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Small Scale Gold Mining and Environmental Degradation, in Ghana: Issues of Mining Policy Implementation and Challenges

Kwaku Dwumor Kessey[1], Benedict Arko[2]

[1]Kwame Nkrumah University of Science and Technology, Ghana
[2]Development Practitioner

Corresponding author: Kwaku Dwumor Kessep, Kwame Nkrumah University of Science and Technology, Ghana

Abstract. Small scale gold mining in Ghana has a long history. It has existed as far back as the eighth century as a household economic activity. It was legalised recently when the Small Scale Mining Law (PNDCL 218) 1989 was passed and public policies were formulated to support the implementation of the law. From then, the industry has become a major contributor to total quantity of gold produced in Ghana. The industry is a major employer of rural labour force. Despite these contributions, the industry has several negative effects on environment. This study was conducted in the Denkyira area which is located in the northern part of the Central region of Ghana, where there is heavy presence of small scale miners. The Offin river, the main source of water for household chores and other activities, which flows through the area is heavily polluted through the activities of small scale gold miners. Some mining sites have also turned into 'deserts' as the vegetation cover in those areas has been removed. Since small scale gold miners do not have resources to properly manage the environment they have ignored that activity. On the other hand, public environmental regulatory bodies have also failed to carry out their statutory functions due to inadequate resources and poor institutional collaboration, among them. The implication of the action of the small scale gold miners' with respect to poor management of the environment, calls for education for the miners to build collective resource capacity for environmental management. Although, Ghana has several environmental protection laws and policies their implementation, has not been able to address the environmental challenges. Therefore the institution of appropriate strategies to control activities of the miners, especially the illegal small scale gold miners (Galamsay) who are the worst offenders, cannot be overemphasized. Since the Public agencies charged with the responsibility of regulating small scale gold mining are ineffective, the need to search for alternative approaches is crucial. For example, sites where a licensed small scale miner has operated in the past, could be inspected officially, for purposes of environmental management accreditation, before his/her application for renewal of license is considered, that is, if the inspection report is positive, otherwise the application must be put on hold or rejected.

Keywords: Environment, Degradation, Tailings, Mercury, Pollution.

Introduction

Ghana has a long history of small scale gold mining, but at the peak of colonial exploration; Europeans introduced large scale gold mining which led to the abolition of small scale mining activities with the passage of the Mercury Law in 1933, by the colonial government (Darimani and Akabzee, 2001). As small scale gold mining activities were the economic backbone in many areas, households did not give up the mining activities, notwithstanding the ban on those operations. Rather, the law made the small scale miners operate underground. That approach taken by the miners has become a national challenge up to date, notwithstanding the lifting of the ban after 56 years.

Legal Stance on Small Scale Mining

The ban on small scale gold mining was lifted in 1989 by passing Small Scale Mining Law, 1989 (PNDCL 218). Small scale gold mining has contributed to production of gold in Ghana and creation of employment for the unskilled labour force in rural areas of Ghana. The competitive price of gold on the international market made the mining industry very lucrative. Though the risk to life and environment is equally high yet small scale mining activities continued.

Despite the contributions of the small scale gold mining sector to the economy, its negative effects especially on degradation of environment cannot be overemphasised. Many small scale miners use rudimentary equipment such as dredging boats, water pumps, pickaxe, shovel, mercury and of late excavator.The small scale mining has negative effect on environment because the miners do not give it the attention it deserves. That is, eliciting the change and action needed to mitigate its harmful effects. Consequently, the small scale gold mining industry is getting more destructive as second largest source of pollution after agriculture in Africa (Twerefou, 2009). If small scale gold mining is to be given the support it deserves as

a viable economic investment in Ghana, then its environmental sustainability must be considered. This study therefore focused on examining the degradation of environment from operations of small scale gold mining in the Denkyira corridor in Central region of Ghana, one of the areas badly affected by the activities of small scale gold mining. In terms of content, the study focused on analyzing the process of small scale gold mining and its effect on the environment. Generally, the study assessed aspects of small scale gold mining practices and the environment. Also, it examined the effectiveness of State regulatory policies, institutions and structures put in place in relation to environmental management in small scale gold mining areas.

