ghana. The farmers and galamsey operators range from different age brackets; few of them are minors and school-going youths whereas the majority of them are adult men and women. Gender wise, galamsey activities in Ghana have been dominated by men (Aryee, 2012) and this is confirmed by the study (Fig.2). On the other hand, more women than men, in the rural communities of Ghana, are into food crop production (Fig.2). This is possibly because women in rural and traditional parts of Ghana are deliberately denied of formal education and thus, resigned to farming since it is seen as a job for the uneducated and the poor. Another possible reason why more women are found in farming could be because of the national population structure. Naturally, more females than males live in the rural communities of Ghana; and to compound this, many of the men in the rural communities frequently migrate to the cities.

Although past studies have shown the growing numbers of foreign nationals engaging in galamsey activities, Ghanaian nationals have however been preponderant in these illegal mining activities (Fig.5). Locally, it is frequently observed that non-residents invade communities with galamsey activities; but this study disagrees with this observation (Fig.5).

5.2 The effects of galamsey activities on farming

Galamsey activities compete with farm lands. Previous studies have shown that galamsey operators encroach on farm lands (Moomen & Dewan, 2015). However, in some cases, these galamsey operators connive with illegitimate people in the communities to acquire concessions for their activities. This takeover of farm lands by galamsey activities has reduced the size of farmlands in gold-rich rural communities (Table 11).

Secondly, galamsey activities have affected the quality and quantity of water for crop irrigation. Galamsey workers use poisonous chemicals which end up in inland water bodies. These

chemicals contaminate water sources and even get them polluted (Fig.4). When this happens farmers become reliant on rains; and may reduce food production in the event of poor rainfall.

Thirdly, galamsey activities in the communities have degraded the quality of the soil. Galamsey operations leave trenches and gullies behind; these practices destroy the top soil which supports crop cultivation. Further, the soils nutrients are leached or eroded as a result of galamsey activities. In some cases, because of galamsey, rainfall washes away farmlands; or galamsey-triggered landslides may destroy croplands.

Finally, the phenomenon of ‘quick’ money in galamsey has lured some farmers to convert to practicing galamsey activities. The number of farmers is shrinking since some farmers see the galamsey business more lucrative. Meanwhile, other farmers have taken the farming activities as a seasonal job. They cultivate their lands during the rainy seasons and thus, rely on galamsey at off-peak seasons. Some farmers have outrightly converted their farms to mines. Altogether, annual crop production in these communities has reduced.

5.3 Changes in food crops

The major food crops in Ghana appeared to be what are produced in the study communities. These staple crops are maize, cassava, plantain and tomato. The annual production of these major crops was not static but changes over time. Generally, the productions of these crops increase every ten years (Fig.11). The observed decadal changes in the production of these crops might be attributed to alterations in physical factors and policies.

In terms of physical factors, agriculture in Ghana is rain fed. The decadal rise in crop production could be attributed to increase in rainfall. This is even confirmed by the observation in 1983 (when Ghana recorded long drought periods), and thus, food production correspondingly declined (Fig. 11).

Policy-wise, the Government of Ghana is a signatory to a plethora of international food security treaties and as a result several national agricultural policies have ensured a massive support from the Ministry of Agriculture and NGOs to farmers. For instance, farmers are supported with subsidized quality seed, fertilizers and free extension services. The influence of policy

implementation on crop production is evident in tomato production in 2001. Tomato production declined whereas the other crops saw increase in production (Fig.11). This is because Government of Ghana relaxed on policy efforts on tomato production in the year preceding 2001.

6 Conclusions and Recommendations

6.1 Conclusions

Galamsey activities have long been practiced in rural parts of Ghana. The menace is illegal but people, especially unskilled and unemployed youths, still practised it on the blind sides of authorities. The activities of galamsey workers have been discreet and appear organised; and their activities have been threatening food crop production. This study therefore examined the effects these galamsey activities have on food crop production. To this end, three farming communities where these illegal galamsey activities rampantly happen were studied. These study sites are Hia, Ewiase and Mile Nine located in Amansei central district of the Ashanti Region in Ghana. Data obtained through questionnaires and secondary sources were used to analyse changes in farm sizes, sizes of farmers and pollution of water sources used for crop irrigation as a result of galamsey practices. Also, the production trends of maize, cassava, plantain and tomato which happen to be the staples in the study areas.

It is observed in this study that the number of men involve in galamsey is significantly different from their female counterpart. This observation confirms the popular opinion that galamsey operations are male dominated. Although more females are involved in crop farming activities in rural communities of Ghana, the study did not find any significant difference from its male counterpart.

The study also found that the sizes of farm land have shrunk as a result of galamsey operations. Galamsey operators have encroached on lands under cultivation whereas some farmers voluntarily convert their farm lands into galamsey use because of the notion that galamsey is more lucrative. Meanwhile, some of the farmers switched to galamsey practice during agricultural off-peak periods.

Galamsey activities have affected water quality in these farming communities. The study observed that many of the in-land water bodies have been contaminated or polluted by galamsey workers. Many farmers have thus been heavily reliant on rains for good harvests.

The crops cultivated in the study sites are important to the national food basket. To this end, the analysis of these crops (maize, cassava, plantain and tomato) at national scale indicated that the decadal production of these crops change significantly. Furthermore, it is observed that, aside favourable climate; implementation of national and/or international programmes alters food crop production in Ghana.

Altogether, galamsey activities have been rampant in Ghana and is dwindling the fortunes of food crop production in the hinterlands. Water for crop irrigation is becoming expensive while the quality of agricultural soils has been depleted.

6.2 Recommendations

It is true that there are concerted efforts from Government of Ghana, NGOs and civil society organisations to arrest the evils of galamsey operations. Because galamsey activities are illegal it is difficult to obtain secondary data for certain analyses. However, the study would suggest that the Mineral Commissions of Ghana should partner researcher community to quantify the impacts of this phenomenon on national economy.

Furthermore, the role of traditional authorities in fighting galamsey activities should be modernised. This is to suggest that traditional authorities should be trained and equipped with information technology to be able to play their role effectively. The galamsey workers have become sophisticated now and regulators should be equal to the task.

In sum, the objectives of this study could, in the future, be re-examined in spatial and temporal terms so as to map and quantify the costs of illegal mining on food crop cultivation. The availability of satellite images could be used to analyse land use changes and thus, be able to estimate the changes in the size of farm lands as a consequence of galamsey operations.

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APENDICES