

Bachelor Degree Thesis

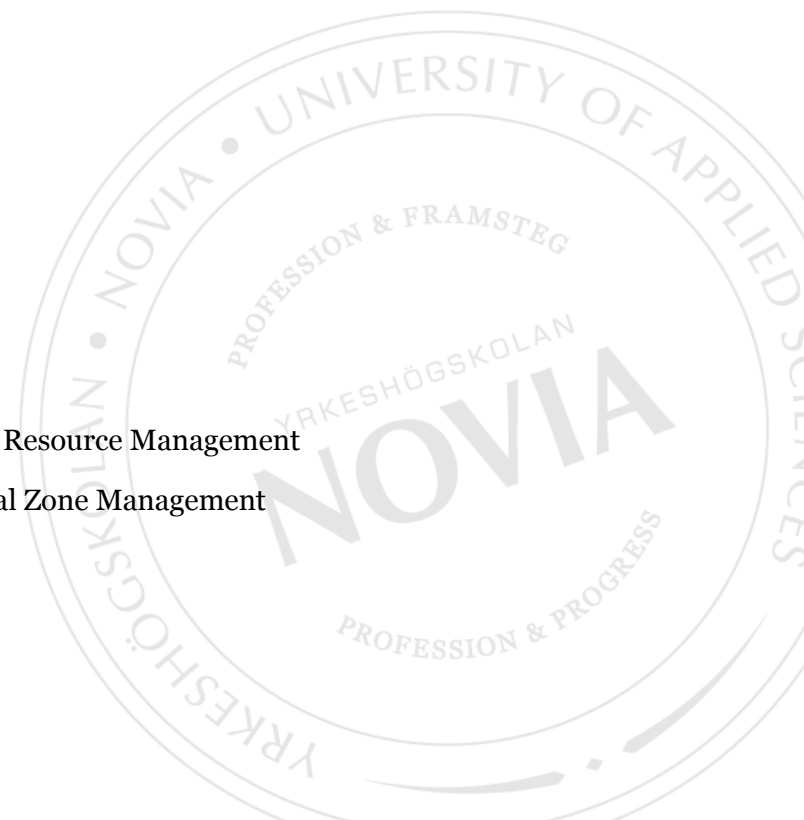
ARTISANAL AND SMALL-SCALE MINING IN WASSA AMENFI EAST DISTRICT, (Ghana)

EZEJI EMMANUEL ONYEBUCHI

Thesis for a Bachelor degree on Natural Resource Management

Degree Programme in Integrated Coastal Zone Management

Ekenäs/Raseborg, 2014



Acknowledgment

With great joy, I am grateful to God for His courage, strength and kindness up on me en route this success. Having brought me this far, especially in an unknown destination glory be to His name. Let me also express my gratitude to my cousin (Hilary), through whom I started this journey. I am sure he will be happy for this success today.

My profound gratitude once again goes to my project supervisor (Maria Söderström) for her directives and encouragement that led to the output of this project. To my H. O. D (Anna Granberg) and other staffs and lectures (Dr. Purba Pal), I am grateful to you all.

BACHELOR'S THESIS

Author: Ezeji Emmanuel Onyebuchi

Degree Programme: Integrated Coastal Zone Management

Supervisor: Maria Söderström

Title: ARTISANAL AND SMALL-SCALE MINING IN WASSA AMENFI EAST DISTRICT, (Ghana)

Date 31st July, 2014

Number of pages 37

Appendices: 3

Abstract

Artisanal and small-scale mining in Ghana has been in existence as far back as pre-colonial era. The industry which is mostly controlled by Ghanaians is highly unregulated pre 1987 (Hilson, 2001). However, because of dwindling state of the economy, the government under the auspices of the German NGO; Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) and the World Bank, decided to legalize small-scale mining as part of Economic Recovery Policies (ERP), allowing individuals to mine minerals in both mechanized and un-mechanized manner. Several laws were enacted to strengthen this policy. Despite the laws, illegal mining has been going on unabated in the country causing several environmental destructions.

This study was carried out using Wassa Amenfi East district as a case study to determine (1) the impact(s) of legalizing small-scale mining in the country using the three principles (pillars) of sustainable development (economy, social and environmental) as indicators. (2) The perception and preference of the local population between exploitation of minerals for economic growth and conservation of natural environment.

It was discovered that small scale mining has had an insignificant impact on the district/individuals economy while the district have suffered various degrees of environmental degradation, water pollution, deforestation, heavy metal contamination, loss of farm land, etc.

Language: English: Key words: Artisanal, Small-scale mining, Minerals, Gold, Wassa Amenfi East, Ghana

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1. Introduction

Ghana is richly endowed with mineral resources such as *gold, diamonds, manganese, bauxite, clays, kaolin, mica, columbite-tantalite, feldspar, chrome, silica sand, quartz, salt* etc, (Draft National Mining Policy of Ghana, 2010). Artisanal and small-scale mining in Ghana has been in existence as far back as pre-colonial era (Hilson, 2001). Citizens from different communities (including Wassa Amenfi East) engaged in this activity as a means of supporting themselves as well as to make provisions for their family needs (Awumbila & Tsikata, 2007). However, artisanal and small-scale mining which is locally called “*galamsey*” were said to be illegal in the country, and those who engage in it do it secretly or out of desperation for survival.

But recently (1987), Ghana government under the auspices of the German NGO Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) and the World Bank, decided to legalize small-scale mining as part of Economic Recovery Policies (ERP), allowing individuals to mine minerals in both mechanized and un-mechanized manner, (Draft National Mining Policy of Ghana, 2010). Although this effort has scored a significant degree of good result, however, problems such as environmental impacts, land-use conflicts, surface and ground water pollution, etc. has been ignored largely by the government (Hilson, 2001).

The purpose of this study is to examine the impact(s) of legalizing small-scale mining in the country using the three principles (pillars) of sustainable development (economic, social and environmental) indices as indicators. In this study, Wassa Amenfi East district is used as a case study where all the necessary investigations were to be carried out.

The result of this study could be used to (1) determine the consequential impacts of this decision by the government from the local populace, and (2) know the preference of the local population between exploitation of minerals for economic growth and conservation of natural environment.

Key words; Artisanal, Small-scale mining, Minerals, Gold, Wassa Amenfi East, Ghana

1.1 Background

The West African nation of Ghana like many other countries in the continent was naturally blessed with numerous mineral resources such as gold, diamonds, manganese, bauxite, clays, kaolin, mica, columbite-tantalite, feldspar, chrome, silica sand, quartz, salt etc. (Lawson & Bentil, 2013). The chief deposit of these minerals especially gold and diamond could be mainly found within the forest area of the southern Ghana (the Ashanti region), Ghana Mineral Commission (G.M.C), 2010.

Before the arrival of the Portuguese sailors in search of gold in West Africa in the late 1400s, mineral resources have been trading in large quantities and are transported across the Sahara, to North Africa. Mining and trading of these resources helped to establish and support major trading centers in the Sahel, along the coast of the Niger River. It also contributed to the establishment of main trading ports along the Mediterranean Sea (Ghana Mineral Commission, 2010; Aryee et al, 2002)

Gold production increased within the forest area of the southern Ghana as a result of the arrival of the European traders, and southern Ghana became popularly known as the “gold coast”. The area became one of the most important gold producing area in the world eclipsing other major gold producing areas in west African region of Mali (Bambuk) and (Boure) in the northern Guinea. The European traders competed vigorously for minerals especially gold for over 400 years (1490s till late 1800s), which lead to the sprout of several forts and trading posts along the gold coast (G.M.C, 2010).

Furthermore, the high demand for these commodities and vigorous competition among the stakeholder hasten the abrupt diminishing of gold deposits in the area for about three centuries. Sadly, the trade for minerals took a diabolic turn and became slave trade and the coastal forts suddenly became way-stations for West Africans who were carted away to a new world where they were enslaved as plantation workers. However, the gold trade recovered early in mid 1800s after slave trade was abolished in many countries (G.M.C, 2010). It is important to note that productions all these while were carried out in an unmechanised manner that could today be regarded as artisanal or small-scale mining.

2. DEFINITION OF ARTISANAL AND SMALL-SCALE MINING

Artisanal and small-scale mining (ASSM) has been defined differently around the world due to its diverse nature (Hilson, 2005). Artisanal and small-scale mining may be defined as the exploitation of minerals by poor people with the help of primitive tools such as diggers and shovels (spades) usually on a small scale. However in recent times, the ASSM industry in many countries has been on constant growth which has resulted in the use of sophisticated equipment. This change has brought some controversies on the earlier definition of the industry, Hentschel et al, 2002; Aryee et al, 2002; Buxton, 2013.

As a result, some institutions and organizations defined ASSM in terms of production ceiling or level of sophistication of the production process (equipment used). For example, the UN (United Nations) defined ASSM as “any single mining operation unit having an annual production of unprocessed material of 50,000 tonnes or less as measured at the entrance of the mine” (Aryee et al, 2002). Intermediate Technology Development Group (ITDG) defined artisanal and small-scale miners as “poor people, individuals or groups who depends on mining for living; who use rudimentary tools and techniques (e.g. picks, chisels, sluices and pans) to exploit their minerals”.

In Ghana however, ASSM was defined in Small Scale Gold Mining Law (1998 PNDCL 218) as “*mining by any method not involving substantial expenditure by an individual or group not exceeding nine (9) in number or by co-operative society made up of ten (10) or more persons*” (Aryee et al, 2002). The complexity of this definitions could also be confirmed in Ghana’s Mineral and Mining Act 2006 (Act 703), section 93 which says “*a person licensed under section 82 (a person must obtain a mining permit before operating a mine) may win, mine and produce minerals by an effective and efficient method; and shall observe good mining practices (health & safety rules) and pay due regard to the protection of the environment during mining operations*”.

Furthermore, an interpretation of the Ghana Minerals and Mining Act, 2006 defined small-scale mining operations as “*mining operation over an area of land in accordance with that number of blocks prescribed*”. However for clarity, ASSM is classified by;

- a. Production volume

- b. