Health Impacts of Local and Chinese Small-Scale Gold Mining Operations on Ghanaian Communities

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Section 1: Introduction & Background

1.1 Introduction

The subject of my major research paper is the health impacts related to the environmental problems of small-scale gold mining in Ghana. The gold mining industry happens to be the backbone of the Ghanaian economy, contributing significantly to the country’s foreign exchange and revenue. Moreover, the industry is famous for the direct and indirect jobs it creates, thereby alleviating the country’s crisis of long-term unemployment. However, the increasing production of gold in the country implies that the Ghanaian government is trading off economic growth for the externalities of environmental degradation and negative health impacts. The wealth amassed from the gold mining industry seldom goes into the development of mining communities. In addition, the burdens of gold mining like environmental degradation and damaging health are imposed on the inhabitants of mining communities. The small-scale gold mining sector is notable for the negative impacts it inflicts on the environment and health of residents. Yet, in spite of the vast sums of money generated by the gold mining industry, the government of Ghana shows no concern in tackling the problems pervading mining communities.

The research is mainly focused on the early mid-2010s, which corresponds with the influx of Chinese miners in Ghana’s small-scale gold mining sector. While the sector has always been the preserve of Ghanaian nationals, since the 2010s, the advent of Chinese miners has exacerbated the environmental and associated health hazards of gold mining. The deleterious impacts of small-scale gold mining predate the arrival of Chinese miners, as stated in the literature. Nevertheless, Chinese miners are credited with revolutionizing the small-scale gold mining sector with their mechanization and intensification of gold production. The sector can no longer be described as artisanal, since the introduction of modern equipment by Chinese miners, including bulldozers, excavators, and trench drills, have gradually supplanted the simple tools employed by local miners.
Although their participation in Ghana’s gold mining industry has increased the production of gold dramatically, the downsides of Chinese gold mining operations have been catastrophic. The mechanization and intensification of gold production have engendered an extensive environmental degradation, destruction of farmlands, and pollution of waterbodies, especially rivers that serve as sources of drinking water for mining communities. Besides, Chinese miners are known for their introduction of river mining, also known as dredge mining, which is legally forbidden in the country. The impacts of this type of mining on rivers have been disastrous.

Therefore, given the harmful environmental impacts of small-scale gold mining, especially as a result of Chinese mechanization and intensification of gold production, the research aims to investigate the consequences of local and Chinese small-scale gold mining activities on the health of Ghanaian communities. In order to sufficiently explore the health impacts of the activities of the two groups of miners on Ghanaian communities, the research will be guided by the following questions:

1. What are the relative environmental and health impacts of large-scale gold mining in comparison to small-scale gold mining?
2. Who are the local players in Ghana’s small-scale gold mining sector?
3. As Chinese participation in small-scale gold mining in Ghana increases, is there evidence of negative environmental and health impacts that may correlate with Chinese mining operations in local Ghanaian communities?
4. Are health risks from small-scale gold mining operations in Ghana distributed unequally with respect to age and gender?
1.2 Justification for the Research

I have always been curious about the gold mining industry given the importance of the mineral to the Ghanaian economy. Yet, the long tradition of gold mining in the country has barely brought any form of prosperity to the residents of mining communities. My reasons for focusing on the health impacts of small-scale gold mining are as follows:

Firstly, the negative impacts of small-scale gold mining on rivers have become a national concern with the current government devising a host of strategies to curtail the situation. Most rivers in the country defy the colorless property of water as they look very brown. Livelihoods in mining communities are being deteriorated due to the state of the environment. This has triggered the youth to pressure the government to remedy the impacts of mining on waterbodies. Hardly a day goes by without seeing #Fixthecountry on twitter with images of polluted rivers in the country. The recent assertion by the Asantehene (Ashanti king) that politicians are well-knowledgeable about those behind illegal small-scale gold mining in the country has even stoked the youth’s pressure on the government.

Secondly, the negative impacts of small-scale gold mining on the environment are largely attributed to the operations of Chinese miners. This stems from the Chinese miners’ introduction of high-tech machines to accelerate the extraction of gold. The consequence of the mechanization of gold mining is the large-scale pollution of waterbodies and lands in mining communities. In addition, the direct mining of gold in rivers by Chinese miners have been alleged to be primarily responsible for the distasteful state of rivers in the country.

Lastly, I grew up in my hometown of Bonfa Achiase, which happens to be a gold mining community. I remember hailing the discovery of gold in the community owing to the significant
number of jobs gold mining could generate. But my joy for the gold discovery was ephemeral after witnessing the harms gold mining brought to the community. Farmlands were being degraded and River Enuru became severely contaminated. This caused food shortages and water problems in the community, thereby damaging a lot of livelihoods. Also, one problem inherent in the mining activities was the abandonment of pits. These are normally pits of quicksand which are potential dangers for the people in surrounding areas. Sadly, in May 2015, I lost a cousin who drowned in one of these pits on his return from the farm.

While the country is more fixated on the environmental problems associated with small-scale gold mining, it also bears considering the health implications of the gold mining operations. Therefore, this informs my focus on the health impacts of local and Chinese small-scale gold mining operations on Ghanaian communities.

1.3 Contributions

This research will help elucidate the relative environmental and health impacts of large-scale and small-scale gold mining in Ghana. Oftentimes, the harmful impacts of the various scales of mining are lumped together, obscuring the possibility to ascertain which group of miners are responsible for the environmental degradation in mining communities. Furthermore, the research will contribute to the growing environmental justice literature as it explores the disconnect between the flow of economic and other benefits of extractive industrial operations and the human and environmental costs it entails. Lastly, with the comprehensive review of the dynamics of the small-scale gold mining sector, the research will help guide policies and actions to better address the unique challenges of the sector.
1.4 Methodology

My paper investigates the health impacts of local and Chinese small-scale gold mining on Ghanaian communities based upon a review of secondary literature. The paper is methodologically qualitative and quantitative as it uses both categorical data and statistical figures. The qualitative method enables a deeper understanding of individual actions and practices in the mining process, which cannot be achieved by only considering statistical figures. In contrast, statistical figures are utilized to strengthen arguments in the research.

The data for the research are gleaned from secondary literature. The secondary literature primarily comprises academic books and journal articles on gold mining in Ghana. In addition, information from news articles, governmental publications, organizational publications such as the World Bank and World Health Organization (WHO), and other non-governmental organizations (NGOs) are used. The data from these sources are valid and reliable given that interviews and other fieldwork techniques were employed in generating the data. Furthermore, the official social media platforms of relevant stakeholders of the mining sector such as the Ghana Chamber of Mines, Ministry of Lands & Natural Resources, the Minerals Commission, Environmental Protection Agency, Ghana Standards Authority, and the Parliament of Ghana are utilized in the research. This source becomes relevant for the study as new developments in the gold mining industry are posted by the various stakeholders on their official social media platforms.

The literature is then organized according to thematic categories including large-scale gold mining, local small-scale gold mining, Chinese small-scale gold mining, environmental pollution, health hazards affecting the entire community, and specific health risks related to variables such as gender and age (women and children). This helps in identifying the health and environmental consequences of the various scales of mining on Ghanaian communities. Moreover, information
on pollution, sanitation, the rate of deaths, diseases, and occupational hazards are used as the basis for understanding the health impacts of gold mining on Ghanaian communities.

1.5 Organization of the Research

The research is in seven sections, including this section which provides the introduction and background of the research. Section two: “Theoretical Framework” provides the supporting theory of the research. The theory of environmental justice is utilized as the theoretical framework. Section three: “Historical and Global Context of Gold Mining in Ghana” offers an understanding of the growth of Ghana’s gold mining industry and the context of the industry in the global system. This helps to appreciate current developments in the gold mining industry. Section four: “Structure of the Gold Mining Industry in Ghana” describes the structure of the gold mining industry, highlighting the players in the industry, methods of operation, and their various contributions to the Ghanaian economy. Section five: “Environmental Impacts of Gold Mining on Ghanaian Communities” looks at the impacts of large-scale, local, and Chinese small-scale gold mining operations on the environment of mining communities. Section six: “Health Impacts of Gold Mining Operations on Ghanaian Communities” investigates the diseases, occupational injuries, deaths, pollution and sanitation associated with large-scale, local and Chinese small-scale gold mining operations. The final section, section seven: “Conclusions,” provides a summary of the study and the limitations of the research. Also, it suggests areas warranting further research.
Section 2: Theoretical Framework

2.1 Introduction

This section looks at the theoretical framework for the research. The theoretical framework provides the supporting theory of the research. The theory of environmental justice is used as a framework for interpreting data in the research, with the aim of addressing the research problem. Also, the section explores the association between environmental justice and occupational hazards. This association is utilized as the basis for understanding why the residents of mining communities venture into accident-prone jobs like galamsey, which frequently leads to their deaths. Galamsey is synonymous with illegal small-scale gold mining (an adulterated version of the English phrase ‘gather them and sell’) in Ghanaian parlance. This section provides the structure of the research and also establishes the significance of the research.

2.2 Theoretical Framework

The intellectual framework for the research is the theory of environmental justice. A theory “seeks to explain, and predict, the phenomenon of interest” (Haugh, 2012, p. 8). The theoretical framework serves as structure that supports the theory of the research (Ennis, 1999; Eisenhart, 1991). It also justifies the importance of the research (Lederman & Lederman, 2015). In other words, “It serves as the structure and support for the rationale for the study, the problem statement, the purpose, the significance, and the research questions” (Osanloo & Grant, 2016, p. 12). As Ennis defines it, a “theoretical framework is a structure that identifies and describes the major elements, variables, or constructs that organize your scholarship” (Ennis, 1999, p. 129). The theory of environmental justice will therefore be used as a framework for understanding, analyzing, and designing ways to investigate the health impacts of local and Chinese small-scale gold mining operations on Ghanaian communities.
Environmental justice theory emerged mainly from traditional environmental movements' focus on only preserving and protecting nonhuman natures to the disregard of environmental risks, which could considerably impact the people of affected communities (Kojola & Pellow, 2020). The theory drew inspiration from environmental justice movements led by people of color in the 1970s; it foregrounds the intersections of social inequality and environmental quality (ibid). The theory now expands to produce ways of ruminating about the intersections of social inequality and environmental injustices that “impact people along intersecting axes of class, race, gender, sexuality, ability, indigeneity, and citizenship, among others” (Kojola & Pellow, 2020, p. 3). Thus, the theory supposes that the burdens and benefits of the environment are distributed unequally. And these burdens are endured by marginalized people in society such as women, people of color, queer persons, indigenous and low-income people (Watson et al., 2020; Brosemer et al., 2020; Mascarenhas, 2007; Cannon, 2002; Collins et al., 2017). According to Landrigan et al. (2010), “Environmental injustice is the inequitable and disproportionately heavy exposure of poor, minority, and disenfranchised populations to toxic chemicals and other environmental hazards. Environmental injustice contributes to disparities in health status across populations of differing ethnicity, race, and socioeconomic status” (p. 178).

Quite a number of scholars have explored environmental justice topics. Canon (2002), for example, talks about the economic and gender disparities in Bangladesh that make women more vulnerable to environmental disasters such as cyclones and floods. Aside from their inability to withstand disasters, gender disparities in Bangladesh also diminish women’s capacity to recover from such disasters. Also, in their discussion of the social determinants of health, Watson et al. (2020) claim that in addition to living in unhabitable environments, people of color face several institutional inequalities which negatively affect their health. Hence, this explains why people of
color are disproportionately impacted by COVID-19. Moreover, Brosemer et al. (2020) divulge the fact that people in many areas of the world lack access to basic energy services, and in most cases, these areas are the sites for extracting resources for producing energy services. They cite Native American communities that have long endured the extraction of energy resources, yet lack the adequate supply of energy services. Lastly, Mascarenhas (2007) remark that First Nations in Canada have fared badly in major life outcomes. This is partly demonstrated by the fact that, as of 2007 there were “as many as 95 First Nations reserves that must boil their drinking water because it [was] unsafe to drink” (Mascarenhas, 2007, p. 571).

The current condition of mining communities in Ghana provides an exemplary situation of environmental injustice (Aboagye, 2014; Amponsah-Tawiah & Dartey-Baah, 2011). Given the centuries of gold mining in Ghana (Allen, 1958), it is reasonable to expect that the communities in which the gold is extracted will experience some form of development and improvement in the well-being of the inhabitants. In contrast, despite the billions of dollars accumulated from the gold mining sector (Chamber of Mines, 2019), mining communities still linger in abject poverty and worsening livelihood (Aboagye, 2014). To augment the injustice, the burdens of the mining operations, like environmental pollution and impaired health, are inflicted on the residents of mining communities (Usman et al., 2021). Amponsah-Tawiah & Dartey-Baah (2011) assert that “the gains from the sector in the form of increased investment and foreign exchange earnings are being achieved at some significant environmental, health and social costs to the people living in mining communities” (p. 66). Therefore, Frost’s (2019, p. 135) statement that “Extractive profits are overwhelmingly diverted to non-indigenous industry owners and workers while externalities are dumped on the local, primarily indigenous population” adequately captures the state of mining communities in Ghana.
Mining communities in Ghana are not homogenous and therefore are differently affected by mining operations. In this research, a mining community refers to all communities which are directly and indirectly affected by gold mining. This definition is irrespective of the scale of mining in the community as the research considers the impacts of the various scales of gold mining. Given that mining in Ghana mostly takes place in rural areas, most people residing in mining communities are farmers (Aboagye, 2014; Jnr et al., 2016). The arrival of mining companies in the country alongside the extension of their operations have led to the displacement of these farmers (Akabzaa & Darimani, 2001; Jnr et al., 2016; Ofosu-Mensah, 2011), who are often not compensated for the lands lost (Aboagye, 2014). Also, there are youths in mining communities, whom as a result of the scarce opportunities in these communities, venture into galamsey to make a living (Andrews, 2015; Tejan-Sie, 2020). This is despite the glaring dangers like injuries and deaths involved in galamsey. Moreover, there are children who participate in small-scale gold mining in order to sponsor their education (Hilson, 2010). In addition, there is the increasing participation of women in small-scale mining (Teschner, 2012; Andrews, 2015; Arthur-Holmes, 2020). According to Teschner (2012), most of these women are employed in labor-intensive and harmful aspects of the mining process. Some women are not directly involved in mining operations; these women sell foods and assorted goods to the miners (Akabzaa & Darimani, 2001). Besides, there are commercial sex workers, some of whom travel to mining communities in the search of jobs. The absence of jobs thus coerces them into prostitution (Amponsah-Tawiah & Dartey-Baah, 2011). Therefore, given the complex make-up of mining communities, the residents are differently impacted by the presence of gold mining.
2.2.1 Environmental Justice & Occupational Hazards

The theory of environmental justice offers a different standpoint for tackling occupational hazards. Several studies demonstrate that disadvantaged people are more likely than the rest of the population to work in hazardous occupations (Spiegel, 2009; Friedman-Jiménez, 1993; Murphy-Greene, 2002). This form of employment increases the risk of occupational diseases and injuries for the marginalized people in society. While these people could reject dangerous jobs like the rest of the population, financial hardships often serve as an obstacle for them to reject or leave dangerous jobs. As Friedman-Jiménez (1993) puts it “Low wage workers and workers of color may be less able than the general population to leave or refuse dangerous or obviously health-damaging jobs” (p. 608). The same situation was discovered by Murphy-Greene (2002) among the farm workers of Florida, U.S.A. as the absence of opportunities and skills for less-risky jobs keep workers in a “cycle of poverty with poor health and low-educational levels” (p. 306). This makes occupational health a fundamental aspect of environmental justice (Friedman-Jiménez, 1993).