General overview of Small Scale Gold Mining Industry in Ghana

The Economic Commission for Africa has conceded that, there is no universal definition for small scale mining. But it has common characteristics, as being labour intensive with no requirement for skilled labour and sophisticated technology. It operates with limited capital investment which leads to low productivity. The law in 1989 (PNDCL 218) reserved the small scale mining activity for nationals of Ghana, but now that has been overlooked by the miners. Recently, some of the illegal small scale gold miners arrested in Ghana were from China, Nigeria, Mali, Burkina Faso and Niger just to mention a few. In Ghana, the government has defined 25acres concession as land size for small scale gold mining activities. (Hilson, 2001).

There are two groups of small scale gold miners in Ghana, namely the licensed or legal small scale gold mining firms and unlicensed or illegal small scale gold mining units, also known as “galamsey”. However, Hilson and Potter (2005) have observed that there is little difference either organizationally. or technologically between legal and illegal mining activities except that the former has security of tenure on a demarcated mineralized concession for a given period of time. Also it should be noted that, in Ghana, mining concessions are not approved for mining to take place,

in prohibited areas such as forest and game reserves, areas close to rivers and water bodies, site close to residential areas and other public infrastructure. (Ministry of Lands and Natural Resources). Any mining activity which takes place in such areas is considered illegal.

National statistics indicate that gold mining industry is a major employer in Ghana. It is estimated that it employs over 520,000 Ghanaians, with about 4 percent working in the large scale subsector and 96 percent in the small scale mining subsector (Ghana National Commission for UNESCO). Out of the total 2,930,328 ounces of gold produced in Ghana, in 2009, the small scale miners produced 18 percent while 82 percent was produced by large scale mining companies.(Ministry of Lands and Natural Resources, 2010).This confirms the low per capita productivity in the small scale gold mining subsector. Again, Hilson and Potter (2005), argue that the logic in the legalization of the small scale gold mining, in Ghana, lies in its resilience and ability to reduce poverty amidst government crackdown, implying that better mining policies and their effective implementation are necessary. Also, that could improve household income and the performance of the subsector; while transforming squatter producers into citizens who are recognised as economic entities capable of participating in public decision making.

Management of Environment and Small Scale Gold Mining

Before the United Nations Conference on Human Environment held in Stockholm, Sweden in 1972, environmental protection did not feature extensively in mainstream development issues in Ghana. (Akabzee and Darimani, 2001). The Minerals Ordinance (CAP 185) and Minerals Act,1962 (Act 126),the main laws regulating mining in the country, had no environmental provisions. The situation improved with the passage of Legislative Instrument, 1970 (LI 665) as amended by (LI 689). (Acquah, 1995). Increased public awareness came after severe droughts and famine in the 1970s and 1980s. The situation has now improved with policy

makers becoming aware of the link between eliminating poverty and environmental protection. Currently, there is multiplicity of laws governing environmental issues within the small scale gold mining industry. These include Minerals and Mining Act, 2006 (Act 703), Environmental Protection Agency Act, 1996 (Act 490), and Minerals Commission Act, 1993 (Act 450), just to mention a few.

Goodland (1995) defines environmental sustainability as the maintenance of natural capital. It implies the unimpaired maintenance of human life support systems. The need for environmental sustainability has arisen due to the recognition that, there are unborn generations who will depend on the environment. Therefore, if the present abuse of the environment is not checked that will lead to biophysical degradation. The move for environmental sustainability is urgent, due to the deterioration of global life support systems. According to Ashton et al (2001) as quoted in Tunhuma et al; four factors impact on the environment, as a result of gold mining operations. These are the;

- type of rock ore being mined,
- the type of mining operation and scale of operations,
- the efficiency and effectiveness of the environmental management system put in place,
- the sensitivity of the receiving environment.

