UNIVERSITY OF ENERGY AND NATURAL RESSOURCE
SCHOOL OF AGRICULTURE AND TECHNOLOGY
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ASSESSING THE EFFECT OF ILLEGAL MINING AND FOOD SECURITY IN JUABOSO DISTRICT OF GHANA.

A DISSERTATION SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL AND RESOURCE ECONOMICS, SCHOOL OF AGRICULTURE AND TECHNOLOGY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BSC. AGRICULTURE
(EXTENSION OPTION)

BY

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DECLARATION

I, Armah Nelson, do hereby declare that this dissertation`` Assessing the effect of illegal mining and food security in Juaboso District of Ghana " is the result of my own original research findings, carried out and submitted to the University of Energy and Natural Resource and has not been presented to this university or elsewhere except where due acknowledgement has been made in the text

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Certified by

Dr Lesley Hope …….. ……..

(Supervisor) Signature Date

DEDICATION

First and foremost, I want to dedicate this work to Almighty God for his guidance and protection throughout this study, and to my parents, Mr and Mrs Armah and my siblings, Salomey Armah, Samuel and Martin who supported me through prayers and moral support for this entire program.

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ABSTRACT

The main objective of this study is to assess the socioeconomic factors that influence farmers' participation in illegal mining, food security and the effect of illegal mining on land and water in the Juaboso District. The sample frame for the study were farmers both present farmers and those who have switched to illegal mining. The study made use of the mix method approach which had to do with both qualitative and quantitative research design. Overall, 120 respondents were interviewed for the study. Primary data was collected by means of structured questionnaires. Binary logistic model was used to isolate the factors that influence farmers' participation in illegal mining. In addition, household food insecurity access score and dietary diversity was used to assess the respondents food security status. The study showed that illegal mining has severely degraded farmland and water resources while diverting labour from agriculture, leading to farm abandonment and rising conflicts. Further, Age, sex and household size were the main socioeconomic factors that drive farmers to switch from farming to mining:. Younger farmers, households with larger sizes and males were the main group of farmers that switched from farming to illegal mining. Analysis of the respondents food security status showed that farmers were more food insecure and miners (former farmers) enjoyed higher food security and dietary diversity through cash income from mining. It is thus recommended that government and local traditional rulers should enforce policies to protect our resources and create sustainable livelihood programs targeting youth and large households.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Ghana has a vast area of land which allows for the promotion of both food and cash crops such as rice, cocoa, oranges and oil palm plantations to feed the local agro based industries and beyond. It however has vast deposit of gold ore in it river basins (Ministry of food and Agriculture 2021). Gold dominates the mining sector and Ghana is Africa's second largest producer of gold after South Africa.

Legal mining refers to mining activities that are authorized, approved and licensed by the relevant government authorities in Ghana and is governed by a framework of law regulations aimed at ensuring responsible and sustainable resource extraction (The Minerals and Mining Act, 2006, Acts 703). The Mineral Commission play crucial role in overseeing to the enforcement of these regulation and the legal mining in Ghana is multifaceted, both positive and negative consequences.

Illegal mining, known as "galamsey" in Ghana, is a widespread and unregulated extraction of mineral resources, predominantly gold, conducted outside the boundaries of established legal frameworks (Hilson & Hilson, 2016). It employs ten times more people than large scale mining. According the Minerals Commissions' report on the performance of the mining industry in Ghana, small-scale mining contributes significantly to the economy that is GDP and it is a source of livelihood to many Ghanaians. In 2023, it contributed newly 35 percent of the total gold output and its output was 10 percent higher than the output of the Gold Fields Group, the largest mining company in the country (Hilson and Hilson, 2016)

Nonetheless, illegal mining is characterized by the use of rudimentary tools, often environmentally destructive techniques, including open-pit excavations, the diversion and pollution of watercourses, and the application of hazardous substances like mercury and cyanide (Akabzaa & Darimani, 2001). According to the Forestry Research Institute of Ghana (FORIG), small-scale mining has resulted in the degradation of about 15000 hectares of arable land across the country (FORIG report 2009). An astounding two million acres of forested land, including rainforest, are lost annually in Ghana to surface mining operations and this has adversely impacted rural communities by contributing to a decline in the productivity of agricultural lands (FORIG 2009). Coincidentally, substantial proportion of Ghana's poor live in rural areas where hundreds of thousands of people, largely unexposed to the wage economy, derive their livelihoods directly from small-scale agriculture and the natural resources provided by the country's forests (Armstrong, 2008). Agricultural farmlands taken for mining operations have resulted in the

shortage of food and cash crop production, fuelwood production and environmental degradation (Aragon and Rud, 2012; Ocansey, 2013). Peasant farmers whose lands are taken over for surface mining loose huge sums of money which in effect can be described as subsidies provided by poor farmers to rich multinational mining companies (Owusu-Koranteng, 2005).

According to Yeboah (2008), the environmental and health impact of mining activities can be linked to the methods of operation by the illegal small-scale mining and even duly registered and permitted mining companies, the health cost of mining operations sometimes outweighs the benefits gained.

The illegal mining sector is characterized by non-compliance to environmental regulations and, as a result, leads to environmental deterioration issues (Ofosu et al., 2020; Hilson & Maconachie, 2017), which can, in turn, hurt agricultural productivity. One key mechanism is land degradation that affects agro-based livelihoods (Mkodzongi & Spiegel, 2019; Munyoka, 2020; Macheka et al., 2021; Magidi & Hlungwani, 2023). Land degradation is associated with deforestation, making it susceptible to landscape destruction and soil erosion (Marther et al., 2020), making once-fertile fields unsuitable for agricultural cultivation. Open-pit mining leads to mixing heavy rock material with topsoil, which has very low water retention, low organic content, low nutrients, and highly toxic components, rendering the soil unfertile for farming (Kinimo et al., 2018)

Ghana has a population of 32.2million, with a per annum growth rate of 2.19 %, and a mean population density of 77 persons/km2 with 68 % and 32 % living in the rural and urban areas respectively. About 52 % of the labour force is engaged in agriculture, 29 % in services and 19 % in industry. Agriculture contributes to 54 % of Ghana's GDP, and accounts for over 40 % of export earnings, while at the same time providing over 90 % of the food needs of the country. Ghana's agriculture is predominantly smallholder, traditional and rain-fed (Ghana at a glance 2020).

About 136,000 km2 of land, covering Additionally, illegal mining has adversely affect agriculture through water pollution (Obiri et al., 2016; Mujere & Isidro, 2016). This can be seen in situations when volumes of water are used in processing gold (Suglo et al., 2021) as well as when mining waste is discharged into water bodies and seepage from tailings and waste rock impoundments (Emmanuel et al., 2018). It can pollute the water bodies with heavy metals such as mercury. Studies have shown that the metallic mercury (Hg) concentration of river water and wells near gold mining regions is high (Malik et al., 2010), and these waters might harm food crops when they flow into agricultural lands. For instance, Dube et al. (2024) and Tuffuor & Takora (2024) noticed a correlation between the surge in illegal mining-related activities and increasing water and mercury use. Furthermore, runoff and wastewater from gold mining have made most water bodies opaque brown due to mud and chemical components from illegal mining activities (Kusi-Ampofo & Boachie-Yiadom, 2012), rendering them unfit for home and agricultural use.

Juaboso District Assembly is one of the Districts in Ghana where small- scale mining operations substantially dominates. In most cases, the concessions of the mines cover lands on which the rural households use for farming activities for a living (Obara and Heledd, 2006). Consequently, the livelihoods of the rural communities are affected in one way or the other by the mining activities. Although, government's efforts in Ghana to legalize the sector have improved the efficiency of

operations, environmental and socio-economic problems as well as affecting major cocoa, rice lands and as a result land-use conflicts continue to exist and are becoming increasingly unmanageable in the Juaboso District area (Juaboso District Assembly 2018) which the researcher intended to investigate. It is therefore unclear whether the mining industry in Ghana has actually contributed positively towards the development of the nation as many previous study claim. Consequently, it is important to ascertain the sustainability of the mining industry of Ghana by weighing the socio-economic benefits with the negative impacts.

1.2 Problems Statement

One critical element which guarantees food availability, food accessibility and ultimately reduces poverty in any country is food production. Food production ensures food availability and accessibility in the sense that it is only through food production that food is available for people to have access and consume. However, while food production continues to improve in the developed world, it dwindles yearly in most developing countries (Ocansey, 2013). This volatile situation to a large extent has been blamed on a number of factors which include; unfavorable rainfall pattern, poor farming systems among others. In recent times, it has been revealed through research that land degradation, pollution of water bodies and other causes of environmental degradation and deterioration are the major causes of low food production especially in developing countries. The activities of illegal gold mining is believed to be a major cause of the above mentioned land and environmental degradation (Aragon and Rud, 2012; Ocansey, 2013).

The rivers and streams are potential resource base for fishing and small scale irrigation schemes. However considerable area of these water bodies have been used up or destroyed as results of galamsey activities. Again, the activity of small scale mining has ill driven the wish and desire of the youth in the area to fully engage in schooling or engage directly in crop production. This has resulted in the shortage of labour for agricultural activities as well as a steady decline in crop production in the area affecting lives and the environment at large.

One of the main occurrences of illegal mining is mining waterbodies and wetlands which include rivers, streams, waterlogged, swampy, mash areas (Ghana Chamber of Mines 2017). Most Ghanaian farmers largely depend on the swampy wetlands for crop production, which provide them with income and livelihood. For example, rice farming mostly takes place in swampy wetlands, and rice farmers are heavily dependent on this area, which accounts for approximately 78% of the domestic rice production: (Baffoe, J.D.; Mizunoya, T.; Yabar, 2021, 19). Wetlands play a vital role in the sustenance of living organisms through the provision of a diverse range of ecosystem services vital to their well-being. Wetlands are described as “areas of marsh/swamp, fen, peat land or water, whether natural or artificial, permanent or temporal, with water that is static or flowing, fresh, brackish or slat, including areas of marine water. (Baffoe, J.D.; Mizunoya, T.; Yabar, 2021,1).

Most Ghanaian farmers largely depend on the swampy wetlands for crop production, which provide them with income and livelihood. For example, rice farming mostly takes place in swampy

wetlands, and rice farmers are heavily dependent on this area, which accounts for approximately 78% of the domestic rice production: (Baffoe, J.D.; Mizunoya, T.; Yabar, 2021, 19). According to Ramsar Convention Secretariat, 2010 and the Millennium Ecosystem Assessment, 2016], their functions can be classified as provisioning, regulating, and controlling, and they play treatment, cultural, and supporting roles. Across the world, people use and appreciate the plants, animals, and minerals in the wetland ecosystem. Despite its importance as a life-support system, swampy wetlands have suffered from degradation and ecological damage in many countries [Ramsar Convention Secretariat 2010]. Ghana is no exception to this trend, and factors such as the disposal of solid and liquid waste (including chemical residues and sewage effluents), illegal mining have contributed to the degradation and damage of Ghanaian wetlands. Which most of the illegal mining operation happens at the waterlogged or marsh/swampy areas due it rich in mineral deposit, this is the land which rice farmers mostly use for their production (Baffoe et al., 2021)

Empirical evidence indicates that every one percent increase in per capita food production lead to a 1.61 percent increase in the incomes of the poorest 20 percent of the population and one percent increase in agricultural yields reduces the number of people living on less than US$1 a day by 0.83 percent (DFID, 2005). The operations of illegal small scale or artisanal miners (popularly known as galamsey) has been on the rise in the country and it is now almost impossible to distinguish the output of legal small scale miners from that of illegal operators. The rapid exploitation of mineral resources in Ghana is causing alarming scenarios for both the present and the future generations of the country. Efforts made by the government of Ghana to address these and other related challenges have led to the enactment of the Small Scale Gold Mining Law, PNDC law 218; in 1989 as revised in 2006 (Mahiye, 2013). Small-scale miners by ensuring acceptable mining practices with minimum damage to the environment (Amankwa and Anim-Sackye, 2003) as sited in (Mahiye, 2013), the environmental challenges of small-scale mining still continues unabated.

Many studies on illegal mining and effect on agriculture often focus on cocoa production, Adjei 2017, Aragon et al 2012 and Hilson et al 2013. This study however looks at how rice production is affected given its competing use of land for galamsey. Further cocoa is a cash crop which is often exported in its raw form, but rice is a foodcrop which is consumed within the country and has therefore implication on food security. small-scale gold mining practices are still a central source of income for millions in the developing world and as much as 13 million in Sub-Saharan Africa alone. However, the backside of such a significant amount of people being involved in small-scale gold mining is its major environmental damage and health effects, which contribute to what is allegedly called a poverty trap (Hilson & Pardie, 2006). The problems related to such extraction, both large-scale and small-scale, is now increasing due to population growth in the developing world as well as increased demand for precious metals, and potentially also by the vast influx of Chinese into the African continent trying to secure natural resources (Bach, 2014).. .

Against this background, the research question arising is what is the effect of illegal mining on the key resources and rice production in the Juaboso district of Ghana

Specific questions are

1. What is the effect of illegal mining on key resources (water, land and labour)

2. What socioeconomic factors drive farmers in Juaboso district to switch from crop production to illegal smallscale mining
3. What is the food security status of the farmers _ illegal miners in Juaboso district.

1.3 General Objectives.

This examine the effect of illegal mining on crop production and food security in Juaboso District, focusing on crop essential to local livelihood. It aims to inform policies that balance economic development, environmental protection and food security in the area.

1.4 Specific objectives.

1. To assess the effect of illegal mining on land, water and labour in Juaboso District
2. To investigate the socio-economic factors that drive farmers in the Juaboso District to switch from crop production to galamsey operation.
3. To assess the food security status of farmers in Juaboso District.

1.5 Justification.

This research address a critical gap in understanding the impact of illegal mining on agricultural productivity and food security in Juaboso District. Despite growing concern over illegal mining activities and its implication to agricultural activities which has necessitated many empirical studies, the studies have often focused cash crops such as cocoa but not on food crop production (ie rice production). Nonetheless rice cultivation has direct implication on food security status as it is a food crop. An investigation into the effect of illegal mining on rice production and subsequently food security is therefore necessary and fill the gap in literature.

Juaboso's agricultural challenges have national implication, particularly for Ghana's rice production industry which is vital to the economy. This research will give a comprehensive insights that can inform policy actions of the government of Ghana.

CHAPTER TWO

2.0 LITERATURE REVIEWS

2.1 Introduction

Reviewing the literature enables the researcher to plan the study methodology and serves as a basis for the topic to be researched (Burns & Grove, 2009). The sources of literature include books, published journals, and textbooks.

2.2 Concept of Illegal Mining

Artisanal and small-scale mining, also known as “galamsey,” has been part of the country’s mining history (Reisenberger, 2010). Before the arrival of the Europeans, local people were heavily involved in the mining of gold ore (Bawa, 2010). The traditional methods applied by artisanal and small-scale miners require nominal or no technology. The sector involves individuals, families, and small groups (Hentschel, Hruschka & Priester, 2002 cited in Ingram, et al., 2011). The Department of Minerals (2014) asserts that illegal mining refers to exploring or extracting without the necessary approval or documents, such as land rights, exploration, and mineral transport permits (Dozolme, 2016). The unregulated artisanal mining engaged in by people known as "zama-zama" is defined as illegal mining in South Africa (South Africa Human Rights Commission, 2013). Illegal mining is defined by the disregard for mining, environmental, labor, and tax laws, and undertaking mining in prohibited areas (Global Initiative Against Transnational Organized Crime, 2016). Illegal mining operations are often due to non-mining shaft closures and abandoned mines, which provide access for these operations (Benchmarks Foundation, 2016). The large numbers engaging in this illicit industry are a result of the economic crisis confronting them (Chamber of Mines, 2016). The causative contributions for illegal mining activities are solely based on economic issues (Boning, 2015). The illegal mining sector, like small-scale mining, uses lesser technology and is labor-intensive. The use of a hammer, shovel, pickaxe, pans, and chisel are some simple equipment used (Reisenberger, 2010). The laws of Ghana state that illegal mining activities are not just on documented concessions, but also involve illegal miners undertaking activities in areas with mineral deposits and prospecting for gold. According to Tieguhong et al. (2009), the artisanal and small-scale sector assists the economy by: increasing income earnings; providing a source of livelihoods for the poor and marginalized; having a lesser startup time, resources, and technology; employing semi-skilled and unskilled labor; and having low levels of mechanization, production, productivity, retrieval, and adeptness.

2.3 The concept of food security and Mining

1.2 million people have limited access to sufficient and nutritious food for an active and healthy life (Biederlack & Rivers CFSVA Report, 2009).

Food security would be looked at in two key dimensions; food availability and food access. Food availability concerns the food that is physically present through all forms of domestic production and commercial imports (Reisenberger, 2010). Food accessibility also concerns a household’s

ability to regularly acquire adequate amounts of food, through a combination of its own home production and stocks, purchases, barter, gifts, borrowing or food aid (Reisenberger, 2010).

2.3.1 Food security relationship with mining

illegal mining activities, particularly through the lens of the resource curse theory. Di John (2010) asserts that the availability of minerals and fuel in less developed countries can lead to negative development outcomes such as economic regression, high levels of corruption, and ineffective governance. The resource curse theory suggests that the natural resources found in some developing countries are seen as a curse rather than a blessing (Siegel, 2008). The theory to the situation where mineral wealth is illegally mined due to high unemployment and poverty, with corrupt officials being easily bribed, which hinders development (Barbier, 2007).

while small-scale mining can contribute to national income and alleviate poverty, its unregulated nature poses a significant threat to sustainable development and, by extension, food security. This is a central theme in the text, which identifies several specific ways illegal mining undermines the ability of communities to feed themselves (Hilson and Potter 2013)

2.3.2 Destruction of Farmlands

Small-scale surface mining activities are a heavy threat to land, destroying about 13% of Ghana's total forested land (Tetteh, 2010). According to Schueler et al. (2011), due to surface mining, large farmlands have been lost through mining concessions, with deforestation taking 58% and 45% loss within the concession zones. These exploration lands are not reclaimed and are left barren, losing their nutrient value for agricultural purposes (Anane, 2003). The topsoil and vegetation are cleared off, and the land can no longer support plant life for production in these areas. This contributes to low crop production (Akabzaa et al., 2005).

2.3.4 Contamination of Food Sources:

The use of chemicals like sulphuric acid (H_2SO_4) or cyanide (CH^-) pollutes water bodies during the processing of ore, threatening human, aquatic, and wildlife (Adetunde et al., 2014; Obiri et al., 2010). Mine tailings, which are toxic, are directed into water bodies, introducing suspended elements that contaminate aquatic habitats (Serfa-Armah et al., 2006; Hayford et al., 2009). The continuous use of mercury in small-scale mining poses a serious health risk to water quality (Osisiadan et al., 2013). This waste is often dumped into water bodies, causing bioaccumulation in aquatic animals and affecting the human food chain (Donkor et al., 2006). A research study by the Council for Scientific and Industrial Research in Ghana shows that most communities in the Western Region are extremely prone to health-related problems due to small-scale mining operations (Yeboah, 2013). The text notes that crops, fish, and vegetables from mining areas have been found to have certain levels of mercury contamination.

2.3 Causes of Illegal Mining

The economic decline in the 1970s gave rise to "galamsey" as people sought additional income alternatives (Owusu and Dwomoh, 2012). Unemployment and attractive income from sales pushed people to engage in illegal mining. The age group of 15-35 makes up a large portion of the unemployed (African Economic Outlook, 2012). The ILO (1999) estimates that 13 million people are involved in this sector globally (Hilson et al., 2010), with an additional 100 million people relying on it for their survival (Danielsen, Balete, Poulsen & Nozawa, 2000; CASM, 2009). Illegal mining is a key employment avenue in many African countries, employing about 170,000 people in Ghana (Adjei, Oladejo & Adetunde, 2012).

Poverty is a factor that drives people to engage in illegal mining (Nyambe & Amunkete, 2009). Rainfall patterns are also a contributing factor, as rural farmers shift from farming to illegal mining during the dry season to earn additional income (Kuma & Yendaw, 2010). Public officials, chiefs, and well-resourced industrialists have been shown to support the illegal mining sector (Government of Ghana, 2003; Nyame & Grant, 2014; Myjoyfmonline.com, 2012b). The small-scale mining law (P.N.D.C. L 218) was enacted to give locals a stake in the sector (Amankwah & Anim-Sackey, 2000).

However, the bureaucratic constraints in acquiring licenses explain the high illicit mining activities (Hilson & Potter, 2013). The lack of alternative employment opportunities encourages people to engage in illegal mining (Teschner, 2011, Bush, 2008). Leased-out fertile farmlands are used for illegal mining and not reclaimed (Nyame & Blocher, 2009). Poverty is the underlying factor (Hilson & Garforth, 2012; Hilson & Potter, 2005; Banchirigah, 2008), and the sector is seen as a sustainable livelihood alternative (Hilson & Garforth, 2012). The structural adjustment program and its retrenchment aspects are also major factors (Hilson & Potter, 2005; Nyame & Blocher, 2009). The unemployed from both urban and rural areas see illegal mining as a livelihood alternative due to the lack of formal employment (Hilson & Garforth, 2012; Nyame & Blocher, 2009).

2.4 Illegal Mining Effects

Mining has adverse implications for communities (Opoku-Ware, 2010). Illegal miners use crude methods, including mining in water bodies and using mercury directly in them. Some basic adverse environmental impacts are environmental erosion, the formation of sinkholes, loss of biodiversity, and contamination of soil, groundwater, and surface water.

2.5 Small-Scale Mining Sector Regulations

The indigenous mining sector remained largely unregulated until 1989 with the PNDCL 218 legislation. This law permits Ghanaians to apply for a license for a plot of land not exceeding 25 acres (Hilson, 2001; Yakovlena, 2007). The government also benefits from revenue, production, and preventing smuggling. Legalized and non-legalized (galamsey) miners have emerged from this initiative, with the latter operating without a license on firms' concessions (Amankwa & Anim-Sackey, 2003). The shortage of licenses fueled the expansion of illegal operations and

unemployment-related poverty (Hilson & Potter, 2003). Goba (2015) asserts that in 2005, over 250,000 small-scale miners were without a license.

Since 1989, the sector has generated huge revenues (Hilson and Potter, 2003). The massive growth in ore production is attributed to unemployment and poverty (Hilson and Potter, 2003). The artisanal mining sector is a livelihood for millions of people (Hilson 2010). The closure of Ghana Consolidated Diamonds has significantly increased unemployment (Hilson, 2010). People engage in artisanal gold mining mainly due to poverty but continue because they have the skills and experience, and it provides stable employment (Banchiriga, 2006). The Minerals and Mining Act 703 (2006) governs the granting of mineral rights, and firms must also obtain a "social license" to operate smoothly (Auty, 2001; Karl, 2004; Humphreys et al., 2007).

2.6 Impact of Illegal Small-Scale Mining on Sustainable Development

The pillars of sustainability are the environment, society, and economy (Ayre and Callway, 2005). The artisanal small-scale sector threatens each of these. Mercury emission reduction will help the environment become sustainable (Versol, 2007). The sector is often described as dirty, dangerous, and disruptive (ILO, 1999) and is largely characterized by poor health, safety deficits, and environmental issues (Hentschel et al., 2002). However, there is strong evidence that artisanal and small-scale mining can contribute to national income and poverty alleviation (Hentschel et al., 2002). The sector generates negative spillovers, with communities suffering from land loss and water pollution.

2.7 Mining Methods

Small-scale miners rely on traditional or manual methods due to financial difficulties, using tools like a pickaxe, shovel, pans, chisels, and hammers. The methods are categorized into:

2.7.1 Hard rock alluvial mining: This method is for gold-bearing reefs and is done using a chisel and hammer (Ntibrey, 2001).

2.7.2 Shallow alluvial mining: Popularly known as "Dig and Wish," this method is used in low-lying areas. Illegal mining is predominantly shallow alluvial mining (Ntibrey, 2001).

Deep alluvial mining: This technique is used for deposits along riverbanks, with pit and digging techniques applied to prevent collapse. This include machines like chanfan, excavators

2.8 Mining and Environmental Effects

Illegal small-scale mining can have a serious impact on ecosystems and society, poisoning the environment and wildlife with heavy metals and chemicals (Fashola et al., 2016). It causes erosion and siltification of rivers (Dissanayake and Rupasinghe, 2017). Mining comes with several environmental effects, including loss of biodiversity, contamination of soil, surface water, and air pollution. The health of the surrounding population can be affected by contamination from chemical leakage (Ostergren and Le Boss, 2011). The exploitation of natural resources is not a new phenomenon, and poor environmental decisions have dire consequences for future

generations (Martinez-Alier, 2002). Illegal mining is conducted without necessary safety precautions and is dangerous (Harding, 2013).

2.8.1 Land Degradation

Land degradation and destruction are heavily threatened by small-scale surface mining, destroying about 13% of forested land in Ghana (Tetteh, 2010). Large farmlands have been lost through mining concessions (Schueler et al., 2011). Land destruction in the form of excavations is common (Aryee, 2003; Yelpaala, 2004), and in some places, riverbanks are mined to a depth of 35m (Hilson, 2002). The unique habitats of fauna and flora are destroyed, and lands become less productive (Asiedu, 2013). Unstable piles of waste, barren lands, and abandoned pits are a result of these activities, making farmlands unhealthy, unsafe, and unproductive (Aryee, 2003; Yelpaala, 2004).

2.8.2 Mercury Pollution

The mining industry faces serious environmental problems from mercury, a toxic element (Donkor et al., 2006). Natural and anthropogenic sources can cause mercury contamination (Oduro et al., 2012). The continuous use of mercury in small-scale mining poses a serious health risk to water quality (Osisiadan et al., 2013). When digested, inhaled, or absorbed, mercury becomes toxic to the environment and humans (Hilson, 2001). Waste products containing mercury are dumped into water bodies, causing bioaccumulation in aquatic animals and affecting the human food chain (Donkor et al., 2006). Exposure to mercury can lead to respiratory, kidney, and central nerve problems, among others, and can be fatal.

2.8.3 Pollution of Water Bodies

Gold mining communities face prevalent contamination of surface and groundwater (Adetunde et al., 2014). Chemicals like sulphuric acid or cyanide pollute water bodies during ore processing (Obiri et al., 2010). Mine tailing is directed into water bodies, introducing suspended elements that contaminate aquatic habitats (Serfa-Armah et al., 2006). Mine tailing is toxic and poses serious health threats (Hayford et al., 2009). A research paper by the Council for Scientific and Industrial Research in Ghana shows that communities in the Western Region are extremely prone to health problems due to the pollution of water bodies (Yeboah, 2013).

2.8.4 Air

Air quality is affected by all mining methods. When unrefined materials are released, toxic materials such as cadmium, lead, and arsenic can be exposed. The removal of topsoil and vegetation exposes the bare soil to harsh weather, and particles can be ingested or get on the skin, adversely affecting human health with illnesses related to the respiratory system (Hilson 2012)

2.8.5 Biodiversity

Mining activities lead to the destruction and modification of the landscape, which has an enormous impact on biodiversity, causing habitat loss for microorganisms, vegetation, and animals. Temperature or pH modifications can disrupt the livelihoods of communities near the site. Endemic species are most affected, as they are sensitive to habitat disruption and can face extinction (Donkor et al., 2006).

2.8.6 Effects of Mining on Livelihoods

Huge farmlands are cleared for small-scale mining, and compensation is often not paid, resulting in low crop production (Akabzaa et al., 2005). These exploration lands are not reclaimed and lose their nutrient value (Anane, 2003). There is a high incidence of soil erosion, and crops, fish, and vegetables from mining areas have certain levels of mercury contamination.

2.9 Theoretical and Conceptual Framework

Many African countries face serious livelihood challenges from mining, even with its social and economic benefits. The negative spillovers of small-scale mining are extreme. Subsistence mining is a major livelihood in Ghana despite being illegal. This research will adopt the Sustainable Livelihood Approach (SLA) as a coping strategy for mining communities. Di John (2010) asserts that negative development outcomes like growth collapse and corruption can arise from the availability of minerals in less developed countries. The resource curse theory suggests that natural resources can be a curse rather than a blessing (Siegel, 2008). where the value of a country's currency appreciates after a resource boom, making other exports less competitive (Di John, 2010). Rich natural resource countries like Malaysia, Thailand, and Indonesia have shown that resources can enhance economic growth (Demissie, 2014). The resource curse theory is applied here to understand how a well-endowed resource can be exploited, leading to issues like corruption (Barbier, 2007) and the crowding out of human and social capital (Demissie, 2014).

2.9.1 Sustainable Livelihood Approach

The Sustainable Livelihood Approach (SLA) reinforces the idea that illegal gold mining is a coping strategy for communities. The SLA is a poverty reduction strategy (Department for International Development 2024). It is a framework for understanding the difficulties of poverty and guides actions to address it (DFID 2024). Other NGOs like CARE, Oxfam, and UNDP use these models to implement development programs.

2.9.2 Defining Livelihood

According to the Oxford Dictionary (2010), a livelihood is a means of securing the necessities of life. DFID 2024 defined livelihood as capabilities and assets, including social and material resources. A livelihood is sustainable if it can cope and recover from stress and shocks

2.9.3 Livelihood Assets

The Sustainable Livelihood Approach explains that access to livelihood assets varies. The main entry point to the framework is capital assets, which the poor can access and control (Serrat, 2008). Some of these are:

* Natural Capital: Essential for sustainable livelihoods, including water, vegetation, and soil.

* Financial Capital: Cash, remittances, loans, and credit, which households use to make investments.

* Human Capital: The skills, knowledge, and health that enable individuals to successfully undertake different livelihood strategies.

2.9.4factors influence livelihood choice

Age: The age group of about 15-35 constitutes mostly to the unemployed category, which is linked to their engagement in illegal mining (African Economic Outlook, 2012).

Educational Level: The illegal mining sector "employs semiskilled and unskilled labour force" (Tieguhong et al., 2009). This implies that a lower educational level may be a factor in seeking employment in this sector.

Gender: "About 40% of illegal artisanal small-scale mining at Noyem and Ntronang areas are women" (Yakovlena, 2007).

Income: "economic decline" (Owusu and Dwomoh, 2012), "poverty" (Nyambe & Amunkete, 2009), and the "attractive income from sales" (Chamber of Mines, 2016) as primary drivers for people to engage in illegal mining. The illegal mining sector is also described as a "lucrative source of employment" that helps with poverty alleviation (Nyambe & Amunkete, 2009).

Employment Status: The review explicitly links "unemployment" and the "non-availability of alternative employment opportunities" to the illegal mining menace (Teschner, 2011; Bush, 2008).

Livelihood Diversification: The farmers shift their attention to illegal mining during the dry season to "earn additional income" and deal with their "idleness" (Kuma & Yendaw, 2010).

Dependence on Agriculture: The article describes farming as the "foremost source of occupation" but notes that its vulnerability due to the slow maturation rate of crops like cocoa makes it less attractive compared to illegal mining as a source of quick money (Kuma & Yendaw, 2010).

2.9.5Ethical consideration

Since the use of voice recording has been applied, this further increases the issue. In order to mitigate this as much as possible, the recordings were deleted as soon as they were properly transcribed, to increase the degree of privacy. Informed consent entails the readily informing of participants and informants regarding the research project and its purpose, as well as making it clear that participation is fully voluntary (Bryman, 2012).

However, the concept is a debated topic when it comes to research ethics, and although the norm is that it is to be retrieved from all participants this proves difficult in many situations (Bryman, 2012). Further, the definition of “informed” fuses more questions, as research projects often are highly complex and it could be too time-consuming giving every participant the full information about it.

In fact, giving all information that exists on the research project could also bore the participants and limit their patience and willingness to be active participants (Bryman, 2012). However, the researcher did strive to readily inform all participants about the research project, their anonymity and that participation was voluntary.

Where is the review on factors that influence illegal mining. I remember you did that review. Please include it

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methodological framework employed to conduct the research, focusing on the specific approaches used to gather, analyze, and interpret data relevant to the research objectives. It details the research design, process, and the rationale behind the chosen methodologies. It describes the data collection, analysis, and reporting procedures. A detailed profile of the Juaboso District, the study area, is also presented, highlighting its geographical, environmental, and socio-economic characteristics

3.1 RESEARCH DESIGN

The study adopts both qualitative and quantitative research approaches. Quantitative, broadly defined, means 'a research that produces discreet numerical or quantifiable data (Simons, 2007). Descriptive survey design was adopted in conducting this study. This is because descriptive studies are not only restricted to fact findings, but often result in the formulation of important principles of knowledge and solution to significant problems (Orodho, 2003).

Administered a questionnaire to a sample of respondents in the district. The researcher carry out survey on these individuals to find out approaches, effects, challenges and attitudes they are facing as a results illegal small-scale mining activities.

3.2 Population of The Study

The target population is the group of individual that possess the information required by the researcher and bout which inference are to be made (Malhorta & Birks, 2007). The most important thing in defining the target population is the precise specification of who should and who should not be included in the sample (Churchill & locubucci, 2002; Malhorta & Birks, 2007).

3.3 Sample and samples technique

A sample is a small subset of population said to be representative of a given population (Quinlan, 2011). Sampling can be a vital procedure when analyzing data as it is a valid way of collecting data without using the entire population, in particular when both time and budget constraints exist for the researcher. However, taking the different classes of respondents into consideration as well as the different kinds of questions needed to be answered, systematic sampling technique was the most appropriate technique that was applied in this study.

Johnnie (2012) describe it as a probability sampling procedure in which a random selection is made of the first element for the sample, and then subsequent elements are selected using a systematic interval until the desired sample size is reached.

3.3.2 Sampling Technique

The population for the study is 300 rice farmers. Multi-stage sampling technique will be used to select 120 respondents for the study. In the first stage, the Juaboso district will be purposively selected

Secondly, purposive sampling will be used to select two different communities namely Juaboso and Manhyia in the District because these are communities the District Assembly's Office as well as the District Department of Food and Agriculture indicated were predominantly rice farming communities which have been badly affected by small-scale gold mining exploration in the entire district.

Also, a simple random sampling technique will be used to choose the farming households from the four different communities to form the sample size. Depending on the formula given by Yamane (1967), the number of respondents for this study will be entered.

Where; n= sample size, N=400 and e=0.07

$$N = \frac{N}{1+N(e^2)} = \frac{300}{1+400(0.07^2)} \quad n=120$$

Sample size = 120.

In order to obtain a fair idea of issues across the communities, the sample size determined were divided by the communities to ensure the same sample sizes were interviewed from each of the communities.

In view of this, 60 respondents comprising of 30 farmers and 30 former farmers (thus farmers who were farming and are not farming but they are in to galamsey operations) each in scale were interviewed from each of the two communities. The selection was based on purposive sampling technique. This was based on regular and genuinely affected farmers. The selection was done with assistance from opinion leaders, and Extension Officers in the communities.

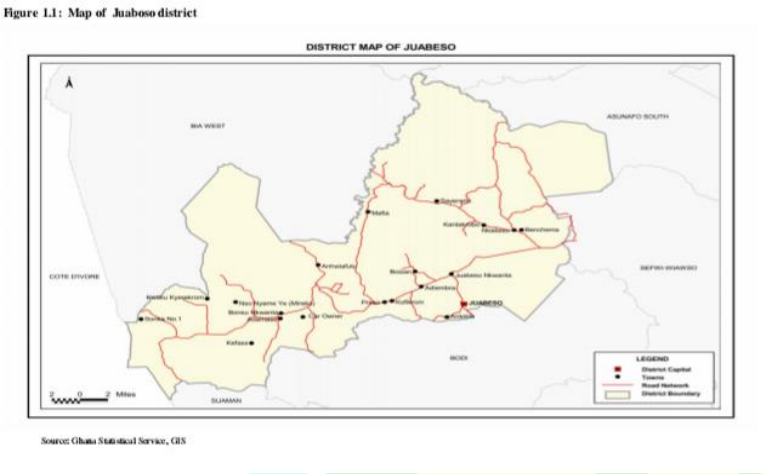
3.4 Study area

This research was conducted in Juaboso District in the Western North Region of Ghana. The district shares borders with Bia and Asunafo North Municipal to the north, Asunafo South and Sefwi Wiawso districts to the east, Bodi district to the south and La Cote d"lvoire to the west. The district capital, Juaboso is located 360km to the north-west of the Sekondi Takoradi Metropolis, the Regional Capital. (GSS 2021). This research was carried out in Juaboso Metropolitan Municipal District Assembly of Ghana because crop production is a common economic activity for many people in the municipal, especially rural folks. Rice is one of the primary food crops produced in the municipal (GSS 2021)

3.4.1 Location and Size of District

The Juaboso District population in 2021 was 88,814 with more males (45,722) representing 51.5% and females (43,092) constituting 48.5%. The District occupies a land sizes of 1,291 square kilometers with a population density of 68.8 persons per square kilometer (GSS 2021).

Fig 3.1 map of Juaboso district



source: Ghana statistical services 2021

3.5 Data Collection

The study employs both primary and secondary data. Field surveys to the study District was undertaken to obtain primary data as well as secondary data for the study. Respondents from which data were solicited included small-scale miners ie former- farmers, farmers

3.5.1 Primary data

This is data originated by the researcher especially to address the research problem (Malhatra and birks 2007). Amissah et al 2008 argued that primary data are first-hand information gotten from the research. Primary data for the study was collected through the administration of structured questionnaires as well as interviewing some farmers and small- scale miners in the study area. In order to get the relevant respondents (rice farmers) for all the stated objectives, purposive sampling techniques were used to select rice-growing communities in the district.

This is because apart from these communities being rice growing ones, Galamsey activities are prevalent in them. Specifically, the data for this study were gathered through the administration of a questionnaire to the respondents drawn from various courts as sellected.

3.5.2 Secondary Data

Sources of secondary data were from various textbooks at MoFA office Juaboso, journals, media and internet reports (both print and electronic). The data gathered were subjected to both qualitative and quantitative analysis. These are documentation, archival records, interviews, direct observation, practical observation, physical artifacts, Yin (2003) as cited in Khiabani (2006). For the purpose of this research the researcher employed questionnaires and interviews

3.6.0 Data Collection Procedure

3.6.1 Questionnaires, Interview and letter Administration: The questionnaires were administered to respondents who were able to read and write. However, interview was used as majority of the respondents were comfortable with it and it was the main means that could help the researcher gather the requisite data. This was due to the fact that most of the respondents could not read and write.

The respondents were briefed first about the purpose of the study and the instructions were explained. A written instruction was also available at the beginning of the questionnaire. The respondents were also informed that they are free to ask any questions if they do not understand something in the questionnaire or the interview process. Questionnaire was completed within 1 to 5 days. The interview was scheduled for only was recorded and later played back.

3.6.2 Validity of Research Instruments

The study instrument was content-validated. Donald and Pamela (2001) posit that content validity is determined by expert judgment. The university supervisors scrutinized the instrument to find out whether it addressed all the possible areas that were intended to measure, ensured its appropriateness, completeness and accuracy. They were relied upon to determine whether items in the instrument were adequate representation of all the areas that were under investigation.

3.7 Reliability of Research Instruments:

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials. Kothari (2009) reliability refers to consistency of measurement; the more reliable an instrument is, the more consistent the measure. The researcher used split-half procedure to test the reliability of the principals' questionnaire through piloting. This procedure was chosen over the other methods such as the Kuder- Richardson approaches for its simplicity yet accurate (Fraenkel and Warren, 2000). The instrument was piloted. It tested the basic emerging variables of this study described in the conceptual framework.

The open-ended questions scored by giving a mark for a relevant response and a zero for irrelevant and blank responses. The questionnaires selected were divided into two equal halves taking odd numbered items against the even numbered items. The scores of the halves were then correlated using the split – half measure of reliability. This yielded a half test coefficient. The Spearmanm - Brown Prophecy formula for the full test was employed to obtain a total test coefficient of the

instruments. They were considered reliable since the reliability fell between 0.7 - 1.0, which are considered adequate (Fraenkel and Warren, 2000).

3.8 Data Analyses

Based on the nature of the research and data collected, descriptive analysis was used to pursue the objective assessing the effect of illegal mining on key resources (land, water and labour). Also binary logistics regression analysis was used to analyzed the socio-economic factors that drive farmers in Juaboso to switch from rice farming to galamsey operation. This include dependent variable and independent variables

1. Dependent variable: galamsey participation: a binary variable indicating whether a farmer is currently involved in galamsey operations (1=yes, 0= no)
2. Independent variable: representing the socio-economic factors. Eg agriculture income, poverty level etc,

Household food security access scale and diversity score was used to analyzed the food security status of farmers and illegal miners in Juaboso district. The results were presented in tables, graphs and pictures. Statistical Package for Social Sciences (SPSS) version 20 was the statistical tool used to arrive at the results of this study.

The final output was presented in the form of texts. The application of this method of analysis by the researcher is based on the fact that, the original views of respondents will be demonstrated without any biased interferences with the view of the researcher. In view of this, data for the analysis were presented, explained and discussed using descriptive statistics such as frequencies, tables, graphs and percentages.

In addition, a chi-square test was employed to test the proposed hypotheses. The application of quantitative analysis enabled the researcher to generalize the findings and also made comparisons between two variables. Finally, quantitative analytical approaches also allowed the researcher to report the summary of results of the study in numerical terms.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results and discussion of the study based on the three research objectives. Both descriptive and inferential statistics are analyzed and discussed in relation to existing literature.

4.2.1 Demographic Data

Most of the study participants, 88 (73.3%), were males, and 32 (26.7%) were females. Therefore, more males participated in this study than females, likely due to the labor-intensive nature of the mining and farming. As such, more strength and energy are required, making males more suited for this kind of role. This aligns with the findings of Aryee (2012), that farming and illegal small-scale mining is dominated by men. This is shown in table 4.1

48.2% in this study have had primary education, followed by those with no primary education 34.2%, Secondary (9.2%), JSS (5%) and tertiary education (4.3%). This is significant to inform their decision on illegal mining and farming; This support the assertion made by Hilson et al (2017) that participation in illegal mining in influence by illiteracy, It could be about economic gains for them to undertake such mining activities. This support the findings of (Tschakert, 2009 & Heemskerk, 2005) economic reasons pushes people to take up mining, particularly with the high price for gold, inability to find other work, the inadequate pay of other available jobs, looking at the high number that have education.

Primarily,56.7% of the respondents in this study are engaged in either one or more secondary jobs. Probably they are not generating enough revenue from one job. It therefore becomes enticing for them to take on other lucrative alternatives such as illegal mining to earn more money. This is in consonance with findings by Hilson et al. (2013) that the miners in the mining areas undertake mining to supplement incomes from agricultural and other livelihood alternatives.

The study indicate that 54 (45%) of the respondents are migrant and 66 (55%) are native . The community is mixed with both indigenes and migrants signaling potential intercultural dynamics with opportunities for both cooperation and tension (Bunce et al 2021)

Out of the 120 respondents, the majority (80, 66.7%) were household head, followed by spouse (35, 29.2%) and others/children (5 , 4%). The predominance of household heads in the sample highlight the survey captured the views of those who typically controls the household resource and make livelihood decisions. Spouse also represent a considerable proportion, contributing perspectives on household well -being and support system.

Table 4 1 Demographic characteristics

Variables	Frequency (N)	Percentage (%)
Sex		
Male	88	73.3
Female	32	26.7
Educational level		
JSS	6	5.0
No primary education	41	34.2
Secondary education	48	48.2
Tertiary	4	4.3
Secondary occupation		
Yes	68	56.7
No	52	43.3
Respondent origin		
Migrant	54	45
Native	66	55

The average age of 40.16 years signals that the sampled farmers/miners are the very vibrant and energetic in the community. These age is classified, as youthful hence it is not surprising to see them at actively involved in the mining activity. Significantly, only few people of age 50 and above are involved directly in the mining activities. They could be more business owner within this age and also because they have minimal strength and ill health, they could not be involved in the active mining (Abdulia, A. Dauda, S. et al 2022). This support the findings of Akudugu, J A. & Laube, W (2022), that artisanal and small- scale mining in Ghana is largely dominated by youth

The size of households also had significant implications. The average household size was 10, and a range of 10 – 15 people, indicating large family sizes. Farmers with large households provided additional labor for farming but also created heavy economic responsibilities. These large family demands increased the need for quick and reliable income to cover food, education, and health, making illegal mining an attractive option. Adamu, et al (2022).

The study showed that the mean number of years respondents have lived in the community is 36 years and suggests that respondent are long term settlers, and therefore, their views on farming and mining are based on deep, lived experience rather than temporary stays. In addition, their testimonies about galamsey's impact on farm carry historical weight and reliability. Banchirigah(2008).

Farmers in the study area own relatively large parcels of land, with the average total farmland being 13.13 acres (median = 13.5 acres, range = 36 acres). However, only a small portion of this land is devoted to rice production, averaging 4.90 acres This suggests that while farmers may control significant landholdings, much of it is not fully utilized for rice cultivation. This is linked with the findings of Hu et al (2023) and Adelabu et al (2023).

Table 4.21.2 Demographic characteristics

Variables	Mean	Range	Mode
Age	40.16	35-49	35
Household size	10	10-15	5
Years in community	35.89	50-65	30
Total rice farm	4.90	5-8	3
Total farm land	13.13	15-20	14

4.2 Perceived impact of mining on households and community

Household food sufficiency

In terms of household food sufficiency, the findings reveal moderate levels of food insecurity among farmers. About 55% of farmers reported that their households are "sometimes" food insufficient, while 25.8% said "often", and 19.2% indicated "always." This means that most farming households are only occasionally able to meet their food requirements, reflecting unstable access to food.. The situation can be explained by the dual impact of mining: (1) reduced food availability due to the loss of farmland and declining yields, and (2) limited food access as farming incomes decline while food prices increase. This is consistent with Tschakert & Singha (2007), who observed that mining disrupts agricultural production and erodes household food security in Ghana. On other hand, former farmers who have shifted in to galamsey activities reported relatively better food secured. Households engage in galamsey are more likely to have access to food throughout the year because additional income from galamsey allows them to buy food from markets, even when local crops are unavailable.(Sarfo-Mensah et al, 2020)**Decline in crop yields**. The study show that all the farmers acknowledge that there have being a decline in crops yield which galamsey is the leading cause of declining yields. Illegal mining contaminates soils with mercury and cyanide, reducing fertility. Land degradation and water pollution directly lower crop yields. Hilson & Garforth (2012) confirm that galamsey reduces crop productivity due to degraded soils and water contamination

Confidence in future food access

Most farmers are uncertain about their food security future. Uncertainty comes from continuous land degradation, reduced yields, and unstable farm incomes due to mining. This confirm the study of Agyemang (2024) that galamsey increases food insecurity, leaving farmers uncertain about future access to food. Also, the study shows that, most farmers are only partly satisfied, reflecting reduced profitability. Farmland lost to mining lowers income from crops. Some households may

even depend on mining instead of farming, creating mixed satisfaction. This is consistent with the Fourth Estate (2025) reports that illegal mining drives farmers away from food cultivation, lowering farm income and shifting livelihoods. Moreover, all of the farmers cannot access financial resources for farming. Disrupted farming systems make financial institutions hesitant to lend to farmers in mining-prone (Yaro et al.(2020)

Table 4 32Perceived impact of mining on households and community

VARIABLES	FREQUENCY(N)	PERCENTAGE (%)
Food sufficiency level		
Sometimes	69	55
Often	28	25.8
Always	23	19.2
Reason for decline in crops		
Pest/ diseases	13	10.8
Galamsey	43	35.8
Climate change	4	3.4
Confidence in future food		
Somehow confident		
Very confident	45	37.5
Not at all confident	2	1.7
	13	10.8
How satisfied with income		
Somehow satisfied	43	35.8
Very satisfied	14	11.7
Not at all satisfied	3	2.5
Credit for farming		
No	60	50
Difficulties in finance access		
Somehow difficult	2	1.6
Very difficult	48	48.4

Farmers' Desire to Engage in Illegal Mining (Galamsey)

Out of 60 farmers surveyed, 23 (38.3%) expressed willingness to engage in illegal mining, while the majority, 37 (61.7%) declined. This indicates that although illegal mining is perceived as a lucrative alternative to farming, most farmers still resist participation due to its risks and unsustainable nature. Studies show that farmers' decisions to engage in mining are often shaped by a trade-off between economic gains and social/environmental costs (Hilson, 2017).

Reasons for Participation (Yes Group) .

All 23 farmers who answered "Yes" cited high income as the motivating factor. This reflects how the promise of quick financial returns outweighs long-term farming benefits for some individuals.

Research in Ghana confirms that illegal mining is seen as an economic survival strategy, especially among rural farmers facing poverty and declining farm productivity (Armah et al., 2013; Baah-Ennumh, 2015).

Reasons for Non-Participation (No Group)

Among the 37 who refused: Loss of human lives (15 farmers, 40.5%), exposure to toxic chemicals, and fatalities associated with galamsey were the main reasons cited. Studies highlight the occupational hazards of illegal mining, including frequent mine collapses and mercury poisoning (Tschakert & Singha, 2007). Not sustainable (13 farmers, 35.1%) – These respondents recognize that mining depletes land and water resources, undermining future livelihoods. Literature notes that illegal mining causes land degradation, water pollution, and reduced agricultural productivity, making it an unsustainable option (Bansah, Yalley & Dumakor-Dupey, 2016). Lack of physical strength (9 farmers, 24.3%) – Others acknowledged the demanding nature of mining work, which requires stamina and youthfulness. Evidence shows that illegal mining is physically intensive and often dominated by younger and stronger individuals (Hilson & Garforth, 2012).

The results suggest that while a significant portion of farmers are attracted to illegal mining because of high income potential, the majority refrain due to concerns over safety, sustainability, and physical ability. This aligns with existing findings that farmers' decisions are influenced not only by immediate financial incentives but also by long-term livelihood security and health.

Table 4.43Desire to engage in illegal mining

Variable	Frequency (N)	Percentage(%)
Desire to engage galamsey		
No	37	30.8
Yes	23	19.2
If yes, why		
High potential income	22	18.3
If no, why		
Unsustainable	13	10.8
Loss of human lives	15	12.5
Lack of physical strength	9	7.5

4.3 Effect on land

Nearly all respondents (99.2%) confirmed that rice farming land had been affected by mining.. This finding confirms Tschakert and Singha (2007) and Hilson (2017), who emphasized that sedimentation and chemical contamination from mining pose major threats to rice production. Ninety-seven point five percent of the respondents reported direct competition for rice-farming land between farmers and miners, reflecting land-use conflicts. Similar situations have been observed in mining areas such as Tarkwa in Ghana (Akabzaa & Darimani, 2001). In terms of farmland loss, respondents explained that this occurred through sales or rental to miners (38.3%), encroachment (21.7%), destruction of farms by equipment (21.7%), and flooding (18.3%). Nyame

and Grant (2014) likewise found that illegal mining often results in encroachment and flooding of farmland.

With respect to mitigation, only 2.5% of respondents reported receiving any form of compensation, while 100% indicated that there had been no land reclamation. This reflects weak institutional enforcement and neglect, consistent with Hilson (2002) and Schueler et al. (2011). Overall, the results show that illegal mining has extensively degraded land resources, particularly rice farming land, and intensified competition between farming and mining.

Table 4 54Effects on Land

variable	frequency(n)	percentage (%)
changes in qualities and usability of land		
deforestation	120	100
soil erosion	120	100
creation of pit	120	100
loss of top soil	120	100
rice land demand for galamsey		
yes	117	97.5
no	3	2.5
total loss of farm land		
yes	115	95.9
no	5	4.1
if yes how		
flood cause by mining	25	20
rice land renting was sold to galamseyers	50	43.4
destruction while transporting their equipment	40	34

4.4 Effects on Water

The majority of respondents (96.7%) disagreed that climate change was the main driver of water-related challenges. Instead, they attributed water crises directly to mining activities. This finding reflects the view of Tschakert and Singha (2007) that communities often link environmental changes to visible human activities such as mining. All respondents (100%) reported reduced access to clean and potable water, which confirms Osae-Kwapong et al. (2020), who found that galamsey severely restricts access to irrigation and drinking water.

In addition, every respondent indicated declines in aquatic life, with half attributing this to chemical use and the other half to declining fish populations. This points to both chemical toxicity and ecosystem collapse. Donkor et al. (2018) and Gyamfi et al. (2018) similarly observed that illegal mining threatens aquatic biodiversity through chemical contamination. Nearly all respondents (99.2%) observed changes in water quality and quantity: 65% reported brown coloration from sedimentation, 19.2% identified riverbank destruction, and 15.8% attributed changes to chemical pollution. This mirrors the findings of Anim-Sarpong et al. (2017) and

Awuah-Bonsu et al. (2019), who documented sedimentation and pollution of water bodies in mining areas. Overall, all respondents (100%) directly linked water changes to mining activities, with 95% citing water pollution and 96.7% reduced flow of rivers. About 80% further reported declines in aquatic life, especially fish, as a result of chemical contamination. These results confirm Donkor et al. (2018) and Gyamfi et al. (2018), who showed that illegal mining causes heavy metal pollution and degradation of river ecosystems in Ghana.

Table 4 65Effects of Illegal Mining on Water

Variable	Frequency (n)	Percentage (%)
Water pollution	120	100
Reduced access to clean water	120	100
Decline in aquatic life	96	80

4.5 Effects on Labour and Social Life

Illegal mining has also significantly undermined labour availability and social stability in farming communities. Nearly all respondents (97.5%) reported that farmers had abandoned farming for mining activities. This supports Banchirigah and Hilson (2010), who found that artisanal mining draws labour away from agriculture. All respondents (100%) indicated persistent labour shortages and rising costs of farm labour. This trend reflects a de-agrarianization process, where mining drains the agricultural labour force and inflates farming costs, as discussed by Hilson and Garforth (2012) and Baah-Boateng (2016). In addition, all respondents (100%) noted that many households had lost interest in farming altogether, preferring the perceived financial rewards of illegal mining. This agrees with Hilson (2017), who argued that small-scale mining often reduces farming's attractiveness to younger populations. On the social front, 95.8% of respondents reported increased crime rates, 100% cited conflicts, 100% mentioned health risks, and 100% reported fatalities associated with illegal mining. Similarly, 98.3% pointed to disputes arising from mining activities. These findings are consistent with Crawford and Botchwey (2017), Hilson (2006), Donkor et al. (2018), Baah-Ennumh et al. (2012), and Banchirigah (2006), who noted that small-scale mining exacerbates community-level crime, health hazards, and disputes. A major reason for these findings is that many young men have abandoned farming for the more lucrative galamsey activities, leaving farms unattended and communities vulnerable. About 65% of respondents specifically indicated that their farms had been abandoned due to these labour shortages. Hilson and Garforth (2012) similarly emphasized that artisanal mining drains the farming labour pool and raises agricultural production costs

Table 4 76: effect on labour and social life

Variable	Indicator	Frequency (n)	Percentage (%)
How mining affect agricultural labour			
Increase agricultural labour	Yes	120	100
Inadequate labour	Yes	120	100
Loss of interest in agricultural land	Yes	115	95.9

Farmers leaving for mining	No Yes No	5 117 3	4.1 97.5 2.5
Social impact related to galamsey **If yes which one** Social conflict Health risk Loss of human life	Yes Yes Yes Yes	120 120 120 120	100 100 100 100
Dispute / conflict related to galamsey	Yes	120	100
Crime	Yes	1200	120

4.6. Factors that drive farmers to switch from farming to illegal mining

Results of the binary logistic model has been summarized and presented in table 4.7. The analysis revealed that age had a significant negative effect on the likelihood of switching from farming to mining. This means that younger farmers are more likely to engage in mining compared to their older counterparts. Younger people are physically stronger, more risk-tolerant, and attracted to the quick income associated with artisanal mining. Older farmers, on the other hand, often value stability and prefer to remain in agriculture where they have established systems (Teschner 2012). Aryee (2012) highlighted that small-scale mining is predominantly dominated by youth because of its labor-intensive demands. Similarly, Hilson (2016) noted that mining appeals more to young men seeking immediate livelihoods.

Sex was found to be a significant positive predictor, with males more likely to switch to mining than females. The coefficient indicates that men are more likely to switch to farming, largely due to the physically demanding nature of mining. Armah et al. (2013) explained that although women are present in mining, their participation is usually limited to auxiliary roles such as processing and trading rather than extraction. The result aligns with (Ofosu, Sarpong et al., 2024) that show men dominate artisanal and small-scale mining activities in Ghana. The result suggests that gender roles and labor divisions strongly influence livelihood switching.

Household size was found to be a significant positive predictor of switching. Larger households increased the odds of farmers abandoning agriculture for mining. This finding reflects the economic burden associated with caring for many dependents. Hilson (2016) argued that the pressure of meeting household consumption needs often pushes rural families to diversify or switch livelihoods, with mining becoming an attractive option. Larger households create higher financial demands, which farming's seasonal and uncertain returns may not adequately meet. Mining, with its promise of quicker income, becomes a survival strategy under such pressure. Similar results were found by Ndamani andWatanabe (2016) who reported that household size significant influenced farmer adaptation strategies under stress.

The study examine income as a factor influencing farmer's decision to switch from farming to illegal mining. This show that farmers with low income or unstable income were more likely to move into galamsey due to higher and quick financial returns (Tschakert 2009). Many farmers indicated that farm earnings could meet household needs, making mining an attractive option. (Hilson et al 20130. Heemskerk (2005) observed that low agricultural profitability pushes rural people into mining. The findings highlight income inadequacy as a strong economic factor that influences many households to switch to mining.

Table 4.87 Factors that drive farmers to switch from farming to illegal mining

Dependent variable: galamsey participation: a binary variable indicating whether a farmer is currently involved in galamsey operations (1=yes, 0= no)

Variable	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]
Number of obs=120					
Age	-0.043*	0.023	-1.91	0.057	-0.088, 0.001
Sex	1.061**	0.479	2.21	0.027	0.122, 1.999
Education	0.466	0.447	1.04	0.298	-0.411 1.342
Income	0.199	0.471	0.42	0.033	-1.122, 0.725
Secondary occupation	0.309	0.414	0.75	0.455	-0.502, 1.120
Household size	-0.120**	0.060	-2.00	0.046	-0.237, -0.002
Constant	1.825	1.169	1.56	0.119	-0.467, 4.117
LR chi2(6) = 18.74	Prob > chi2 = 0.0046	Pseudo R2 = 0.1136			

4.7: Food Security Status of Farmers and Galamsey operators (Former farmers)

The results revealed clear differences in the food security situation between farmers and former farmers who are now engaged in mining. For farmers, the mean Household Food Insecurity Access Scale (HFIAS) scores were 6.22 in 2024 and 6.30 in 2023, indicating that they are more food insecure compared to their mining counterparts. Their dietary diversity score of 6.3 falls within the moderate range (5–8), suggesting that their diets are moderate few food groups and lack sufficient nutritional variety. This outcome can be attributed to the loss of fertile land and declining agricultural productivity due to illegal mining activities, which have reduced farmers' capacity to produce enough food for household consumption. Similar patterns have been reported in Ghana, where smallholder farmers in mining-affected areas face declining crop yields and worsening household food security (Owusu-Nimo et al., 2019; Armah et al., 2016). Thus, despite being primary food producers, farmers in the study area experience greater food insecurity and diverse diets.

Former farmers who shifted to mining exhibited mean HFIAS scores of 1.37 in 2024 and 1.30 in 2023, reflecting greater food security. Additionally, their dietary diversity score was 13.75, which

falls within the high category (greater than 9), indicating access to a wide range of food groups. This improvement can be attributed to their cash income from mining, which allows them to purchase diverse foods from the market rather than relying solely on farm output. Although mining is associated with environmental and livelihood risks, in the short term it enhances household purchasing power and food access. Hilson (2017) similarly observed that mining households often achieve higher dietary diversity due to increased income, while FAO (2021) highlights that income stability plays a critical role in improving dietary outcomes. Therefore, compared to farmers, former farmers appear more food secure and maintain highly diversified diets, even though such security may be fragile in the long term.

Farmers, though food producers, were more food insecure, with higher HFIAS scores and only medium dietary diversity (Armah et al., 2016). This is largely due to farmland loss, soil degradation, and water pollution from mining, which reduce yields (Owusu-Nimo et al., 2019). Former farmers who shifted to mining showed lower HFIAS scores, indicating greater food security. They also achieved very high dietary diversity, supported by cash income from mining (Hilson, 2017). Mining income enables households to buy diverse foods, improving diet quality (FAO, 2021). However, this security is fragile since mining incomes are unstable and environmentally unsustainable.

Table 4 98 food security status of respondents

	Household food insecurity access scale (mean)		Dietary diversity
	2024	2023	
Farmers	6.22	6.30	6.3
Former farmers	1.37	1.30	13.75

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

The findings, conclusion, and recommendations from the study are presented in this chapter.

5.2. Summary of Findings

The main objective of the study is to assess the effect of illegal mining on rice production and food security in Juaboso District.

The findings revealed that illegal mining has severely degraded land, polluted water bodies, and undermined agricultural labour. Nearly all farmers reported that rice lands had been destroyed through encroachment, flooding, and creation of pit, with no compensation or land reclamation efforts. Water resources were equally affected, with all respondents citing pollution, reduced river flow, and declining aquatic life, making safe water for irrigation and domestic use increasingly scarce. Labour shortages were also acute, as many youth abandoned farming for mining, leading to rising farm labour costs, loss of interest in agriculture, and worsening social problems such as conflicts, crime, and health risks.

The regression analysis further showed that among the variables sex, age , household size income, were statistically significant. These factors influenced the respondents to switch from farming to mining. However, educational level, secondary occupation are not significant. These results highlight how demographic and household pressures shape livelihood transitions in mining-affected communities.

In terms of food security, farmers were found to be more food insecure despite being primary producers, with higher household food insecurity scores and moderate dietary diversity. In contrast, former farmers engaged in mining exhibited lower food insecurity and higher dietary diversity, largely due to cash incomes from mining which enabled them to purchase a wider range of foods. However, this improved security is short-term and unsustainable, as it depends on environmentally destructive practices that threaten long-term agricultural production and rural food systems.

5.3 CONCLUSION

Illegal mining in Juaboso District has degraded land, polluted water bodies and drawn labour away from farming. Also age, sex, household size, income influence switch to mining. Farmers remain more food insecured with moderate dietary diversity, while former farmers in the mining appear better off in the short term. However, such food security from mining is fragile and unsustainable due environmental destruction. Overall, the study underscore a tension between short-term mining income and long term agricultural sustainability.

5.4 RECOMMENDATION

The following recommendations are made based on the findings from this study.

Land and Water Protection: Government and local authorities should enforce stronger regulations against illegal mining, particularly to safeguard fertile farmlands and water bodies. Strict monitoring, land reclamation, and rehabilitation programs must be prioritized.

Support for Farmers: Provision of affordable credit facilities, input subsidies, and extension services should be expanded to strengthen farming as a viable livelihood and reduce the lure of mining.

Alternative Livelihood Programs: Youth and households with large dependents should be targeted with skills training, non-farm employment opportunities, and sustainable agribusiness initiatives to ease the economic pressures driving them into mining.

Community Education and Awareness: Sensitization campaigns are needed to highlight the long-term risks of mining, including health hazards, land loss, and food insecurity, and to promote sustainable farming practices.

Strengthening Social Structures: Interventions should address the social consequences of illegal mining, such as rising crime and conflicts, by involving traditional authorities, community leaders, and local institutions in peacebuilding and youth engagement.

Food Security Interventions: Farmers should be supported to adopt climate-smart and intensive farming methods to restore productivity and improve dietary diversity, while mining households should be encouraged to invest mining incomes into sustainable ventures for long-term food and income security.

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APPENDIX
QUESTIONNIARE: ASSESSMENT OF ILLEGAL MINING ON RICE PRODUCTI AND FOOD SECURITY

General Information

1. District .....
2. Name of your community? .....
3. GPS coordinates.....

A. Demographic characteristics of households

4. What is your name? _____
5. Age _____
6. Sex of respondent _____
7. What is your position in the household? [ ] Household head [ ]Spouse [ ] Others specify _____
8. Please indicate if you are a native or migrant? _____[ ] native [ ] migrant _
9. What is your religion? _____
10. What is your level of education? [ ] No formal education [ ] Primary [ ] JSS [ ] Secondary [ ] Tertiary
11. What is your main occupation? A. Rice farmer [ ] B. Trader [ ] C. Galamsey operator other, plea//se specify .....
12. Please indicate secondary occupation if any_____
13. Household size _____
14. How long have you been living in the community? .....

B. Household livelihood activities

15. Total area of land in acres .....
16. Area of rice farm in acres _____
17. Other crops grown.....
18. How often does your household produce enough food to meet its needs throughout the year? 1.Always ( ) 2. Often( ) 3. Sometimes( ) 4. Rarely, Never( )

19. During which months of the year does your household face food shortages?.....

20. Have you experienced any decline in your crop yields in recent years? [ ] yes [ ] No

21. What do you think are the reasons?.....

22. Have you experienced any unexpected events (e.g., crop failure, loss of income) that affected your food security in the last 12 months? Yes \ No

23. How confident are you that your household will have access to enough food in the next year? (Very confident, Somewhat confident, Not very confident, Not at all confident)

24. How satisfied are you with income derived from farming

[ ]Very satisfied [ ] Somewhat satisfied [ ]Not very satisfied [ ] Not at all satisfied

25. Did you have access to extension ? [ ] Yes [ ] No

26. Do you have access to credit for farming activities [ ]Yes [ ]No

27. How difficult is it to access credit for your farming activities

[ ]Very difficult [ ] Somewhat difficult [ ]Not very difficult [ ] Not at all difficult

28. Do you have any desire to engage in Galamsy? [ ]Yes [ ]No

29. If Yes, why .....

30. If No, why..... .....

C. Motivations for Engaging in Illegal Mining: (for former farmers)

31. How did you get involved in illegal small-scale mining?.....

32. How long have you engaged in illegal mining (indicate in years).....

33. Do you have access to credit for mining activities [ ]Yes [ ]No

34. How difficult is it to assess credit for mining activities

[ ]Very difficult [ ] Somewhat difficult [ ]Not very difficult [ ] Not at all difficult

35.Are you engaged in other livelihood activities

36. What were the main reasons that led you to switch from farming to mining?
[ ] Higher potential income [ ]lack of profitability in farming [ ]Unemployment
[ ] influence of others [ ]perceived easier work [ ] other specify_____

.....

38. How does the income from mining compare to your previous total income from farming?

.....

39. What are your perceptions about the risks of illegal mining compared to farming?

.....

.....

40. What are your perceptions about the benefits of illegal mining compared to farming?

.....

has your social status or that of your household changed since becoming involved in mining? Yes / No

D. Assessing the Effects of Illegal Mining Activities on Land, Water, and Labour

46. How long have these activities been going on? Responds in years .....

43. What is the type of the mining operations in your area?

1. alluvial mining ( ) 2. Dig and wash ( ) 3.underground mining ( ) 4.others.....

Effects on Land:

44. Have you observed any changes in the quality or usability of land in your area due to mining? 1.deforestation ( ) 2. soil erosion ( ) 3.loss of topsoil ( ) 4 creation of pits ( ) 5.land degradation ( )

Other, specify .....

44. Have you observed any changes in the quality or usability of land in your area for rice farming attributable to mining? [ ] Yes [ ]No

If yes, please specify.....

45. Has mining affected the availability of land for general farming? YES | No

If yes in what way?_____

46. Has mining affected the availability of land for rice farming? YES | No

If yes in what way?_____

47. Is the type of land you use for rice production in high demand for mining? [ ]Yes [ ]No

48. Have you experienced any loss of total farmland due to mining activities? Yes |No

If yes how?..... .

49. Have you experienced any loss of rice farmland due to mining activities? Yes |No

If yes how?.....

50. Were you compensated? [ ] Yes [ ]No

51. Are there any efforts to reclaim or rehabilitate mined land in your area? [ ] yes [ ]No

If yes, how effective are they?.....

Effects on Water Resources:

52. Have you noticed any changes in the quality or quantity of water in rivers, streams, or groundwater sources in your area? Yes | No.

If yes, what changes have you observed ?.....

.....

.....

53. what can you attribute that to? 1. water pollution ( ) 2.sedimentation( ) 3.reduced water flow( ) 4. drying up of water bodies( ) Others. Please specify.....

54. Has mining affected your access to clean water for drinking, irrigation, or other household uses? Yes \ N0

55. Have you observed any impacts on aquatic life fish populations)? Yes \No

if yes, kindly describe your observation .....

.....

.....

Effects on Labour:

56.How has illegal mining affected the availability of agricultural labor in your community?.....

57. farmers leaving for mining ( ) 2.increased labor costs ( ) 3. Inadequate labour for farming 4. Lost of interest to agriculture labour ( ) Other, kindly specify.....

58. Have there been any social impacts related to the influx of people involved in mining

1.crime ( ) 2. social conflicts ( ) 3. Health risk ( ) 4.loss of human lives.( )

Others specify.....

59. Have there been any conflicts or disputes related to mining activities? Yes \ No

E. Food security

I. HOUSEHOLD FOOD SECURITY		2023
60. During the last 12 months, was there a time when you or others in your household worried about not having enough food to eat because of a lack of money or other resources?	1. Yes 2. No	
61. Still thinking about the last 12 months, was there a time when you or others in your household were unable to eat healthy and nutritious food because of a lack of money or other resources?	1. Yes 2. N0	
62. During the last 12 months, was there a time when you or others in your household ate only a few kinds of foods because of a lack of money or other resources?	1. Yes 2. No	
63. During the last 12 months, was there a time when you or others in your household had to skip a meal because there was not enough money or other resources to get food?	1. Yes 2. No	
64. Still thinking about the last 12 months, was there a time when you or others in your household ATE LESS THAN YOU THOUGHT YOU SHOULD because of a lack of money or other resources?	1. Yes 2. No	
65. During the last 12 months, was there a time when YOUR HOUSEHOLD RAN OUT OF FOOD STOCK because of a lack of money or other resources?	1. Yes 2. No	
66. Was there a time when you or others in your household WERE HUNGRY BUT DID NOT EAT because there was not enough money or other resources for food?	• Yes • No	
67. During the last 12 months, was there a time when you or others in your household WENT WITHOUT EATING FOR A WHOLE DAY because of a lack of money or other resources?	1. Yes 2. No	

I.2 FOOD DIVERSITY		
68. Did your household consume CEREALS AND GRAINS in the last 7 days? [RICE, WHEAT, MAIZE, OR ANY FOOD MADE WITH THESE]	1. Yes 2. No	
69. Did your household consume ROOTS AND TUBERS in the last 7 days? [POTATOES, CASSAVA, YAMS OR ANY FOOD MADE WITH ROOTS]	3. Yes 4. No	
70 Did your household consume PULSES, LEGUMES, NUTS, AND SEEDS in the last 7 days? [LENTILS, BEANS, NUTS, OR ANY FOOD MAKE WITH THESE]	5. Yes 6. No	
71. Did your household consume ORANGE VEGETABLES AND TUBERS in the	7. Yes	

last 7 days? [PUMPKIN, CARROT, SQUASH, OR SWEET POTATOES THAT ARE ORANGE INSIDE OR OTHER LOCALLY AVAILABLE VITAMIN-A RICH VEGETABLES (e.g. sweet red pepper)]	8. No	
72. Did your household consume GREEN LEAFY VEGETABLES in the last 7 days?	9. Yes 10. No	
73. Did your household consume OTHER VEGETABLES in the last 7 days? [TOMATOES, EGGPLANTS, CABBAGE, OTHER]	11. Yes 12. No	
74. Did your household consume ORANGE FRUITS in the last 7 days ? [MANGO, PAPAYA]	13. Yes 14. No	
75. Did your household consume OTHER FRUITS in the last 7 days ? [GRAPES, BANANA, WATERMELON, COCONUT]	15. Yes 16. No	
76. Did your household consume MEAT in the last 7 days? [BEEF, MUTTON, LAMB, CHICKEN AND OTHER BIRDS]	17. Yes 18. No	
77. Did your household consume FISH/SEAFOOD in the last 7 days? [FRESH FISH, DRIED FISH, SHELLFISH, CRAB, SNAIL] MAYBE HERE WE SHOULD BE MORE SPECIFIC?	19. Yes 20. No	
78. Did your household consume LIVER, KIDNEY, HEART AND / OR OTHER ORGAN MEATS in the last 7 days?	21. Yes 22. No	
79. Did your household consume EGGS in the last 7 days?	1. Yes 2. No	
80. Did your household consume MILK AND OTHER DAIRY PRODUCTS in the last 7 days?	1. Yes 2. No	
81. Did your household consume OIL/FAT/BUTTER in the last 7 days?	1. Yes 2. No	
82. Did your household consume SUGAR AND SWEETENERS in the last 7 days?	1. Yes 2. No	
83. Did your household consume MISCELLANEOUS CONDIMENTS, SPICES, COFFE, TEA in the last 7 days?	1. Yes 2. No	