Given the poverty and worsening livelihood in mining communities in Ghana (Aboagye, 2014), a good number of people in these communities resort to galamsey as a means of subsistence (Andrews, 2015; Tejan-Sie, 2020). This is despite the risky nature of galamsey which occasionally leads to deaths and injuries (Basu et al., 2015; Kyeremanteng-Amoah & Clarke, 2015). Unofficial estimates show that an average of one galamseyer dies weekly (Boiko-Wayrauch 2010). Yet, these galamseyers opt to embark on galamsey due to the hardships in their communities. The state of mining communities is expressed by one galamseyer who posits that “You have to work so you can eat. You see, the mining companies don’t help us. They have to employ us to work with them, but they will go and bring people from Kumasi and Accra, . . . even the Volta Region. We are here, and they give us nothing” (Andrews, 2015, p. 12). Another galamseyer also claims that “There are
no jobs available that is why they have involved themselves in the galamsey...there are some people that will starve if they do not go to do galamsey even for a day, which is very sad” (Tejan-Sie, 2020, p. 33). Also, Hilson’s (2010) study on child labor at small-scale gold mining sites in northern Ghana provides insights into the state of mining communities. Contrary to the widespread belief that children’s involvement in small-scale gold mining discourages them from attending school, the study revealed that children rather worked at the mines to financially support their education. Therefore, denied the benefits of their environment, inhabitants of mining communities exploit the few survival options, including embarking on galamsey which occasionally leads to their deaths.

2.3 Conclusion

This section has considered the theoretical framework of the research. The theory of environmental justice is utilized as the framework or conceptual basis for understanding, analyzing, and designing ways to investigate the impacts of local and Chinese small-scale gold mining activities on the health of Ghanaian communities. Also, the link between environmental justice and occupational hazards enables a more profound understanding of the drivers of illegal small-scale gold mining. In all, this section provides the structure of the research in addition to justifying the essence of the research.
Section 3: Historical and Global Context of Gold Mining in Ghana

3.1 Introduction

This section provides an insight into the historical legacy and global context of gold mining in Ghana. Gold mining in Ghana dates to the 15th century. In the colonial era, British and foreign investors controlled the mining sector. However, the post-independence period was characterized by state ownership of mineral resources. Consistent decline in the production of gold during this period necessitated a reformation of the sector, which returned the sector to foreign interests. The growing dominance of China in Africa is felt in Ghana, with a legion of Chinese miners involved in the small-scale gold mining sector. This section attempts to track the evolution of the mining industry from the colonial era to today to understand the current trends in the industry.

3.2 Pre-Independence

The historical value of gold mining to the Ghanaian economy has long been recognized. As a matter of fact, the country’s colonial name, Gold Coast, reflects the essence of the precious mineral (Agbesinyale 2003; Akabzaa 2000). Gold mines can be found in approximately 51,800 km² of Ghana’s total land size of roughly 239,400 km² (Mireku-Gyimah & Suglo, 1993). The inception of gold mining in the country is undocumented. The first record of gold mining is from 1471, with the arrival of the Portuguese (Allen, 1958). During that time, most of the gold traded by Africans was acquired from streams and beach sand, where it had been deposited by rivers and rains (Allen, 1958; Ofosu-Mensah, 2011). Later in the 18th century, Africans began working on auriferous layers and washing for alluvial gold (Allen 1958).

Most auriferous soils in Ghana can be found within the Akan inhabited regions. European sources confirm that gold could be found on the surface of the gold-rich Akan states in the precolonial days. Hence, gold mining was a backbone of several Akan states (Ofosu-Mensah,
To identify the mineral, the people frequently observed the lands adjoining rivers and streams. Moreover, some species of vegetation were suspected to connect with gold-bearing soils. In addition, some elders remarked that ancestors could reveal gold in one’s dreams. Employing simple but productive technology in their mining exploits, the Akan could produce gold in larger quantities, which was then exported to North Africa and Europe (Ofosu-Mensah, 2011). Between 1493 and 1600, Ghana accounted for 36% of total gold produced in the world (8,153,426 ounces) (Tsikata, 1997).

Large-scale gold mining by the British and other foreign investors in Ghana began in the late 19th century (Hilson, 2004; Akabzaa & Darimani, 2001). British mineral policies in Ghana were specifically aimed at ensuring successful mining operations and augmenting the self-sufficiency of the British Empire (Akabzaa & Darimani, 2001). Most mining methods utilized by the Africans were abandoned by the Europeans on the grounds that they were unsophisticated and ineffective (Ofosu-Mensah, 2011). From 1918–1929, gold production in Ghana fell due to labor scarcity (Akabzaa & Darimani, 2001). This hitch emanated from the burgeoning cocoa industry which offered higher wages than the mining firms. Also, the Akan abhorred underground mining; they believed that such mines held evil spirits and was an activity largely associated with slaves (Ofosu-Mensah, 2011). Moreover, the thriving rubber plantation in Liberia limited the supply of Kru (an ethnic group in Liberia) workers to Ghana, thus further reducing the labor available for the production of gold (ibid.).

Equipped with traditional and modern methods of mining, such as the use of mercury and cyanide solutions, some Ghanaians fled the European firms to start their own mining operations (Ofosu-Mensah, 2011). This greatly exacerbated the issue of labor scarcity in the mining industry. In response, the British passed the Mercury Ordinance of 1932 to prohibit Ghanaians from using...
mercury for mining. The ordinance represents the commencement of banning small-scale gold mining in the country. Output from the large-scale mining sector increased as more workers became available. Nonetheless, the charged political climate due to the unyielding struggle for independence plummeted the country’s gold production from 1943 to 1954. The unrest persuaded several investors to migrate to new key producing countries (Akabzaa & Darimani, 2001). After independence, government efforts focused on the smooth running of the mining industry.

3.3 Post-Independence

Dr. Kwame Nkrumah became Ghana’s prime minister in 1957 and subsequently its first president in 1960. His socialist policies, which gave the state a greater control of the industries in the country were mostly disregarded by the national liberation council (NLC), which toppled his government in 1966. The NLC opened the economy and privatized some fruitless state-industries, as advised by the IMF. The ensuing government, led by Dr. Kofi Busia (1969-72), equally liberalized the economy to woo investors. However, Busia’s government ran into a grave trade deficit, undermining any efforts to fix the economy. In 1972, the national redemption council (NRC), led by General Ignatius K. Acheampong, ousted the Busia government. Many Ghanaians were unhappy with the Acheampong government as corruption and mismanagement became so rife. In 1978, Acheampong was deposed in a palace coup by General F.W.K. Akuffo. Akuffo’s government was similarly accused of corruption and mismanagement. In 1979, Akuffo’s government was toppled by some young soldiers headed by Flight Lieutenant Jerry Rawlings. After three months, Rawlings handed over power to Dr. Hilla Limann. Limann’s government encountered great economic problems alongside widespread corruption. Therefore, in 1981, Rawlings overthrew the Limann administration and acceded to the governorship of the country.
Rawling’s administration is credited with contemporary decentralization with the passing of the 1987 Local Government Law (PNDC Law 207) (Antwi-Bosiako, 2010), which has several implications for the mining industry. The law was fused into the 1992 Constitution of Ghana and the Local Government Act of 1993, Act 462. In the attempt to transfer power from the central government to local authorities, the government through its’ decentralization initiative, established state agencies, including the Regional Coordinating Council, the Metropolitan/Municipal/District Assembly (MMDAs), and Unit Committees. Hundred and ten districts were then created in all the regions in the country in 1988/89. Two-thirds of the district assembly are elected by the people and one-third are appointed by the central government plus a district chief executive for each of the 110 districts (Antwi-Bosiako, 2010). According to the Local Government Act of 1993, Act 462, the main function of the MMDAs is to exercise political and administrative authority in the district, provide guidance, give direction to, and supervise the other administrative authorities in the district. The local government law is however problematic in that it neither specifies the relationship between the MMDAs and chiefs nor allows for the institutional representation of traditional authorities in the district assembly (Adjei et al., 2017). The dissonance between the state and customary institutions creates numerous problems. In regards to the mining industry, the constitution assigns the control of natural resources transactions to state actors while chiefs are the owners of these same lands. This creates an institutional discord between state actors and traditional rulers, giving agency to actors operating from both formal and informal institutions for their personal gains (Boafo et al., 2019). Although chiefs are excluded from the licensing process, mining activities cannot be undertaken without their consent. In many cases, illegal miners acquire mining concessions by only engaging with the chiefs. This is substantiated by Bach (2014), who found that Chinese miners in Amansie West claim to operate legally after negotiating concession
deals with the chiefs. Also, high-ranking and local government officials are involved in protecting Chinese miners and facilitating their activities in exchange for money (Crawford & Botchwey, 2017; Botchwey et al., 2018). Hence, Boafo et al. (2019) argue that the dissonance between the state and customary institutions is responsible for the influx of Chinese miners in Ghana’s small-scale mining sector. This further lends credence to the statement that mining communities are differently impacted by the presence of gold mining.

Due to the country’s incessant economic problems, Rawlings sought the assistance of the international community. In 1983, partnering with the IMF and the World Bank, the Rawlings’s régime established an economic recovery program (ERP) to boost Ghana’s economy (Sarpong, 2010). Prior to the launch of the ERP, the Ghanaian government had a greater control over the mining industry. It owned 55% of shares in all large-scale mines in the country (Akabzaa & Darimani, 2001). As described by Hilson (2004), in the 1960s, the Ghanaian government had “purchased all equity shares of mines threatening to close, and had subsequently established the Ghana State Mining Corporation and obtained shares in Ashanti Goldfields, the country's largest gold producer at the time” (p. 61). Apart from those operating in Obuasi and Konongo, all other mines were managed by the state (Hilson, 2004). Most of the mines were, however, employing outdated technology and producing below capacity (Hilson & Potter, 2005). Among all the mineral resources, gold was the one suffering the most significant fall in output (Amponsah-Tawiah & Dartey-Baah, 2011). As the bedrock of the country’s foreign exchange, the Ghanaian government was compelled to prioritize the mineral sector under the ERP (Mensah et al., 2015).

Reforms of the mining sector were targeted at attracting investors and ensuring significant growth. Investors complained about the legislative and bureaucratic complexity involved in government evaluation and approval of projects (Akabzaa & Darimani, 2001). Hence, the Minerals
Commission was established in 1986 to provide all the necessary service to investors (Akabzaa & Darimani, 2001). The Commission recommends “mineral policy, advises government on mineral matters, reviews and promotes mining sector activities” as its main duty (Sarpong, 2010, p. 73). Also in 1986, the government enacted the Minerals and Mining Law to open the sector and offer many benefits to would-be investors, including low investment taxes for the first year of operation; total assumption of pre-production costs; and removal of import duties on mining equipment (Hilson & Potter, 2005). The government then sold a greater number of shares of state-owned mines to private investors (Amponsah-Tawiah & Dartey-Baah, 2011).

A further slate of legal and policy revisions to facilitate mining operations were introduced in the latter 1980s. In addition to the declaration of the Minerals and Mining Law and the establishment of the Mineral Commission in 1986, the government also passed the Additional Profit Tax Law, 1985; the Minerals and Royalty Regulations, 1987; the Small-Scale Gold Mining Law, 1989; the Precious Marketing Corporation Law, 1989; and formed the Precious Minerals Marketing Corporation in 1989 (Akabzaa & Darimani, 2001). Small-scale gold mining was legalized through the Mercury Law, the Small-Scale Gold Mining Law, and the Precious Minerals and Marketing Law (Hausermann et al., 2020). These laws work together to regulate small-scale gold mining, regulate the purchase of mercury for mining activities, and provide authorized marketing channels for the minerals produced by the miners (Mensah, et al., 2015).

The reforms in the mining sector yielded significant results. Billions of dollars of foreign investments have flowed into the mining sector with companies from Australia, Canada, South Africa, and the United States owning 85% of the sector (Mensah et al., 2015). Thus, the results of the reforms have been to return the mining sector to foreign interests, much as it had been during the colonial period. In this regard, Ghana shares the fate of several African countries in the global
system of trade (Bond, 2006). The country’s long history of trading of gold and other mineral resources is barely reflected in national development (Akabzaa, 2009). In fact, the increasing trade between the African continent and the rest of the world rather impoverishes the continent (Ndikumana, 2015; Leonard and Strauss, 2003; Bond, 2006).

3.4 African States and the Global Trade System

The increasing trade across the globe does not affect all countries equally. Most developing nations are in the grip of marginalization (Sarpong, 2010; Little, 2008; Gul, 2003). Gul (2003) mentions the uneven development between developed and developing countries as responsible for precluding most developing countries from obtaining the profits of globalization. Although the advent of multinational corporations could aid host countries in gaining access to modern technology and expertise for development, direct investment by these corporations has rather proven less advantageous in developing countries (Gul, 2003). Heavily burdened by the debts, impoverished by supra-national actors, developing countries are highly susceptible to the devastating negative effects of globalization (Porter & Sheppard, 1998).

Leonard and Strauss (2003) posit that Africa’s interactions with the international system have rather stymied the continent’s efforts for development. According to Arrighi (2002), African countries were “invited to play by the rules of an altogether different game, that is, to open up their national economies to the cold winds of intensifying world-market competition” (p. 23). Arrighi’s claim is shared by Little (2008, p. 149), who states that “Africa was forcefully supplied neoliberalism.” Brown (2007) contends that the source of Africa’s inability to accrue the benefits from the global trade boils down to the colonial division of labor that was designed for the continent. Thus, after attaining independence, African political leaders took over economies that had already been structured by colonial interests. Brown’s (2007) argument is confirmed by the
fact that despite the significant increase in trade, Africa's share in global trade remains very small (Ndikumana, 2015). For instance, by 2013, “Africa's share in world trade was only 2.8 percent, a decline from 6 percent in 1950 and 4.8 percent in 1980” (Ndikumana, 2015, p. 9). Apparently, global trade has been designed in a way that restricts Africa’s role to the supply of primary goods like minerals and agricultural products (Ndikumana, 2015; Rodney, 1981 cited in Sarpong, 2010).

The recent decades have experienced a rapid upsurge of Chinese investors participating in several African economies (Bond, 2006). Western capitalist nations’ participation in African economies is steadily waning in comparison to their peers from China, who are moving into the resource sectors of developing areas, mostly sub-Saharan Africa (Wegenast et al., 2017).

### 3.5 Sino-Africa Relations

Since the 1990s, when China implemented its ‘Going Out policies,’ the country’s ‘foreign relations’ with advanced economies have undergone a significant change, with a larger focus now shifted to the economies of developing countries, including those in sub-Saharan Africa (Hess & Aidoo, 2016, p. 308). China’s trade with African countries gained momentum at this time, growing “from 2 percent to 9 percent” (Bond, 2006, p. 9). China is now Africa’s largest trading partner, “with a trade volume of USD 172 billion in 2015 after a peak of USD 216 billion in 2014” (CARI 2017a as cited in Wegenast et al., 2017, p.6). The country’s mission to garner mineral resources to enhance economic growth (Foster et al., 2008) underlies its engagement in African economies, where minerals resources remain largely untapped (Hess & Aidoo, 2016). Increasing Chinese trade in Africa has spurred two diametrically opposing views by scholars. The optimists, who see Chinese influence in the continent as presenting opportunities for African development; and the pessimists, who view growing Chinese influence as representing a scary threat to host counties, paralleling the “scramble for Africa” (Naidu & Mbazima, 2008; Hess & Aidoo, 2016). The view
of the pessimists is downplayed by scholars who posit that Chinese exploits in Africa are not led by the Chinese government but rather private individuals, operating beyond scope of the Chinese government (see Loubere, 2018; Antwi-Boateng & Akudugu, 2020). It is however difficult to concur with the position of these scholars that the Chinese government plays no role in the dominance of Chinese nationals in Africa. For instance, the Chinese government could have put a stop to the influx of Chinese miners in Ghana’s small-scale gold mining sector given that the laws of Ghana exclusively forbid foreign participation in small-scale mining.

Indeed, African countries could benefit from the intensified trade with China, as the latter could provide the needed technology and capital for economic growth (Wegenast et al., 2017). In fact, “The continent is vulnerably dependent on China for trade, infrastructure development, and foreign aid, including COVID-19 emergency support estimated at US$280 million” (DW, 2020 as cited in Tettey, 2020, p.4). However, Chinese activities cause dissatisfaction in host communities (Wegenast et al., 2017; Bond, 2006). Chinese mining operations in particular have caused protests in several African countries, including Nigeria, Namibia, Zambia, Chad, Ghana, and others, over environmental damage and poor working conditions (Wegenast et al., 2017). In Ghana’s case, Chinese gold mining is highly associated with environmental pollution (Crawford & Botchwey, 2016; Botchwey et al., 2018). Also, one fundamental strategy of Chinese engagement in Africa is Beijing’s soft power (Naidu & Mbazima, 2008; Hess & Aidoo, 2016). China’s soft power is cited by some scholars as the reason why Chinese nationals are able to partake in Ghana’s small-scale gold mining sector despite laws forbidding foreigners (Hess & Aidoo, 2016; Antwi-Boateng & Akudugu, 2020). According to Hess and Aidoo (2016), Ghana’s gold mining reveals “Beijing’s reactions as coercive diplomacy that undermines its ideals of South–South allegiance and the noninterference doctrine, both cornerstones of China’s foreign policy toward Africa” (p. 323).
3.6 Conclusion

This section has discussed the developments in Ghana’s mining sector from the colonial era to date. As mentioned, the country has a long heritage of gold mining. During the colonial era, the sector was largely controlled by the British and foreign investors. After a period of decline under state control, the sector was reformed in 1986 to enable growth, which returned it to foreign interests. The growing influence of China in Africa has introduced new players in Ghana’s mining industry. Currently, Ghana is the top producer of gold in Africa and ninth in the world (Minerals Commission, 2021).
Section 4: Structure of the Gold Mining Industry in Ghana

4.1 Introduction

The section details the structure of the gold mining industry in Ghana. Mining operations in the country can be grouped into large-scale and small-scale gold mining. The large-scale mining companies own 85% of the industry and the rest is owned by the state of Ghana and small-scale gold miners. Despite the passing of the Small-Scale Gold Mining Law in 1989, the government’s effort to regulate the small-scale gold mining sector remains minimal. The licensing process has been described by small-scale miners as cumbersome, hence most of them choose to operate illegally. Also, there has been significant participation of Chinese miners in the sector which flouts the Minerals and Mining Act, 2006. The section investigates the various players in the gold mining industry, the methods employed in mining gold, and their contributions to the Ghanaian economy.

4.2 Large-Scale Gold Mining

The reforms of the mining sector began producing significant results in 1998 as the country witnessed a surge in the number of companies prospecting for gold (Jnr et al., 2016). At present, there are 14 mining companies involved in gold exploration in Ghana (Minerals Commission, 2021). Table 1 below provides a list of the major mining companies in Ghana:

<table>
<thead>
<tr>
<th>Mining Company</th>
<th>Country of Origin</th>
<th>Area of Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AngloGold Ashanti (Ghana) Ltd.</td>
<td>South Africa</td>
<td>Obuasi</td>
</tr>
<tr>
<td>AngloGold Ashanti (Iduapriem) Ltd.</td>
<td>South Africa</td>
<td>Tarkwa</td>
</tr>
<tr>
<td>Gold Fields Ghana Ltd.</td>
<td>South Africa</td>
<td>Tarkwa</td>
</tr>
<tr>
<td>Abosso Goldfields Ltd.</td>
<td>South Africa</td>
<td>Damang</td>
</tr>
<tr>
<td>Golden Star Resources Ltd.</td>
<td>Canada</td>
<td>Prestea/Bogoso</td>
</tr>
<tr>
<td>Company Name</td>
<td>Country</td>
<td>Location</td>
</tr>
<tr>
<td>------------------------------------</td>
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</tr>
<tr>
<td>Golden Star Resources Ltd.</td>
<td>Canada</td>
<td>Wassa</td>
</tr>
<tr>
<td>Newmont Ghana Gold Ltd.</td>
<td>U.S.A.</td>
<td>Kenyasi</td>
</tr>
<tr>
<td>Newmont Golden Ridge Ltd.</td>
<td>U.S.A.</td>
<td>Akyem</td>
</tr>
<tr>
<td>Chirano Gold Mines Ltd.</td>
<td>Canada</td>
<td>Chirano</td>
</tr>
<tr>
<td>Adamus Resources Ltd.</td>
<td>Australia</td>
<td>Teleku Bokazo, Nzema</td>
</tr>
<tr>
<td>Perseus Mining (Ghana) Ltd.</td>
<td>Australia</td>
<td>Ayanfuri</td>
</tr>
<tr>
<td>Asanko Gold Mine</td>
<td>Canada</td>
<td>Amansie West</td>
</tr>
<tr>
<td>Xtra Gold Resources Corporation</td>
<td>Canada</td>
<td>Kwabeng</td>
</tr>
<tr>
<td>Kibi Goldfields</td>
<td>South Africa</td>
<td>Osino</td>
</tr>
</tbody>
</table>

Source: Mineral Commission (2021)

AngloGold Ashanti’s mine in Obuasi, which began in 1890, is the oldest mine in the country (Akabza & Darimani, 2001). Gold output from the producing member companies of the Chamber of Mines, which include all the companies listed except Xtra Gold and Kibi Goldfields, totaled 2.845 million ounces in 2020. Gold fields Ghana Ltd. overtook Newmont Ghana Gold Ltd. as the highest gold producer with 18.5% of the total output in 2020 (Chamber of Mines, 2021). The Western Region of Ghana appears to be the mining hub of the country with a total of seven companies in operation. About one-third of the land area of the Region has been leased to large-scale mining companies. Roughly 31,237 km² of Ghana’s land area, constituting 13.1%, is under concession to mining companies (Jnr et al., 2016).

4.2.1 Method of Operation

Large-scale mining operations are usually large both in physical size and capacity, involving the use of heavy equipment and the latest mining technology (Garvin et al., 2009). It often requires huge capital investment, skilled workers, and high-level technology, as the miners
operate within tunnels which go deep into the earth (Mensah et al., 2015; Schueler et al., 2011). Large tunnels, sometimes about two kilometres deep, are dug deep into the ground to reach minerals that cannot be reached from the surface (Hayford et al., 2009). Recently, most of the large-scale mining companies have transitioned from underground, labor-intensive to capital-intensive surface activity (Akabza & Darimani, 2001; Amponsah-Tawiah & Darney-Baah, 2011; Yankson & Gough, 2019). AngloGold Ashanti is the one exception. It still operates an underground mine at Obuasi. All the other mines are surface mine operations (Amponsah-Tawiah & Dartey-Baah, 2011; Akabza & Darimani, 2001). Yankson and Gough (2019) argue that this transition in the large-scale miners’ method of operation explains their enduring conflicts with the small-scale miners. Formerly, both large-scale and small-scale miners worked peacefully on the same auriferous lands, as large-scale mining took place underground and small-scale mining occurred mainly on the surface. With the large-scale firms’ transition to surface mining, small-scale miners are restricted in their access to mineralized lands, triggering disputes between the two groups of miners.

4.2.2 Contributions of Large-Scale Gold Mining to the Ghanaian Economy

The large-scale gold mining industry in Ghana generates foreign exchange, government revenue, and creates direct and indirect employment. The mining sector has become the top gross foreign exchange earner since 1992 (Akabzaa and Darimani 2001). Gold took over from cocoa as the leading foreign exchange earner for the country in 2005 (Salifu et al., 2013). Gold alone contributes about 40% of the country’s gross foreign exchange earnings which is equivalent to about 5.7% of the country’s GDP (Mensah et al., 2015). In 2019, the member companies of the Chamber of Mines paid US$3.3 billion to the country, representing 73 per cent out of the mineral export revenue of US$4.5 billion (Chamber of Mines, 2019).
The sector also generates direct and indirect employment (Amankwah & Anim-Sackey, 2003). At the end of 2020, the number of direct employees and contractors of the Chamber’s producing member companies was 8,760 and 25,603 respectively. The total employee population of 34,363 comprised 444 expatriates and 33,919 Ghanaians. The total number of female employees of producing member companies was 2,752, comprising 20 expatriates and 2,732 Ghanaians (Chamber of Mines, 2021). This level of employment excludes employees not registered with the Chamber of Mines and those indirectly providing services to the producing member companies. Notwithstanding, the sector has a relatively limited capacity to generate employment owing to the transition to surface mining (Salifu et al., 2013).

Lastly, the large-scale sector generates revenue for the Ghanaian economy through the salaries, wages and other payments made to employees and contractors, corporate income taxes, royalties, concession rents, services, customs and harbor duties, ancillary levies, and social security contributions from employees and their employers (Akabzaa and Darimani 2001). For instance, in 2020, the mining and quarrying sector’s contribution to the national fiscal purse increased from US$67.2 million in 2019 to US$69.9 million in 2020. The growth was a result of the increase in mineral royalty receipts, which helped to counteract the reductions in the sector. The significant rise in the price of gold during that year increased mineral royalty revenue by 38.20 per cent from US$16.9 million in 2019 to US$23.3 million in 2020 (Chamber of Mines, 2021).

4.3 Small-Scale Gold Mining

The Minerals and Mining Act 2006 (Act 703) of Ghana defines small-scale gold mining as any method not involving substantial expenditure by an individual or group of persons not exceeding nine in number or by a co-operative society made up of ten or more persons. According to Aryee et al. (2003), “The definition therefore includes (1) what has been termed “artisanal”—
those operations using only rudimentary/artisanal implements—as well as (2) more sophisticated mining activities operating at a relatively low level of production and which generally require limited capital investment” (pp. 131-132). The Small-Scale Gold Mining Law was fused into the current Minerals and Mining Act 2006 (Parliament of the Republic of Ghana, 2006). The law entreats small-scale miners to apply to the Minerals Commission for a concession of 25 acres maximum in specified mining areas and then to obtain a license to mine. Under the law, no person shall undertake any small-scale gold mining operation unless granted a license. The law allows provision of a mining license only to Ghanaian citizens who are at least 18 years old and registered by the district center in the designated area. The Minerals Commission has established nine small-scale mining district centers to help with the licensing procedures and monitoring of operations (Bansah et al., 2016). A small-scale gold mining license for a concession of one to five acres is subject to government review and approval every three years. Concessions of five to 25 acres must be renewed every five years. Aryee et al. (2003) expound the licensing procedure. First, applicants are required to submit ten copies of a completed small-scale mining application form. Also, the site plans of the specific area must be presented to the relevant office from among the nine district centers. If there are no concerns, the completed forms are put together alongside an environmental impact assessment statement from the municipal Environmental Protection Agency (EPA), and then sent to the Minerals Commission in Accra for additional processing. After the Minerals Commission has received the stipulated fees and is content that the documents comply with the requirements, it advises the Minister of Lands and Natural Resources on whether to issue a license. Once the documents have been approved and signed by the minister, a license is delivered to the applicant. In the bid to eliminate the smuggling of gold, the Ghanaian Government, through the
Precious Minerals Marketing Corporation (PMMC), employs nearly 700 licensed buyers to purchase gold from artisanal miners at approximately standard prices (Hilson & Pardie, 2006).

Unlawfulness pervades the small-scale gold mining sector despite the government’s attempt to regulate the sector. Many small-scale gold miners operate without a license. The process of acquiring a license has been criticized by the miners as expensive and bureaucratic, hence most of them choose to operate illegally (Hilson & Adu-Darko, 2014; Crawford & Botchwey, 2016; Bansah et al., 2016; Mensah et al., 2015; Akabzaa & Darimani, 2001). In addition, the emergence of powerful informal actors, such as chiefs and landlords, further encumbers the licensing process as miners are saddled with settling official and unofficial fees (Crawford & Botchwey, 2016). This unlawfulness has engendered two groups of small-scale miners, those registered and licensed and those operating illegally (Akabzaa & Darimani, 2001). Currently, there are 30 percent registered and 70 percent unregistered mining operations across the country (Boafo et al., 2019). Figure 1 is a map that shows the districts of widespread illegal mining in Ghana. The map illustrates that almost all illegal mining sites are in regions to the south of Ghana.

Another illegality in the small-scale gold mining sector is the participation of foreigners in the sector (Antwi-Boateng & Akudugu, 2020; Crawford & Botchwey, 2017; Hausermann et al., 2020; Hess & Aidoo, 2016). This contravenes the Minerals and Mining Act 2006 which restricts the sector to Ghanaians. Although this is not a new phenomenon, the last decade has witnessed an unrivalled inundation of foreign miners in the small-scale gold mining sector, particularly from China (Crawford & Botchwey, 2017).
4.3.1 Chinese Small-Scale Gold Mining in Ghana

Contrary to popular belief, Chinese small-scale gold mining operations in Ghana, like their numerous exploits in Africa, defies the narrative of a powerful monolithic Chinese state. Chinese mining operations are rather conducted by private individuals embarking on their own adventures beyond the ambit of the Chinese government (Loubere, 2018; Antwi-Boateng & Akudugu, 2020). Antwi-Boateng and Akudugu (2020) categorize the involvement of Chinese miners in Ghana’s small-scale gold mining sector in two waves. The first wave of Chinese miners mostly come from Shanglin County, a poor region in the Guangxi province. In 2006, news spread in the county about the lucrativeness of gold mining in Ghana by some returned locals who had worked in the small-scale gold mining sector. Consequently, many local residents pooled all the financial resources at

![Figure 1. Map of Ghana showing districts of prevalent illegal mining (Source: Boafo et al., 2019).](image-url)
their disposal and travelled to Ghana (Hess & Aidoo, 2016). The travels of the Chinese miners to Ghana were riddled with illegalities. According to a Ghanaian immigration officer, many Chinese miners travelled to Ghana through Togo. Togo had a ‘no visa required’ arrangement with China. The Chinese miners then crossed the border into Ghana illegally, while others entered as tourists (Crawford & Botchwey, 2017). Most of the Chinese miners operate in the rural areas surrounding Kumasi, Obuasi, and Takoradi, (Loubere & Crawford, 2017). The second wave of Chinese miners took advantage of an ambiguity in the Minerals and Mining Act of 2006 (Act 703), which allowed foreign companies to provide support or technical services to registered Ghanaian small-scale miners. The act was later revised in 2014 to restrict the role of foreigners in providing services to Ghanaian miners (Boafo et al., 2019).

By 2013, there were almost 50,000 Chinese miners participating in Ghana’s small-scale gold mining sector (Boafo et al., 2019). That same year, an official from the Minerals Commission estimated Chinese nationals held 70% of the country’s small-scale gold mining concessions (Hausermann et al., 2020). This is astonishing given that small-scale mining is a right reserved for Ghanaian citizens (Boafo et al., 2019; Hausermann et al., 2018; Hess & Aidoo, 2016; Crawford & Botchwey, 2017). The growing participation of Chinese in Ghana’s small-scale gold mining violates the Minerals and Mining Act of 2006 (Act 703). The Act ostensibly regulates small-scale mining to ensure that it remains the preserve of the local people.

A convivial relationship existed between the Chinese miners and Ghanaians until prevalent reporting of fierce clashes between the Chinese and locals began in 2012 (Crawford & Botchwey, 2017). As they began to chalk up massive success in gold extraction, the Chinese miners became targets of local bandits and armed robbers (Ibid). This incited the Chinese miners to prepare themselves frequently with guns bought illegally from the local police and engage in firefights
with prospective thieves, leading to the deaths of both Chinese and Ghanaians (Hess & Aidoo, 2016). Therefore, in June 2013, John Mahama, Ghana’s former president, established a Task Force with the power to seize equipment used in illegal mining, arrest and extradite any foreigner without a license, and abrogate the licenses of any Ghanaians collaborating with these foreigners (Crawford & Botchwey, 2017). By July 2013, over 4,500 Chinese citizens left or were expelled from Ghana (Hess & Aidoo, 2016).

Despite the clampdown on Chinese miners by the Ghanaian government in 2013, several reports indicate that the Chinese are still involved in small-scale gold mining (Quartey, 2013; Hausermann et al., 2020). In 2019, Ghana’s President, Akufo-Addo, publicly declared that Chinese mining must end in spite of the “strong relationship” between the two countries (Hausermann et al., 2020). The persistence of Chinese mining operations unreservedly undermines the laws of Ghana. But why has the Ghanaian government failed to bring Chinese small-scale gold mining operations to an end? Scholars are divided on explaining why the government of Ghana has been unable or unwilling to do so. Some indicate the soft power of China as the reason why the government of Ghana is unable to implement its laws (Hess & Aidoo, 2016; Antwi-Boateng & Akudugu, 2020; Hausermann et al., 2020; Boafo et al., 2019). This line of argument coincides with the view that globalization weakens the sovereignty of the nation state (Julius, 1994; Sarpong, 2010; Ohmae, 1995). In contrast, other scholars insist that the persistence of Chinese mining in the country is as a result of corrupt state actors who tend to ignore their activities (Crawford & Botchwey, 2017; Loubere & Crawford, 2017; Antwi-Boateng & Akudugu, 2020; Hausermann & Ferring, 2018). In some cases, these state actors even facilitate the Chinese mining operations (Hausermann & Ferring, 2018). A handful of scholars admit that both globalization and corruption are at play (Hess & Aidoo, 2016; Antwi-Boateng & Akudugu, 2020).
4.3.2 Method of Operation

Small-scale mining is characterized by low levels of mechanization and insufficient mining and processing practices leading to poor productivity and mineral recovery (World Bank, 2004; Mensah et al., 2015). The method utilized in the mining operation is informed by the nature of the mineral deposit. Traditionally, small-scale miners employed methods including the anomabo, chisel and hammer, underground “ghetto”, and the dig and wash in their exploitation (Bansah et al., 2016). The anomabo method is employed after the rainy season when loose materials are deposited on riverbeds. The miners (often a group of two persons) obtain the auriferous gravels from the riverbeds, which are then processed for gold (Yamoah, 2002). The chisel and hammer method is utilized for mining hard rocks that are visible on the surface. Miners use the chisel and hammer to splinter the rocks into fines, which is then sluiced to obtain the gold (Tepkor, 2005). The underground “ghetto” method, which occur in old and deserted mines, is used for mining hard rocks in the earth. Miners create tunnels to reach the precious mineral. Lastly, the dig-and-wash method involves mining alluvial gold deposits along river banks, terraces, or valleys. Dug materials are washed adjacent to waterbodies (Bansah et al., 2016).

The influx of Chinese miners in small-scale gold mining has revolutionized the sector in terms of the methods employed (Botchwey et al., 2019; Boafo et al., 2019; Loubere & Crawford, 2016; Bansah et al., 2016). The manual methods have become less common with the introduction of equipment such as excavators, bulldozers, wash plants, and trench drills by the Chinese. The mechanization and intensification of the sector has enabled large areas of land to be mined within a few days (Boafo et al., 2019; Crawford & Botchwey, 2016). One innovation credited to Chinese miners is the direct excavation of gold within rivers even though river mining is illegal (Crawford & Botchwey, 2016; Botchwey et al., 2019). Bansah et al. (2016) describe the novel methods
introduced by the Chinese in the mining sector and later adopted by Ghanaian miners. These methods are locally referred to as the “changfa”, “more blade”, dredge, and alluvial washing plant. The changfa is a machine for breaking ore deposits into powdery form. A water pump connected to the changfa endlessly pumps water onto a sluice a board (usually covered with a blanket) for washing. The blanket is then washed to obtain the gold. The more blade method involves the use of excavators to mine pits, often close to waterbodies. The excavated materials are washed on a sluice board with some members fetching and pouring water onto the board. With the dredge method, the ore deposits are mined “directly by suction from the stream/river bed and transported hydraulically onto sluice boards mounted along the bank of the river for washing” (Bansah et al., 2016, p. 12). Lastly, the alluvial washing plant involves the use of two excavators and a mini washing plant. The first excavator mines the auriferous deposit and amasses it next to the second excavator. The second excavator rehandles the deposits onto the washing plant for washing.

The mechanization and intensification of small-scale gold mining has proven very lucrative for concession holders and miners. Although, it is completely against the law, licensed miners turn over their concessions to Chinese miners. Oftentimes, 15% of the value of the gold produced goes to the concession holder(s) and 85% to the Chinese miners, who almost do all the mining operation (Crawford & Botchwey, 2016). This situation supports Teschner’s (2012) argument that the perceived dichotomy between registered miners and galamseyers is illusory. In reality, the activities of both categories of miners are indistinguishable and even dependent on each other.

4.3.3 Contribution of Small-Scale Gold Mining to the Ghanaian Economy

The mechanization and intensification of small-scale gold mining has led to a consequent increase in the country’s gold output. Gold production increased sevenfold from 225,411 ounces in 2005 to 1,576,478 ounces in 2013, while the total gold production from small-scale mining also
increased from 24,795 ounces in 2005 to 567,532 ounces in 2013 (Minerals Commission, 2014). In 2014, the sector produced a stunning 1.49 million ounces of gold representing 34.3% of Ghana's total gold output (Ntibrey, 2016). Out of the 4,094,070 ounces of gold produced in Ghana in 2020, the small-scale sector produced 1,264,029 ounces (Minerals Commission, 2021).

Much of the increase in the gold output from small-scale mining can be attributed to the Chinese miners. According to the Chinese Mining Association in Ghana, an estimated 40% of the 3.6 million ounces of gold produced in Ghana in 2011 was excavated by Shanglin miners (Hess & Aidoo, 2016). In spite of dips and crackdown on Chinese mining operations, the total output of gold was maintained at 1,570,029 ounces in 2016 (Botchwey et al., 2019). In 2013, at the height of the gold rush, it was estimated that billions of yuan were transferred from Ghana to China (He, 2013 as cited in Loubere & Crawford, 2017).

The small-scale mining sector provides jobs to a plethora of people who would otherwise be unemployed. Following the declaration of the Small-Scale Gold Mining Law, 1989, the number of small-scale miners increased by a whopping 941.73% from 1984 to 2004 (Ministry of Lands, Forestry and Mines). The sector directly employs nearly one million people and supports the livelihoods of about 4.5 million people. Most people participate in galamsey in order to survive the hardships they endure (Andrews, 2015). Women comprise half the workforce in the sector and are subject to discrimination (Hilson, 2001 as cited in Teschner, 2012; Yakovleva, 2007 as cited in Andrews, 2015). According to Teschner (2012), only a handful of women hold management and ownership positions and most of them are employed in the most labor-intensive and harmful aspects of the mining operation. In addition, the sector generates considerable numbers of indirect jobs in other sectors of the economy owing to the demand created for production inputs, transport, and other services (Amankwah & Anim-Sackey, 2003).
4.4 Conclusion

The section has described the structure of the gold mining industry in Ghana. The structure mirrors a pyramid with few foreign companies operating at the top and many small-scale miners operating below. Illegality dominates in the small-scale gold mining sector as many miners operate without a license. Also, the advent of significant participation of Chinese miners in the sector breaches the Minerals and Mining Act, 2006. Chinese miners have had a massive impact in the small-scale gold mining sector, including mechanization and intensification of gold production. Nonetheless, the gold mining industry, comprising both large-scale and small-scale operations, constitutes the backbone of the Ghanaian economy.
Section 5: Environmental Impacts of Gold Mining on Ghanaian Communities

5.1 Introduction

This section considers the environmental impacts of gold mining on nearby communities. Undoubtedly, the gold mining sector is the backbone of the Ghanaian economy, generating foreign exchange, employment, and revenue among other benefits. Nonetheless, a growing literature suggests that the success of the sector is being achieved at a significant cost to mining communities. While they rarely benefit from mining activities, mining communities endure severe environmental pollutions associated with mining, including land degradation, water, air and noise pollution. The advent of Chinese miners has exacerbated the pollution already caused by large-scale and local small-scale miners to the environment. This section looks at the environmental impacts of the various scales of mining operations on mining communities.

5.2 Environmental Impacts of Large-Scale Gold Mining on Mining Communities

The large-scale gold mining sector plays a pivotal role in the success of the Ghanaian economy. The country derives a bulk of its foreign exchange and revenue from large-scale gold mining. However, research demonstrate that the sector’s noteworthy contribution to the Ghanaian economy is attained at some substantial cost to mining communities. The ensuing subsections look at the environmental harms inflicted on mining communities as a result of large-scale gold mining.

5.2.1 Loss of Agricultural Land and Land Degradation

Vast areas of agricultural land are being lost due to large-scale gold mining. In the Tarkwa, Bogoso/Prestea and Damang concessions, 4,935 hectares, constituting 25.5% of Bogoso/ Prestea and Damang and 5% of the Tarkwa Nsuaem municipality’s total agricultural land, is lost owing to large-scale gold mining (Emmanuel et al., 2018, p. 48; Jnr et al., 2016). Farming is banned on concessions unless permitted by the mining companies. At places where permission is granted,
farmers are restricted to growing seasonal crops to preclude any form of compensation if mining operations extend to such places (Ofosu-Mensah, 2011). During their field study Usman et al., (2021), discovered that the lands and soils in the mining communities of the Ellembrulle District have been excessively damaged by large-scale gold mining activities. The activities of Adamus Resource Ltd., such as excavation and deep drilling, have resulted in loss of vegetation and decrease in soil quality in host communities. Vegetation loss in host communities like Salman, Anwia, Telaku-Bokazo, and Nkroful has engendered frequent soil erosion and gullies, less groundwater recharge and several other problems (Usman et al., 2021). Also, Emmanuel et al. (2018) report that the mining activities of Newmont has created severe land degradation in Kenyasi as shown in figure 2. Similarly, the activities of AngloGold Ashanti in Obuasi have degraded the lands in nearby communities like Kokotenten, Dokyiwaa, and Nhyaeso (Wan, 2014). Residents of mining communities, who are mostly farmers, bear the cost of large-scale gold mining as their lands are either lost or rendered unfertile for agricultural functions.

Figure 2. Blast loosening at Newmont’s Kenyasi mine site. (Source: Stohr, as cited in Environmental Justice Atlas, 2018).
5.2.2 Water Pollution

Cyanide pollution of water resources by large-scale mining activities are rife in mining communities (Amponsah-Tawiah & Dartey-Baah, 2011). The mining communities in the Western Region of Ghana are heavily impacted by mining operations as cyanide spills and leakages by companies such as Goldfields Ghana Ltd and AngloGold Ashanti have contaminated Anikoko Angonabe, Bodwire and Assaman rivers (Mensah et al., 2015). In their study, Usman et al. (2021) notice that the operations of Adamus Resources Ltd. have severely polluted rivers and streams like Subri, Anwiabaka, Bruma, Angajaleh, Kandagale, Bangara, and Kowire. Some residents of Nkroful, Salman, and Teleku-Bokazo claimed that they occasionally found dead fishes at the shores of rivers and streams with poisonous effluents from mines site (Usman et al., 2021). Sewage discharge from AngloGold Ashanti’s Pompora Treatment Plant into river Kwabrafo, a tributary of the Jimi River, has equally polluted these rivers and dispossessed residents of communities such as Sanso, Odumasi, Akofuom, and Jimiso Kakraba of potable water supply (Action Aid, 2006). The Executive Director of the Wassa Association of Communities Affected by Mining (WACAM) narrates that in 2004, Golden Star Resources spilled cyanide into River Apere which flows into rivers such as Egya Nsiah, Bemanyah, Manse, and Ankobra. The cyanide spillage affected Dumasi and other towns namely Goloto, Juaben and Egyabroni (Asumin, 2005 as cited in Singh et al., 2007). According to a study published by the Commission on Human Rights and Administrative Justice (CHRAJ) in 2008, access to water is a problem in several communities as many rivers and streams have either been contaminated or dried up. The study noted significant cyanide spillage from mining companies into the rivers and streams.

5.2.3 Noise Pollution

Noise is inherent in the mining process owing to the use of heavy machinery and frequent operations like excavation and blasting (Salifu et al., 2013; Usman et al., 2021). Host communities
in the Ellembelle District endure extreme noise and strong vibrations, mainly from the blasting activities of Adamus Resources Ltd. The excessive noise and vibrations have affected buildings in these communities, especially in Nkroful and Anwia, with detectable cracks on structures (Usman et al., 2021). Similarly, in Obuasi and Prestea, blasting activities of mining companies have caused cracks in several buildings (CHRAJ, 2008). Another major source of noise pollution in Prestea and Obuasi is the movement of heavy trucks to and from the mining sites (CHRAJ, 2008). This source of noise was also shared by respondents from Nkroful and Telaku-Bokazo (Usman et al., 2021).

5.2.4 Air Pollution

Usman et al. (2021) discover that air pollution in Nkroful, Telaku-Bokazo, Anwia, Aluku, and Salman emanates from several mining activities, especially dust from untarred roads. Fumes and chemicals from vehicles and processing plants, dust and chemicals from excavation, blasting, and loading of ores constitute another source of air pollution in these communities. In Kenyasi, Newmont’s transport of heavy machinery and other equipment on untarred roads is a major source of air pollution. Besides, chemicals used for blasting activities are released into the air (Emmanuel et al., 2018). Complaints about dust pollution seems ubiquitous in all mining communities. Apparently, mining companies are frivolous about suppressing dust; they only control dust in areas close to their active operations (CHRAJ, 2008).

5.3 Environmental Impacts of Local Small-Scale Gold Mining

Local small-scale gold miners consist of Ghanaians who operate with a license and galamseyers. On the one hand, the small-scale gold mining sector has proven to be important to the Ghanaian economy, providing jobs to many people. On the other hand, the activities of the
miners significantly deteriorate the environment of surrounding communities. The following subsections review the impacts of small-scale gold mining on the environment.

5.3.1 Land and Vegetation Degradation

Coomson (2004) claims that land degradation is the main impact of small-scale mining on the environment in Ghana. Coomson’s claim is consistent with that of Mensah et al. (2015) and Schueler (2011), who observe that small-scale gold mining engenders the elimination of vast quantities of vegetation and mass deforestation in Ghana. Land degradation appears to be common at several slipshod small-scale mining sites (Aryee et al., 2003). According to Boadi et al. (2021), galamsey activities by people in Ataso and Nnwerem have degraded an estimated 4.4% of the total area (56.67 km²) of the Offin shelterbelt forest reserve (p. 117). Per their projection, 0.88% of the reserve is being degraded annually strictly by galamsey activities. Figures 3 shows the severity of land degradation at galamsey sites. Moreover, the surface mining method employed by small-scale miners leads to the removal of huge volumes of topsoil, leaving the land to succumb to erosion (Mensah et al., 2015; Aryee et al., 2003).

Figure 3. Land degradation at a galamsey site (Source: Ghana News Agency, 2020).
Furthermore, materials dug from the mining sites, also termed as overburden, are treated haphazardly by the miners. In Kessey and Arko’s (2013, p. 20) study, 34% of the miners stated that they just leave overburden around the pit. Exposed minerals in the removed overburden combine with oxygen and become acidic. During erosion, an acidic solution, also known as tailing, is formed. It endangers the biodiversity within the mining areas. Also, small-scale underground mining is associated with environmental problems for the host communities. Excavated pits are often not backfilled and then they are abandoned after mining operations. As a result, these pits become breeding grounds for mosquitoes and deathtraps for farmers, hunters, and animals in the host communities (Bansah et al., 2016; Aryee et al., 2003).

5.3.2 Water Pollution

Small-scale mining of alluvial gold is considered to be the principal cause of river water pollution in Ghana (Aryee et al., 2003). Among small-scale miners, the activities of galamseyers are believed to significantly deteriorate waterbodies (Mensah et al., 2015; Emmanuel et al., 2018). Major rivers such as Ankobra and Asesree, which served as the main sources of water for nearby communities, have been heavily polluted by galamsey activities (Mensah et al., 2015). Figure 4 shows the state of river Ankobra. Also, galamsey operations have affected the quality of river Bonsa, which was formerly relied on by farmers and fishermen in close communities for the source of their livelihood (Emmanuel et al., 2018; Bansah et al., 2016). The methods of operation employed by small-scale miners are highly associated with water pollution. Siltation is widespread in major rivers and streams where small-scale miners operate as they wash alluvial gold in the water (Bansah et al., 2016). Moreover, inappropriate disposal of tailings pollutes the waterbodies (Aryee et al., 2003). In Kessey and Arko’s (2013) interview with 44 licensed small-scale miners about how they handle tailings, 21% of the miners treat tailings before releasing into rivers whereas
27% amass it in pits. The remaining 52% sent tailings into rivers with no treatment, thus gravely polluting the rivers. Also, the removal of vegetation constitutes a potential source of water pollution as soil erosion increases the turbidity of surface runoff (Aryee et al., 2003). Furthermore, the use of mercury in the gold amalgamation process threatens the waterbodies in mining communities (Clifford, 2017; Emmanuel et al., 2018; Tulasi et al., 2021; Kessey & Arko, 2013).

To extract gold from its ore, the mineral is mixed with mercury to form an amalgam which is then heated to separate the gold. Kessey and Arko (2013) ascertain that both licensed miners and galamseyers leave the residue of the amalgamation process on the ground, which finds its way into the rivers. Therefore, it is no accident that 54% of the water samples analyzed by Clifford (2017) from active small-scale mining sites are harmful to fishes and unsafe for drinking. In addition, high levels of methylmercury (MeHg) were found in river Aprepre owing to the use of cyanide and mercury by small-scale miners (Tulasi et al., 2021). Lastly, miners often divert the natural courses of rivers and streams to facilitate their operations. This deprives communities along the rivers of their source of water (Emmanuel et al., 2018; Bansah et al., 2016).

Figure 4. The state of river Ankobra due to galamsey activities (Source: Graphic online, 2017).
5.3.3 Air Pollution

Small-scale mining activities emit gaseous pollutants through the crushing of ore (Aryee et al., 2003; Bansah et al., 2016). The crushing of ore causes the suspension of dust particles in the atmosphere. While the dust generated can be diluted by the wind in surface mining operations, the same cannot be said about underground mining. Miners create adits to access stopes in the absence of suitable ventilation systems, hence dust amasses in the stopes. Mines usually recommence working in the stopes after they cannot see any dust suspension or smell blast fumes. This tactic could still be detrimental to miners since they are susceptible to inhaling fine particles of dust (Al-Hassan & Amoako, 2014). Moreover, gases emitted during drilling and blasting constitute a major source of air pollution (Bansah et al., 2016). Also, a common practice among small-scale miners is the burning of mercury-gold amalgam in open air. This practice generates mercury fumes, which are discharged into the atmosphere (Aryee et al., 2003).

5.3.4 Noise Pollution

Small-scale mining activities are a major source of noise pollution in nearby communities. For instance, in the Nkanponase community, residents complain about the noise generated from the blasting activities of small-scale miners (Bansah et al., 2016). The methods employed by the mines produce intense noise. During the excavation process, noise is generated from the use of dynamites. Also, the use of generator-powered grinding machines for processing ore constitutes a source of noise pollution in mining communities (Emmanuel et al., 2018).

5.4 Environmental Impacts of Chinese Small-Scale Gold Mining

Chinese miners have had a greater impact in the small-scale gold mining sector owing to their mechanization and intensification of gold production. Gold output from the sector since 2016 ranges from 30% to 40% of the country’s total gold output (Minerals Commission, 2021). Chinese
mining operations have created both direct and indirect employment in host communities. In fact, after the clampdown on Chinese mining in 2013, some inhabitants of mining communities in the Central Region of Ghana requested the return of the Chinese. Nevertheless, Chinese over-mechanization and intensification of gold production has engendered extensive damage to the environment, especially agricultural land and waterbodies. The next subsections consider the impact of Chinese mining operations on the environment.

5.4.1 Land and Vegetation Degradation

While the activities of local small-scale miners have been detrimental to the environment, those of the Chinese miners have exacerbated the negative impacts of mining on the environment (Antwi-Boateng & Akudugu, 2020). The mechanization of gold mining by Chinese miners has destroyed large tracts of fertile lands, rendering them unproductive for farming for years (Botchwey & Crawford, 2018; Botchwey et al., 2019). In their fieldwork, Crawford et al. (2015) observed that large tracts of fertile land have been ruined by Chinese mining in the Central Region and is no longer workable for farming activities. This is supported by the Association of Church-based Development (ACDEP), an NGO in the Talensi District, which claims that Chinese mining activities in the district have made it impossible to carry out farming activities. The ACDEP has also noticed that crops in mining communities do not flourish in comparison to those in non-mining communities in the Talensi district despite having the same type of soil (Antwi-Boateng & Akudugu, 2020). Moreover, the Chinese use prohibited hazardous chemicals for mining that have lasting effects on the environment. For instance, according to a local galamseyer in Talensi, the Shaanxi Mining Company uses cyanate, which is banned for mining owing to its pernicious effects on the environment (Crawford et al., 2015). As a result, Chinese mining operations have caused a dramatic decline in food production in host communities, jeopardizing the country’s food security.
and foreign exchange (Botchwey & Crawford, 2018; Hausermann et al., 2018). John Yaro, a community opinion leader recapitulates the impacts of Chinese mining operations on the land in Gbani in the Talensi District:

Gbani is dying. Gbani and its environs are under threat. We the citizens, having been aggrieved by their actions, are asking for the immediate deportation of all Chinese nationals resident in Gbani because they are irresponsible and have no respect for authorities. Possible violence is looming because of the operations of the Shaanxi Chinese [workers]. Their activities are affecting us. Our people cannot get water to drink. Our animals cannot survive. The shea trees are going. (Starrfmonline, 2017 as cited in Antwi-Boateng & Akudugu, 2020, p.155).

Several abandoned pits were left uncovered which became flooded, serving as deathtraps for people in mining communities (Crawford & Botchwey, 2016; Botchwey & Crawford, 2018; Hausermann et al., 2018; Crawford et al., 2015). Figure 5 shows a mining pit deserted by Chinese miners. In their fieldwork in the Central Region, Crawford et al., (2015) learned about the drowning of a young girl in an open pit near the elementary school in Pokukrom, near Dunkwa. Edward, a local teacher interviewed by Hausermann et al., (2020, p.65), remarks on the Chinese use of heavy equipment and the consequent degradation of the land:

At first there was a gang [of Ghanaian miners] working there … they didn’t cause the destruction you see now. But then the Chinese started coming, around 2010, with their heavy machinery … the Chinese easily import excavators, washing plants, pumps … And with that equipment they can clear land. When they are finished, they just leave the pits so the whole place becomes flooded and infertile.
Figure 5. Mining pit abandoned by Chinese miners in Ghana (Source: Foreign Policy in Focus).

On registered concessions, it is the responsibility of local licensed miners to reclaim the land after mining operations. Respondents from China and Ghana divulged the fact that money is paid by the Chinese miners to the licensed miners for reclamation purposes. However, the licensed miners fail to fulfil their part of the deal after the completion of mining activities (Botchwey et al., 2019; Crawford et al., 2015).

5.4.2 Water Pollution

The Chinese reliance on heavy machines and toxic chemicals for mining has catastrophic impacts on the waterbodies in mining communities (Hess & Aidoo, 2016; Hilson & Pardie, 2006; Botchwey et al., 2019, Antwi-Boateng & Akudugu, 2020; Hausermann et al., 2020). The ongoing spate of water pollution in the country mainly stems from dredge mining within rivers, which was introduced by the Chinese (Botchwey et al., 2019; Crawford & Botchwey, 2016; Crawford et al., 2015). The technique is illegal as the law forbids mining activities within 100 meters of a riverbank (Crawford et al., 2015). Galamseyers in the Dunkwa area have adopted the technique as discovered
by Crawford et al., (2015). Furthermore, the rerouting of rivers and streams to wash sediment from mining significantly impacts the waterbodies (Hausermann et al., 2020). As a result, major rivers have been ravaged severely with high levels of turbidity. Many communities close to Chinese mining operations are being deprived of their source of drinking water. The pollution of rivers also destroys aquatic life, further ruining the livelihood of mining communities (Botchwey & Crawford, 2018; Crawford et al., 2015). Notable among these rivers are Pra and its tributary, Offin. Figure 6 demonstrates the degree of the pollution of River Pra. Also, the pollution of rivers inflicts financial onus on affected communities who have to resort to pipe-borne water. In the same vein, the government of Ghana has to bear a huge financial cost to restore the potability of polluted rivers (Council for Scientific and Industrial Research, 2013).

Figure 6. The state of River Pra (Source: My Ghana Links).

5.4.3 Noise Pollution

The activities of Shaanxi Mining Company are highly associated with noise pollution and the demolition of close facilities. The company uses very powerful explosives for their blasting activities which serve as a nuisance to the Gbani community. Also, the Gbani primary school,
which is located within 70 meters of the company’s mine shaft, has endured structural damages from the company’s operations. The school is scattered with lots of waste debris from the company’s underground mining. During blasting activities, the school is evacuated (Crawford et al., 2015).

5.5 Conclusion

The section has examined the impacts of large-scale, local, and Chinese small-scale mining operations to the environment of host communities. Indeed, the gold mining industry is significant to the growth of the Ghanaian economy. However, the gains from the sector are being traded with severe environmental damages in mining communities. The significant participation of Chinese miners in the small-scale gold mining sector has aggravated the issue of environmental pollution owing to their introduction of new methods and technology. Agricultural lands are no longer usable for farming and rivers are unsafe for drinking. The atmosphere is invaded by gaseous pollutants alongside intense noise in mining communities. Therefore, gold mining rather deteriorates the livelihood of mining communities.
Section 6: Health Impacts of Gold Mining Operations on Ghanaian Communities

6.1 Introduction

This section deals with the health impacts of gold mining activities on nearby communities. While Ghana continues to accumulate significant revenue from gold mining, the residents of mining communities, from whose lands the precious mineral is extracted, endure hardships generated by mining. As a clear case of environmental injustice, the proceeds accrued from the gold mining sector barely goes into the development of mining communities. In addition, numerous studies indicate that both large-scale and small-scale gold mining negatively impact the health of mining communities. The recent participation of Chinese miners in gold mining has worsened the health issues in mining communities. Having limited options to make ends meet, most destitute residents of mining communities venture into illegal gold mining in the face of horrific occupational risks which occasionally lead to injuries and deaths. This section explores the health impacts of large-scale, local, and Chinese small-scale mining on Ghanaian communities.

6.2 Health Impacts of Large-Scale Gold Mining

Ghana acquires a colossal amount of wealth from the large-scale gold mining sector to achieve her development goals. It would be impossible for the country to effectively embark on development projects without the large-scale gold mining sector. However, the wealth accrued from the sector is not distributed equally. To exacerbate the case, the harms caused by the mining companies are endured by the residents of mining communities. Studies indicate that large-scale gold mining is a perilous venture associated with pollution, poor sanitation, and impaired health. The next subsections look at the health impacts of large-scale gold mining on mining communities.

6.2.1 Pollution and Sanitation

In their evaluation of heavy metals contamination and human health risk assessment around the Obuasi gold mine, Bempah and Ewusi (2016) reported that the levels of arsenic, mercury, iron,
manganese, chromium, and cadmium in most wells exceed the WHO’s standards for drinking water quality. Moreover, their study showed that vegetables from three communities (Sanso, Dokyiwaa, and Pampora) within the study area have arsenic and nickel concentration beyond acceptable limits, as per the WHO’s standards. In addition, the vegetable from Sanso had the highest bioaccumulation factor followed by that from Dokyiwa and then Pampora. Thus, plants in Sanso accumulate more heavy metals and other pollutants from the soil. There was a higher likelihood for the inhabitants of the three communities to develop cancers as carcinogenic risk of arsenic via drinking well water and eating vegetables are beyond acceptable risks. Also, the residents around the mine area could endure other health problems from eating vegetables given the greater hazard quotient values (ratio of the potential exposure to toxins and the degree at which no adverse effects are expected) for arsenic, lead, and mercury in the vegetables.

From their field survey, Usman et al. (2021) observe that the mining operations of Royal Adamus Ltd. has caused several pits and gullies around their sites. These pits and gullies are filled with stagnant water which pose a plethora of health risks to the members of the community. Firstly, they serve as habitats for harmful reptiles like snakes which imperil the lives of residents. Also, they become breeding grounds for mosquitoes which could cause a surge in malaria cases. Usman et al. (2021) notice that communities surrounding the mining area are exposed to contaminants such as dust, fumes, and chemicals. In 2018, some inhabitants of Nkroful protested against the severe air pollution originating from mining companies’ use of untarred roads. The protest erupted from an outbreak of respiratory illness in the community which was associated with the severe air pollution.

Bortey-Sam et al. (2015) ascertained the concentration of heavy metals and metalloid in borehole drinking water from 18 communities in Tarkwa and the potential health risks. The study
assessed the health risks of arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, zinc, and carbon monoxide in drinking water from the communities. In some communities, the concentration of heavy metals in borehole drinking water exceed the WHO’s standards for drinking water quality. In the Huniso community, the hazard index (noncarcinogenic health risks) for children (1.08) was greater than that for adults (0.781) as per the US Environmental Protection Agency's (USEPA) guidelines. Carcinogenic risk of arsenic through drinking borehole water was higher for adults and children in communities like Samahu and Mile 7. According to the USEPA’s guidelines, the average cancer risk values of arsenic through drinking borehole water around the Tarkwa gold mine was 3.65E-05 for adults and 5.08E-05 for children. Thus, there are three (adults) and five (children) cases of neoplasm in a hundred thousand residents.

On the other hand, Faanu et al. (2011) found that gold mining operations in Tarkwa pose no radiological dangers to nearby communities. The study considered public exposure in the mining area to radiation through four mechanisms: thus, exposure to gamma ray from natural radioactivity in soil/rocks, drinking water containing natural radioactivity, breathing radon gas, and breathing dust containing Uranium-238 and Thorium-232. The mean annual radiation dose from all the exposure mechanisms was 0.69mSv. The figure is lower than the 1mSv per year dose limit approved by the International Commission on Radiological Protection (ICRP). While radon gas contributed 42% of the mean annual radiation dose from all the exposure mechanisms, it was still below the ICPR’s limit to warrant remedial action. Yet, Faanu et al. (2011) advised mining companies in the area to establish monitoring programs to control radon gas. This is because the increasing exposure to radon gas is highly associated with development of cancers (Robertson et al., 2013). And the undetectable nature of the gas makes it more dangerous (ibid.). The findings of Faanu et al.’s (2011) study is akin to that of Faanu et al.’s (2016) study. Faanu et al.’s (2016)
concluded that gold mining at Newmont Golden Ridge Ltd. (Akyem) causes no radiological health hazards to the surrounding communities.

6.2.2 Diseases

Yeboah (2008, pp. 110-111) conducted a study in five communities (Sanso, Anyinam, Abombe, Tutuka, and Anyimadokrom) in the Obuasi mine area to measure the health impacts of AngloGold Ashanti’s operations on residents. Among the diseases reported in the study, malaria accounted for 42% of the responses, followed by respiratory diseases (27%), skin diseases (17.7%), and then diarrhea, fever and other illness (13.6%). Skin diseases were mainly reported by the inhabitants of Anyimadokrom (26.6%) and Sanso (24.3%). At Anyimadokrom, the riefness of skin diseases stems from the town’s nearness to AngloGold Ashanti’s Pompola treatment plant where chemicals such as arsenic are largely used. The upsurge in skin diseases at Sanso is largely linked to the community’s reliance on water bodies polluted with harmful chemicals. Cold or coughs was highly reported at Anyinam (37.1%) where blasting and the removal of top soil with heavy machines are common. At Abompe and Tutuka, apart from malaria, all other diseases were relatively low. This can be attributed to their distance (roughly 1.5 to 3km) from active mine sites.

Yeboah’s (2008) study is supported by the research carried out by CHRAJ (2008) on the impacts of mining on human rights. The commission notes that several health problems in most mining communities are linked to mining activities. At Obuasi, it discovered that common diseases suffered by the residents are skin diseases, diarrhea, malaria, typhoid, and chest diseases including tuberculosis. Residents of Anyinam claimed severe air pollution in the community caused them to experience dizziness and headache. At Akatakyieso, Binsere and Dokyiwaa, residents complained about the outbreak of mosquitoes owing to the existence of stagnant water in abandoned pits and trenches dug by AngloGold Ashanti. The communities claimed that the water borne diseases they
endure stem from their dependence on rivers and streams which are contaminated by the large-scale surface mining operations of mining companies.

Also, Akabzaa and Darimani (2001, p. 62) observed that skin rashes were widespread in areas surrounding the Tarkwa gold mine. The hardest hit areas included communities along River Bonsa and its tributaries. These areas are within the concession of AngloGold Ashanti (Iduapriem) Ltd. (Tarkwa) and Gold Fields Ghana Ltd. (Tarkwa). The communities attributed the prevalence of skin rashes to the activities of the two mining companies. They claimed that their sources of water, stream and wells, were heavily polluted with cyanide from the two companies. At the Mile 8 community, skin rashes were very common with children being the most affected. In addition, malaria was a serious health issue in Tarkwa; the Wassa West District recorded the highest cases of malaria in the country with an annual average nearly 185/1000 compared to a national average of about 40/1000. Malaria was the main cause of child mortality in the country and the district emerged as a badly affected area with an infant mortality rate of about 85/1000 against a national average of 80/1000 (Akabzaa & Darimani, 2001, p. 61). Most of the communities in Tarkwa linked the high incidence of malaria to the activities of mining companies in the area.

Moreover, Obiri et al. (2006) evaluated the non-cancer health risks from exposure to cyanide by adult residents from the operations of Golden Star Ltd. (Bogoso). Mining operations of Golden Star Ltd. have contaminated River Bogoso with harmful chemicals like cyanide. The study considered the exposure to cyanide in the river via oral and dermal contact. In terms of CTE (central tendency exposure) parameters, non-cancer health risk for chronic exposure to River Bogoso downstream was 0.031 and 0.57 through oral and dermal contact respectively. For RME (reasonable maximum exposure) parameters, non-cancer health risk for chronic exposure was 0.28 and 0.13 via oral and dermal contact respectively (Obiri et al., 2006, p. 58). With a hazard index
greater than 1, as per the USEPA guideline, there was a high probability for the adult residents of Bogoso to suffer many health problems from exposure to cyanide. Consequently, the residents were susceptible to sickness such as breathing difficulties, headache, fatigue, and low hemoglobin levels. Also, the operations of Golden Star Ltd. have negatively impacted River Aprepre which is a major source of drinking water for the residents of Dumasi. The estimated non-cancer health risk for chronic exposure to the river was way above a hazard index of 1. Hence, adult residents of Dumasi were highly prone to suffering severe and lasting headaches, throat irritation, and iodine deficiency in their thyroid gland from drinking water from the river. Although the mining company provided a borehole to serve as an extra source of drinking water for the community, continuous leaking of cyanide from the company into the borehole coerced the residents to still drink from the contaminated river.

6.2.3 Occupational Hazards

Ayaaba et al. (2017) evaluated the prevalence of respiratory diseases among 1,001 male miners from Gold Fields Ghana Ltd. (Obuasi) and AngloGold Ashanti Ltd. (Obuasi). They further explored the link between relevant socio-demographic characteristics, environmental and work-related factors, and respiratory illness. They noticed that 37.5% of the miners have asthma followed by pneumonia (14.3%) and bronchitis (9.69%). The commonness of respiratory symptoms ranged from 35.4% of coughing to 25.4% of chest pain (Ayaaba et al., 2017, p. 6). In addition, a strong association existed between socio-demographic characteristics like age and level of education and respiratory diseases. Miners within the age group of 30 to 40 were highly prone to emphysema and pneumonia, while those above 50 were more likely to contract bronchitis. Low level of education was associated with higher risk of respiratory diseases. Ayaaba et al. (2017) claimed that this could derive from the fact that most underground and labor-intensive workers of
several mining companies are inhabitants of mining communities, whom often lack higher education. Hence, their work settings are inundated with harmful chemicals and dust which increase their chances of contracting respiratory diseases. This claim is supported by Aram et al. (2021) who notice that miners with lower education or training are more likely to accept work in bad conditions and thus, experience health problems. Ayaaba et al. (2017) noted that the increasing exposure to dust and extreme conditions were strongly associated with respiratory diseases. Also, in a study of 252 miners at a mining company in Ghana, 59 (23%) had noise-induced hearing loss (Basu et al., 2015, p.1559).

6.3 Health Impacts of Local Small-Scale Gold Mining

Ghana’s small-scale gold mining sector employs nearly one million people. Yet, research reveals that the sector is strongly associated with poor sanitation and diseases. Moreover, the miners, especially the galamseyers, are exposed to several occupational risks which occasionally lead to injuries and deaths. The next subsections review the health impacts of small-scale gold mining on mining communities.

6.3.1 Pollution and Sanitation

Rajaee et al. (2015) noticed that there are higher levels of mercury and arsenic in sediment, soil, and water in small-scale mining areas than non-mining areas. While mercury contamination via soil and water concentrations were within standards around small-scale mining areas, 59% of mean sediment concentrations exceeded WHO’s guideline values. Also, lead was a little concentrated in sediment and plants and in water whereas cadmium was highly concentrated in soil and water in small-scale mining areas. The concentrations of arsenic (62%), cadmium (19%), and lead (21%) in water at all small-scale mining areas were beyond the WHO and GWC’s (Ghana Water Company) standards for water quality (Rajaee et al., 2015, p. 9003). They recognized that
water in small-scale mining areas had a lower pH, hence they were acidic. Besides, some water samples near small-scale mining sites exceeded the WHO’s standard for turbidity and nitrates. However, water quality parameters like conductivity, sulfates, and total dissolved solids were within the WHO’s standards.

Furthermore, Obiri et al. (2006) observed the prevalence of mercury, arsenic, and cadmium in food crops such as cassava and cocoyam cultivated in mining communities. The food crops absorbed these heavy metals through the soil. Therefore, residents of mining communities were prone to so many health dangers by eating these food crops. Also, the consumption of mercury-contaminated cassava by people in mining communities are very high. Obiri et al. (2006) associated this with the careless use of mercury by a plethora of galamseyers. The cassava leaves take in mercury oxide and mercury vapor from the atmosphere during the roasting of the gold-mercury amalgam alongside the absorption of mercury through the roots. Similarly, Basu et al. (2015) noticed that food items such as cassava and drinking water may be polluted with toxic metals in small-scale mining areas. Samples of pito (a locally-produced beer with millet mostly drunk in northern Ghana) are concentrated with chromium, manganese, nickel, zinc, arsenic, aluminum and lead above the WHO’s guidelines for drinking water. Basu et al. (2015) suggested that this could be due to the preparation of pito with water from mining pits which contains these heavy metals.

Moreover, Cobbina et al. (2015) remarked that it is harmful for residents of two small-scale mining communities (Nangodi and Tinga) in northern Ghana to drink from boreholes, hand dug wells, dugouts, and a stream. Their study revealed that levels of mercury, arsenic, lead, zinc, and cadmium in water from Nangodi were above WHO’s guideline for drinking water. Also, mercury, lead, and cadmium were highly concentrated in the drinking water samples from Tinga.
While the presence of heavy metals in drinking water could originate from other sources, Cobbina et al. (2015) mentioned that small-scale gold mining is the principal cause. These heavy metals may pose carcinogenic risks to the residents of Nangodi and Tinga. For instance, assessment of carcinogenic risk of heavy metal concentrations, especially arsenic, in surface and groundwater from Tarkwa showed that cancer risks were very high according to the USEPA’s guideline (Basu et al., 2015).

Also, in his analysis, Clifford (2017) reported that 54% of the water samples from active small-scale mining sites are not potable for drinking and unable to support aquatic life. Besides, 33% of the 36 targeted soil samples contained mercury above background levels and 19% contained mercury way above acceptable limit as per WHO’s standards. Moreover, 27% of soil samples and tailings contained mercury levels about 100 times higher than what can be considered as occurring naturally, thus indicating several mining hotspots (Clifford 2017, p. 502). Additionally, Tulasi et al. (2021) found high levels of methylmercury in River Aprepre compared with River Ankobra. They posited that this could stem from small-scale miners’ use of cyanide and mercury to extract gold from mercury-polluted tailings within the catchment area of River Aprepre.

6.3.2 Diseases

Small-scale gold mining is the single largest source of mercury pollution in the world as it releases between 410 and 1400 tons of mercury each year (Eesdaile LJ & Chalker, 2018, p. 6096). Roughly 10 to 19 million small-scale gold miners use mercury for mining in more than 70 countries (ibid.). According to Amankwah and Anim-Sackey (2003), mercury deserves attention among all the contaminants employed by small-scale miners owing to its poisonous nature and overuse in the mining operation. In their comprehensive review of the health effects of exposure to mercury,
Gibb & O’Leary (2014) found that both children living in mining areas and children in small-scale mining have high levels of urinary mercury concentration. In the body, mercury negatively affects the nervous system, renal system, gastrointestinal tract and respiratory system (Emmanuel et al., 2018). Exposure of pregnant women to mercury is highly associated with cognitive damage and poor neurological development in the unborn child (Giang & Selin, 2016). Dr. Amoako Atta (head of the renal unit of the Komfo Anoye Teaching Hospital) claims that the use of mercury by galamseyers is partly responsible for the rise in the cases of kidney diseases in Ghana. Also, a study conducted to assess the health impacts of mercury on the residents of a galamsey village revealed that 90% of the people (both galamseyers and residents) had slight metallic taste and salivation issues. Furthermore, 20% of the people claimed that they have tremors and 65% had sleep disorders. Moreover, the study noted that 86%-91% of the people were exposed to mercury (Anon, 1999, as cited in Amankwah & Anim-Sackey, 2003, p. 134).

In Batcha’s (2013) study about the social and environmental impacts of gold mining in the Obuasi municipality, 96 out of 100 respondents believed that mining affects health. They largely attributed health problems in the municipality to the slipshod disposal of waste, particularly by galamseyers. Twenty-five percent of the respondents stated that mining brings about malaria, followed by skin diseases (24%), cold and catarrh (17%), tuberculosis (12%), HIV/AIDS (11%), and diarrhea (6%). One respondent claimed that mining causes all the diseases (Batcha, 2013, p. 53). Ofosu-Mensah (2011) also observed the harmful impacts of galamsey operations in Akan communities. With a host of rivers contaminated, mining communities are prone to several water-borne diseases such as buruli ulcer, cholera, bilharzia, among others. Moreover, Ohene et al. (2021, para. 18) discovered a high risk of tuberculosis in small-scale mining communities in the Ashanti Region, Western Region, and Brong Ahafo Region as 910 per 100,000 people screened had
tuberculosis. Risk factors for tuberculosis were being a male miner, in the age group of 35 to 54 years, and located in the Ashanti and Western Region.

According to local health authorities in the Eastern Region of Ghana, malaria, anemia, diarrhea and hypertension were common diseases complained about by female galamseyers (Basu et al., 2015). Additionally, a pilot study conducted by Green et al., (2015) in a small-scale gold mining community assessed the relationship between noise, cortisol and heart rate. A total of 22 small-scale gold miners and residents of the Kejetia community were queried about how often they feel stressed. Half of the respondents claimed that they feel stressed every now and then. Thirty-three percent of the 12 women in the study stated that they are mostly stressed while 17% never feel stressed at all. Tests of salivary cortisol (a measurable indicator of psychological stress) showed just a little drop in levels from day to night which attests to signs of chronic stress (Green et al., 2015, p. 9957). Also, the study discovered that all members of the community may be highly prone to noise-induced hearing loss as 95% of the participants recorded noise exposures exceeding the WHO’s guideline.

6.3.3 Occupational Hazards, Injuries and Deaths

In the course of their operations, small-scale miners are exposed to a plethora of health risks, including the inhalation of harmful mercury fumes, handling mercury-gold amalgam without gloves, and drinking water highly concentrated with mercury (Basu et al., 2015). This is often the case as the majority of small-scale miners fail to utilize personal protective equipment (PPE) in their activities (Bansah et al., 2016). For instance, in a study conducted on 120 miners in the Upper East Region of Ghana about the use of PPE (mask and gloves), 70% claimed that they never use PPE as against 5.8% who used PPE. The remaining 24.2% of the miners occasionally used PPE (Paruchuri et al., 2010, p. 6082). Also, in their visit to several small-scale mining sites, Bansah et
al. (2016) noted that it was common to find a small-scale miner holding mercury-gold amalgam with the bare hands. As a result, small-scale miners are more vulnerable to mercury poisoning.

The disuse of PPE at small-scale mining sites is also observed by Hilson and Pardie (2006) from their fieldwork in the Upper East and Western Region of Ghana. Besides, they noticed that miners suck mercury-gold amalgam to get rid of excess mercury before roasting. This is confirmed by one miner who claimed that:

I do not know it (mercury) poses health problem. Am not aware mercury is toxic and do not know it has any health effects. After panning, to obtain the (amalgam) I put the (amalgam) in a handkerchief and suck the excess (mercury) from the (amalgam) for reuse (Hilson & Pardie, 2006, p. 111).

Moreover, most of the miners exhibited symptoms of overexposure to mercury, like fatigue, frequent coughs, and having red eyes. One miner mentioned that “sometimes, we feel headache and our body scratching, and a little bit of aches” (Hilson & Pardie, 2006, p. 111). The miners mistakenly treated malaria instead of mercury poisoning as both illnesses have similar symptoms. Eventually, a majority of the miners spent most of their earnings in purchasing drugs and undergoing treatment.

Another occupational risk involved in small-scale gold mining is the use of explosives. Teschner (2012) provides a vivid description of the miners’ use of explosives and the related risks. Figure 7 shows Abdul Rahman, a survivor of an explosion in a galamsey pit in Dakurpe in the Northern Region of Ghana. Explosives help to accelerate the mining process as they break ore into loose forms. Underground miners spend a whole day using rudimentary tools to make holes about a meter deep. After that, the miners fill the holes with explosives, light the fuse, and then evacuate
the mine immediately. These explosions are able to affect other underground mines containing workers. As a result, miners work silently with the aim of hearing the explosion before it clatters their mines. Yet, in circumstances like these, miners do not have time to leave adjacent mines. So, they just cover their heads and wish to be hit by little dropping rocks. In his study, Teschner (2012) found a miner having a three inch long cut in the head as result of a falling rock.

Also, Calys-Tagoe et al. (2015) conducted a study on injuries among 404 small-scale gold miners in the Tarkwa-Nsuaem municipality and Prestea-Huni Valley district. The study considered the rate of injuries in the last decade, causes of injuries, and the types of injuries. The study revealed that quiet a number of the miners have suffered injuries; the total rate of injury was estimated at 5.39 per 100 persons in the last decade. The rate of injury was higher among women (11.93 per 100 persons) as against men (2.73 per 100 persons) (Calys-Tagoe et al., 2015, p. 7929).

![Picture of Abdul Rahman receiving treatment at Wenchi hospital](Source: Ghana News, 2020)

Figure7. Abdul Rahman receives treatment at Wenchi hospital after surviving an explosion in a galamsey pit (Source: Ghana News, 2020).
Besides, the rate of injury was higher among those with low mining experience. For instance, 25.31% of those with less than one year of experience have suffered injuries while only 6.3% of workers with more than 20 years of experience have ever been injured (ibid.). Most injuries happened during excavation and crushing. Seventy-one percent of the injuries were due to miners being struck by an object followed by the use of machines (17%) (Calys-Tagoe et al., 2015, p. 7930). Most injuries were lacerations to the upper and lower limbs of the body. Among the 95 miners in the region who had been injured in the last decade, 38 believed that the injuries could have been prevented. Half of these 38 miners believed that the use of PPE will avoid injuries (Calys-Tagoe et al., 2015).

Furthermore, Long et al. (2015) examined accidents, injuries and potential risk factors in small-scale gold mining at the Kejetia community in 2011 and 2013. 173 miners were surveyed in 2011 about their health and occupational risks; 22 of those miners were surveyed again in 2013. The rate of injury for the previous year (2014) was calculated at 45.5 per 100 persons in 2011 and 38.5 per 100 persons in 2013 (Long et al., 2015, p. 8754). Unlike Calys-Tagoe et al.’s (2015) finding, Long et al. (2015) discovered that male miners were rather at increased risk of injury. In addition, psychological demands and stress was higher among male miners than females. Also, mining experience was not predictive of the rate of injury. Most of the injuries are caused by falling objects. The most common type of injury was laceration to lower limbs (legs and feet). Long et al. (2015) posited that occupational training on the use of PPE are scarce at the mining site even though the miners are desperately concerned about their safety.

In addition, Kyeremanteng-Amoah and Clarke (2015) conducted a cross-sectional study of the records of injuries on small-scale gold miners at the Holy Family Hospital in the Kwahu West Municipality of Ghana. A total of 72 cases of injury among small-scale gold miners were recorded
at the hospital from 2006 to 2013. The youngest injured miner was 15 years old while the oldest was 45 years old. The injured miners were mostly between the ages of 20 and 30 years. Ninety-seven percent of the victims were male miners (Kyeremanteng-Amoah & Clarke, 2015, p. 10889).

For the 21 cases that had the cause of injuries recorded, the collapse of mine pit was the most frequent (9) followed by explosion (7) (Kyeremanteng-Amoah & Clarke, 2015, p. 10890). Figures 8 and 9 show the deaths of a group of galamseyers following the collapse of a galamsey pit. The commonest type of injuries sustained by the miners were fractures and contusion, then spinal cord injuries, lacerations, and neurogenic shock (ibid.). Two of the injury cases resulted in death.