While, Aryee et al, (2002), have grouped environmental challenges associated with small scale gold mining into three major components namely, effects on the lithosphere, hydrosphere and atmosphere. In their view, Henstchel et al (2002) gave the causes of the various negative environmental impact of small scale gold mining as lack of knowledge, education and training of miners, inefficient technology for mining; inefficient public administrative management, challenges in human control, economic limitations and human survival, lack of access to better techniques, lack of information on best practices, lack of control and enforcement of policies, non-implementation of environmental legislations and low capital base implying

reduction in investment. Given these complex root causes of mining activities and the environment, it suggests that an integrated approach has to be designed in addressing the challenges as the traditional strict enforcement of sanctions does not work.

Methodology

The case study approach was adopted for this study with both probability and non-probability approaches. The purposive targeted population for the study were licensed and unlicensed small scale gold mining operators in the Denkyira corridor. The total population of 50 licensed small scale miners was taken as potential respondents and 100 unlicensed miners were identified for the interview. The illegal nature of some activities of the miners made a larger sample size impossible. Although 150 potential respondents agreed to participate in the interview the response rates of, licensed and unlicensed units turned out to be 88 percent and 77 percent respectively. This is not surprising as the unlicensed units are usually suspicious of visitors by virtue of the fact that they operate undercover. After identifying the leaders of the legal and illegal units, snowballing approach was applied for data collection. Interview guide was used to collect data from the miners while close ended questionnaires were administered to some officials of public institutions including, Minerals Commission, Municipal Environmental Sanitation Department, Ghana Water Company Limited and Environmental Protection Agency.

Brief Profile of the Denkyira Corridor

The Denkyira geographical corridor has two administrative districts namely, Upper Denkyira and Lower Denkyira. The corridor has its foundation on the Birimian and Tarkwaian rock formations (Hilson, 2001). The area is located in forest-dissected plateau, rising to about 250 metres above sea level. The corridor is drained by two

rivers, the Offin and Bia . According to Hilson (2001), the former contains large amounts of placer gold deposits. The region falls within the semi equatorial zone with two rainfall regimes, and total annual mean rainfall between 120centimetres and 200 centimetres. Intensive small scale gold mining activities by licensed operators take place mainly during the dry season as they have relatively sophisticated equipment while the unlicensed miners operate mainly in the wet season with rudimentary tools. The local economy of the corridor is dominated by the agricultural sector. Besides agriculture which employs over 70 percent of the population, the small scale gold mining industry is the next biggest employer. The industry holds the economy of the corridor together as other economic activities such as commerce; manufacturing and household businesses depend on it. The office of the Minerals Commission, Environmental Protection Agency and other public institutions for the Denkyira corridor are located at Dunkwa-on-Offin.

Analysis and Discussions on Small Scale Gold Mining Processes

Small scale gold mining is undertaken by legal and illegal miners also known as "Galamsey" operators. The former pertains to licensed mining firms that have permission from the State to operate as small scale gold miners. The latter do not have any permit to operate as miners, so they mine undercover. Usually they are the focus of State crackdown operations which have not succeeded in getting them out of work.

Socio- economic background of Licensed Small Scale Gold Miners

There are both male and female licensed miners, comprising 82 percent and 18 percent respectively. This implies that small scale gold mining is a male dominated enterprise. In terms of formal education status of the miners, seven percent do not have formal education, 50 percent schooled up to the Junior High School or Form Four level, 20.percent have Senior High School education and 23 percent schooled beyond Senior High School level. This indicates that small scale gold mining is a

major source of employment for Junior High School leavers. Some Senior High School leavers take to mining a result of either poor performance in the final examination or inability to continue schooling as a result of household poverty.

Licensed Small Scale Mining and Employment

As employment providers, small scale gold mining firms engage between five and fifty workers. About 34.percent of the companies employ between five and twenty workers and 39 percent of the firms employ between 21 and 50 workers. The 44 firms covered by the study, employ about 1,705 workers, with an average of 39 workers per firm. The figure indicates that the industry has high labour absorptive capacity for rural unemployed labour force.

Small Scale Mining Processes and Degradation of Environment

Small scale mining processes cover three major activities namely excavation and construction leading to gold bearing ore removal, tailings disposal and mercury amalgam.