Bansah et al. (2016) attributed several fatalities and injuries in small-scale gold mining to defective stopes and pits. They reported that six small-scale miners died at Kyekyere in the Ashanti Region of Ghana after a pit collapsed on them in 2016. The same misfortune that happened in 2015 claimed 17 lives in the Central Region of Ghana. Also, 45 people died in 2010 when a galamsey mine collapsed. In November 2009, 18 people (including 14 women) perished in a galamsey pit.
Similarly, Emmanuel *et al.* (2018, p. 45) talked about a gruesome incident that occurred at a galamsey site near the Offin River in Dunkwa-on-Offin. More than 100 galamseyers died following the collapse of a pit on June 27, 2010. Reports claimed that nearly 136 galamseyers were working in the pit when the incident occurred. About 13 bodies could be recovered by the rescue team with rest buried in the pit. They mentioned another accident that was recorded at Attaso, near Kotokuom in the Ashanti Region. More than 12 galamseyers met their untimely deaths after a pit caved in on them. Nine bodies were recovered from the pit. Oftentimes, small-scale miners do not report injuries that occur at their various sites in the hope of avoiding public attention (Opoku-Antwi, 2010 as cited in Bansah *et al.*, 2016). The public only gets to learn about injuries and deaths after a gory disaster occurs at the mining sites. Bansah *et al.* (2016) noted from their study that hand and feet injuries suffered by small-scale miners were never reported to authorities or disclosed to the public.

![Figure 9. Nine persons die over galamsey in Bole in the Northern Region of Ghana (Source: Modern Ghana, 2016)](image_url)
6.4 Health Impacts of Chinese Small-Scale Gold Mining

6.4.1 Introduction

The influx of Chinese miners into the small-scale gold mining sector has engendered a significant displacement of the rudimentary tools formerly employed by local small-scale miners. With their pumps, trommels, crushing machines, bulldozers, and other machines, the Chinese have been able to mechanize the sector and intensify the production of gold. Their participation in the sector has generated an increase in the country’s gold output and provides both direct and indirect jobs for Ghanaians. Nonetheless, Chinese mining operations negatively affect the sanitation and health of the residents of nearby communities. The following subsections deal with the health impacts of Chinese mining operations on mining communities.

6.4.2 Pollution and Sanitation

Chinese miners have introduced a novel method of mining in the small-scale gold mining sector known as dredge mining. The method essentially involves the extraction of gold from the base of a waterbody. To this effect, a host of machines are imported from China to undertake the mining operation (Botchwey & Crawford, 2018; Crawford et al., 2015). The method utterly flouts the laws of the country which proscribe mining activities within 100 meters of a riverbank (Crawford et al., 2015). Dredge mining has negatively impacted the sanitation of several mining communities (Botchwey et al., 2018). The method has caused an excessive contamination of drinking water in mining communities (Loubere, 2018). In their study of illegal Chinese mining in Ghana, Debrah and Asante (2019) noticed that dredge mining and the use of mercury and cyanide by Chinese miners have severely polluted major rivers like Pra, Ankobra, Offin, and Birim which serve as main the sources of water for several rural communities. Also, Botchwey and Crawford (2018) and Crawford et al. (2015) made the same observation as they posit that Chinese mining activities has engendered higher levels of turbidity in major rivers. They claimed that
Chinese mining is blighting the source of livelihood of several mining communities as the inhabitants of these communities are dispossessed of their source of drinking water. The state of the Offin River is horrendous to the extent that a local journalist describes it as “now looking like coffee with milk” (Crawford and Botchwey, 2016, p. 10). At the end, residents of mining communities who continue to depend on these rivers as their source of drinking water are at higher risk of contracting countless water-borne diseases, including buruli ulcer, cholera, bilharzia, and many others (Ofosu-Mensah, 2011).

Another issue of sanitation is the failure of Chinese miners to reclaim the land after mining operations (Botchwey et al., 2019; Crawford et al., 2015). Owing to its toxic nature, mine tailings pose several health risks to the residents of mining communities. Ngole-Jeme and Fantke (2017) conducted a study in Krugersdorp, South Africa, to measure the ecological and human health risks associated with the exposure to metals and metalloids in abandoned gold mine tailings. The study found that there were high concentrations of arsenic, cadmium, carbon monoxide, and nickel in the soil which could negatively affect the health of people in the mining areas. Those who live in close proximity to the mine tailings were at higher risks of developing cancer and non-cancer health problems linked with exposure to the heavy metals through avenues, including dermal, ingestion and inhalation. Also, the exposure-related risks were higher among children than adults, primarily through ingestion and dermal avenues. Therefore, the study concluded that communities in close proximity to the tailings should limit their frequency of exposure to the soils. While many local small-scale miners are known for the inappropriate disposal of tailings (Kessey & Arko, 2013), the tailings they produce are just a fraction of what the Chinese miners produce, owing to the latter’s mechanization and intensification of gold production. Hence, the Chinese failure to
reclaim the land presents health issues to those in nearby areas, as Ngole-Jeme and Fantke (2017) reported.

6.4.3 Diseases

In his study of Chinese gold mining in the Amansie West District in the Ashanti Region of Ghana, Bach (2014) observed a correlation between the influx of Chinese miners and health issues in the district. Severe respiratory disease moved from fourth place in 2008 to a second place in 2009 as the leading illness in the district. Malaria maintained its first place in both years. Cases of respiratory diseases increased from 2,497 in 2008 to 3,972 in 2009 (Bach, 2014, p. 58). The basis of Bach’s observation stemmed from the fact a plethora of Chinese miners begun their operations in the district in 2009 and the health problem was attributed to mercury pollution. Moreover, official data from the Ghana Health Services in Manso Nkwanta in the district stated that malaria cases rose from 29,244 in 2008 to 36,097 in 2009 (Amansie West District Assembly, 2012, p.16, as cited in Bach, 2014, p. 59). Hence, Bach (2014) claimed that a correlation existed between the increase in Chinese gold mining between 2008 and 2009 and the rise in the cases of malaria. The issue of Chinese gold mining and the consequent increase in malaria cases is also shared by Hausermann et al., 2020) as they mentioned that between 2008 and 2013, a time when legions of Chinese miners made their journey to Ghana, water in abandoned mining pits increased as well as malaria cases.

According to Hess and Aidoo (2016), Chinese mining operations are very harmful as “The exposure to mercury vapors emitted during gold processing has been linked to kidney problems, arthritis, miscarriages, respiratory failure, neurological damage, and even death” (p. 316). Besides, the exposure to cyanide could cause severe and chronic headaches, throat irritation, and iodine deficiency in the thyroid gland as was found among the people of Dumasi (Obiri et al., 2006). In
addition, the blasting and drilling activities of the Shaanxi Mining Company in the Gbani township (Crawford et al., 2015) could cause noise-induced hearing loss and silicosis (Amponsah-Tawiah & Dartey-Baah, 2011). Armah et al. (2012) discovered respiratory tract diseases in the Prestea-Huni Valley District and Tarkwa Nsuaem Municipality following the blasting, drilling and milling of gold-bearing ore. The respiratory diseases, which included bronchiolitis, bronchitis, pneumonia, croup, laryngitis, and pharyngitis, were highly associated with the exposure to heavy metals like arsenic, cadmium, and mercury. Also, Armah et al. (2012) attributed the various cancers reported in the study to higher levels of arsenic in the blood of children and adults in the areas. Therefore, the Chinese blasting and drilling operations alongside their use of mercury and cyanide could expose nearby residents to heavy metals and thus, contract the diseases reported by Armah et al. (2012).

6.4.4 Injury Risk Factors and Deaths

According to Myjoyonline (2017, as cited in Akudugu & Antwi Boateng, 2020), there have been countless public protests by the inhabitants of the Talensi District against the operations of Shaanxi Mining Company Ltd. For instance, in May 2017, the minister for Lands and Natural Resources, John Peter Amewu, had to halt the operations of the company after the demise of six miners at a different mine. Annoyed denizens of the district linked the deaths to the consequences of unannounced explosions by the Shaanxi Mining Company. Also, in Debrah and Asante’s (2019) interview with media anchors and chiefs, some claimed that the Chinese pollution of water bodies with toxic chemicals may directly or indirectly be associated with the numerous deaths and other injuries from cave-in pits in the various affected communities. The claim is however a conjecture and not supported by medical data.
Moreover, with their earthmoving machines, Chinese miners are leaving large uncovered pits which negatively affect the safety of mining communities (Boafo et al., 2018). In Debrah and Asante’s (2019) interview with a chief and a farmer, concern was expressed about food shortages in mining communities owing to farmers’ fear of slipping into mining pits. The fear of slipping into abandoned Chinese mining pits also emerges in Hausermann et al.’s (2020, p. 66) study. Ninety-four percent of the people surveyed stated that pits present significant dangers; 62% of these people claimed that their greatest fear was the threat to children and livestock. As of February 2017, there were at least three deaths, including a man walking to the farm and two children, in the Pokukrom community from drowning in abandoned pits. Besides, from October 2013 to January 2014, 17 people died in Amansie West from falling into mining pits (Tawiah, 2014, as cited in Bach, 2014, p. 59).

6.5 Conclusion

The section has dealt with health impacts of large-scale, local, and Chinese small-scale gold mining operations on Ghanaian communities. The millions of dollars amassed from the gold mining sector is at the expense of deteriorating health in mining communities. The various scales of mining are all associated with pollution, poor sanitation, and diseases in nearby communities. The recent involvement of Chinese miners has aggravated the impacts of gold mining on health. Amidst the adversities in mining communities, most residents opt to become galamseyers despite being cognizant of the dangers involved. Therefore, Ghana’s gold mining sector bluntly ensures the impoverishment of the inhabitants of mining communities.
Section 7: Conclusions

7.1 Introduction

This section revisits the research questions and provides a summary of the discussions presented to address the questions. It also talks about the limitations of the study while suggesting areas needing further research. The overarching question in the research is: what are the health impacts of local and Chinese small-scale gold mining operations on Ghanaian communities? In addressing this overarching question and other sub-questions, the theory of environmental justice is used as the framework or conceptual basis in investigating the health impacts of gold mining operations on Ghanaian communities.

7.2 Summary

Ranked as the top producer of gold in Africa and ninth in the world (Minerals commission, 2021), the study shows that gold constitutes the bedrock of Ghana’s foreign exchange and revenue. The gold mining industry generates massive employments, with players including licensed miners, galamseyers, foreigners, chiefs, landlords, and state actors. However, the earnings from the gold mining industry are rarely used to improve livelihoods of residents of mining communities. In addition, the study reveals that both large-scale and small-scale gold mining are strongly associated with land degradation, water, noise, and air pollution in mining communities. The advent of the significant participation of Chinese miners in the small-scale gold mining sector has utterly transformed the sector due to their mechanization and intensification of gold production. Hence, this has aggravated the levels of environmental pollution in surrounding areas. Furthermore, the study demonstrates that mining operations deteriorate the health of people in nearby communities. The various scales of gold mining, including that of Chinese, engender pollution, poor sanitation, and diseases in mining communities. Also, occupational injuries and deaths appear to be very
common in galamsey than all other mining operations. Yet, owing to the scarcity of opportunities to thrive in mining communities, most inhabitants embark on galamsey operations, although fully cognizant of the dangers involved. Moreover, health risks from mining operations were found to be distributed unequally in regards to age, with children been the most vulnerable. The correlation between gender and health risks from mining activities was not substantial, although some harmful impacts of gold mining, like the exposure to mercury, is more disastrous for women.

Significantly, the study reveals that large and small-scale gold mining operations engender severe environmental pollution and impairing health in mining communities. The involvement of Chinese miners in recent times has ignited the levels of pollution in mining communities, thereby threatening the health of residents.

7.3 Limitations

The study encountered a number of limitations. First, none of the sources consulted delves into the methods of Chinese gold mining in Ghana. The Chinese are known for introducing machines and intensifying the production of gold; yet, the process through which they extract gold is lacking in the literature. This made it hard to completely grapple with how their activities cause extensive environmental degradation. But, Chinese mining method like dredge mining is highly linked to the contamination of waterbodies. Secondly, the limited studies on Chinese gold mining in Ghana denied a thorough investigation into the health and environmental consequences of their activities. At some point, correlations between Chinese mining operations and similar operations in other countries were used to assess the health dangers on nearby communities. Lastly, most of the research on the health impacts of gold mining fail to consider if the impacts are distributed unequally among the residents of mining communities. Therefore, this prevented the study from conducting an intersectional analysis and illustrating how variables like age, gender, and income
influence the distribution of health risks of gold mining. Nonetheless, the study makes a relevant contribution by highlighting the complex composition of mining communities.

7.4 Recommendations for Future Research

While conducting this study, I realized there are some areas that are worth researching. First, more research is required on how Chinese miners are able to negotiate the various processes to set up their mining sites. Given that the small-scale gold mining sector is legally reserved for only Ghanaians, Chinese miners’ acquisition of license to operate, for example, is not possible. Corruption has been cited to be rife in the sector (see Crawford & Botchwey, 2017; Botchwey et al., 2019), with state actors even facilitating Chinese mining operation (Hausermann & Ferring, 2018); yet, how do strangers from elsewhere, often not knowing anybody (Hess & Aidoo, 2016), travel to a country and negotiate with the various actors in the mining sector to undertake mining operations? Secondly, with the state of Ghana determined to end illegal mining, characterized by frequent crackdowns on Chinese miners, are there any implications for diplomatic ties between Ghana and China? Is China still underwriting development projects in Ghana and also providing loans to the country in the face of Ghana’s suppression of Chinese mining operations? Thirdly, more research is needed on the differential effects of mining on communities owing to the complex make-up of these communities. Lastly, for my PhD, I intend to focus on extractive industries-led development in Africa, illuminating the benefits and costs involved for the continent.
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