Excavation and Construction of Pits for Gold Ore Removal

The licensed firms undertake their mining operations within the concession areas apportioned to them by the Minerals Commission. They construct the mine pits with excavators, washing plants and water pumps.

In the process of pit construction, the vegetation cover is removed first (Figure 1), and other layers of soil from the top soil, through to the gold bearing ore, which is scooped out. On average, the size of pits ranges between 400 and 4000 square feet while the depths range from 6 feet to 30 feet, depending on the location of the gold bearing ore from the earth surface. After the construction of pits the excavators deposit the ore laden soil in washing plants (Figure 2). Pumping machines are used to pump water through water hoses to wash the ore. After washing, the ore is

further reduced to a black substance which is further panned for the actual gold to be extracted. On average a pit with adequate gold ore content would deplete in one month. A concession area of 25 acres could be mined out in about a year, though not every part of the concession is mined due to limited gold ore content.

Effect of pit excavation on Environment

Materials removed, also known as overburden, are dumped by the excavator all round the pit with the various layers of soil lumped together with the top soil which contains humus for agriculture, at the bottom followed by the subsoil in that order. Total of 54 percent of the respondents indicated that they store the overburden materials for reclamation of the sites, while 34 percent said, they just dump it around the pits and 12 percent indicated that they sell it to construction firms. Some of the dumped materials are washed away by erosion. The exposure of minerals in the removed overburden leads to oxidization making it acidic and when washed, the acidic solution, also referred to as tailings, have negative effect on biodiversity within the mining areas.

Tailings Disposal and Environment.

Some firms, after washing, discharge tailings into previously mined pits to be used again, number of times before they finally discharge them into surrounding rivers such as, Offin. The preservation of tailings in pits (Figure 3) occurs at sites about a kilometre from the river banks. For mining sites, close to rivers, the tailings are washed directly into the rivers without storage.

With the licensed operators, 21 percent of the miners treat tailings before discharging into rivers and 27 percent stored it in pits while 52 percent direct tailings into rivers including the Offin river(Figure 4) without treatment. As

tailings enter the surrounding rivers, they pollute the rivers, changing the colour of water in the rivers to deep brown although water is colourless.

Mercury Amalgam Process

At some mining sites, mercury-gold amalgamation processing is undertaken away from where the workers perform their duties. The gold-mercury amalgam takes place by heating a sauce pan with a lid. Although this is an improved process, the miners finally throw the mercury residue, in the sauce pan, on the ground allowing it to escape into the atmosphere, soil and rivers. The study showed that 68 percent of the respondents burned the mercury-gold amalgam over open fire, 27 percent use mercury retorts, while 5 percent do it by other processes such as roasting in a covered sauce pan and extract the gold for the market.

Unlicensed Small Scale Gold Mining "Galamsey" Activities

The unlicensed mining activity also referred to as "galamsey" is widespread. The study showed that, majority of this group of miners are mainly males without formal education, only few have junior high school certificate. This implies that Junior high school graduates also work as miners in the unlicensed small scale gold mining industry.

Unlicensed Mining Processes

Like the licensed operators, the activities of the unlicensed miners also have negative impact on environment in terms of pit construction disposal of tailings and gold - mercury amalgam. This study revealed that some of the unlicensed miners 'galamsey' are engaged entirely in dredging operations. They use locally manufactured dredging boats affixed with two engines (Figure5). The miners affix one engine to suck up debris at the riverbed through a water hose unto the sluice board also affixed to the boat. The second engine is used to suck up water from the river through another water hose to wash down the debris deposited on the sluice. The operations of these miners are mainly labour intensive. The low capital

intensity makes the operation attractive to the rural poor who cannot afford the price of acquiring license and equipment.

Pit Construction and Disposal of Tailings

The construction of pits by the unlicensed miners who do not operate on river surface is undertaken by using rudimentary equipment, such as pickaxe and shovel. The pits are narrow compared to those of the licensed operators. However the pits are quite deep to enable them get to the gold bearing ore deposits. Some of the operations take place in abandoned pits from the licensed firms. It is common knowledge that some of the pits used by the unlicensed miners have fragile nature and cave in easily. That causes disaster which leads to loss of lives in some cases. These miners take little or no precaution in their operations which accounts for the dangerous nature of "galamsey" mining activities. However, the "galamsey" miners are not scared, as they continue the operations daily.

Handling of Tailings

The sluice affixed to the dredging boat discharges the tailings direct into the rivers on which the miners operate. Those who operate at river banks also discharge tailings (Figure.6) directly into rivers without any treatment. That method also pollutes the rivers in the mining areas. .

Mercury Amalgam Process

The mercury-gold amalgamation process of 'galamsey' operations is almost the same as that of licensed miners. All the 'galamsey' miners indicated that they put the mercury-gold amalgam into a sauce pan and burn it on open fire. The residue is poured on the ground and thereby pollute the atmosphere, rivers and top soil.

Small Scale Gold Mining Processes and Environment.

Although small scale gold mining is economically viable as it provides household incomes; reduce rural unemployment and poverty. Again, it contributes to total amount of gold produced in Ghana. Also, it contributes to income from exports, Gross National Product and economic growth for that matter. However, the cost of those activities to environmental sustainability is very high, in the long run. In other words, small scale gold mining is not cost effective in terms of environmental management.

Key Findings on Small Scale Gold Mining, Challenges and Environment.

The key findings and challenges facing small scale gold mining operations, resulting to environmentally unfriendly situation, identified in this study include;

- Lack of in-depth knowledge on the negative effects of the operations on environment either in the short or long run. In other words, the miners have low sensitization on the effects of their activities on environment. This makes training which is supposed to be organized for those miners relevant. In that respect, the Minerals Commission and Small Scale Miners Association have not been effective.
- The usage of rudimentary tools, low technology and labour intensive instead of capital intensive methods does not support the miners to undertake meaningful environmental management activities. The cost of managing the environment manually is prohibitive. For example, refilling a pit manually, could take several days with high wages paid for labour. The technical knowhow for land reclamation is unclear to many small scale gold miners, so they ignore it. In sum, the absence of appropriate equipment, high cost of using labour intensive method and inadequate technical knowhow combine to

create improper environmental management in the small scale gold mining industry.

- Like many small and medium enterprises (SMEs) in Ghana, financing of investment is a challenge in the small scale gold mining subsector. The miners indicated that they finance their activities from a mix of personal savings and informal arrangements with gold dealers. They mentioned that, the system of financing their operations makes it difficult to generate, adequate funding for their activities. Despite those challenges, some miners profit from their business, while some run at a loss. High environmental degradation is found at sites where non profitable the mining firms operate. Although, profit is not the sole indicator for effective environmental management.

- The performance of statutory public regulatory bodies in charge of monitoring the activities of small scale gold miners including; Minerals Commission, Environmental Protection Agency, Ghana Forestry Commission and Local Government Institutions leaves much to desire. Also, they do not implement public policies on small scale gold mining in satisfactory manner. On their part, the institutions complained of inadequate human resources and logistics to perform their duties effectively. However, it was observed that there was weak collaboration among the agencies resulting to poor supervision of the mining activities

A critical examination of the key findings reveals that damage to environment by small scale gold mining activities is caused by combination factors such as low level of formal education, unavailability of improved equipment for managing the environment, low capital base, low production margins and ineffective support from public statutory institutions.

Recommendations

The observations that were made through this study point to the fact that more intensive researches are required in addressing small scale gold mining activities and environmental challenges.

Generally, this study has confirmed that the issue of small scale gold mining and environment is a complicated one. It borders on legislative instrument and policies implementation, public institutional failure, rural poverty, use of rudimentary tools, poor technology, low level of education among the miners and human attitude. Addressing these issues requires a logical progression by the State to enforce several laws on small scale gold mining in Ghana. The ban on illegal mining activities should be revisited and if possible assist the illegal miners "galamsey" to regularize their activities. That will help the State to have a solid data base from the small scale gold mining subsector and integrate them fully into the productive sector of the national economy. Admittedly, that cannot be undertaken as an event, instead it should be handled as a medium to long term process. Obviously, chasing these miners with sticks and guns as a crackdown State measure would not solve the problem.

The non collaborative nature of the State institutions is by virtue of the fact that they belong to different ministries. Therefore, they are controlled from different sources which make them incompatible. This implies that the State should make conscious effort to bridge the gap that exists among the agencies. At the local level, for example, those agencies could operate under the administration of the affected District Assemblies. These agencies should be charged to develop training curriculum or manuals for educating small scale gold miners on the direct link between their operations and environmental degradation.

Environmental management advocacy groups could be formed by residents of the affected communities. These advocacy groups could bring moral pressure to bear on members of their communities who are damaging the environment by their economic activities. Some Donors and NGOs that are environmentally conscious should be encouraged to divert some resources to local advocacy groups for monitoring mining activities in their communities.

Again, in applying for licence to establish small scale gold mining business, the applicant should be made to attach an environmental action plan to the application before it is reviewed. It is also necessary that the environment in the sites where a licensed small scale gold miner has operated should be inspected officially for purposes of environmental management accreditation, before an applicant's licence is renewed, that is if the report is positive.

Conclusion

In conclusion, the study has revealed that small scale gold mining in Ghana is environmentally unfriendly. Therefore serious measures have to be introduced to reduce the environmental cost of that operation, to the Nation. The complicated nature of the challenges should be appreciated and well investigated. Obviously, the acquisition of official licence for small scale gold mining business has not addressed the challenges. This study, is concluded on the basis that in addressing challenges in environmental management and small scale gold mining in Ghana, requires a paradigm shift, to make small scale gold mining activities environmentally friendly and sustainable.

Figure 1. Pit under Construction by an Excavator

Figure 2. Gold Bearing Ore being washed in a Washing Plant

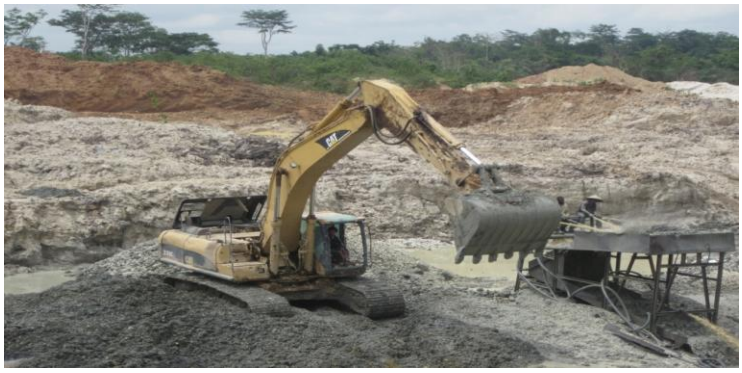

Figure 3. Pit full of Tailings Surrounded by Removed Overburden

Figure 4. Tailings from Washing Plant directed to the River Offin

Figure 5. Disposal of Tailings from a Dredging Boat

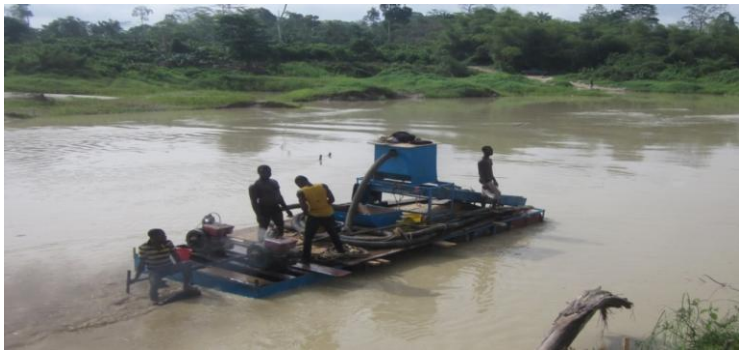

Figure 6. Unlicensed Miner washing tailings direct into a river

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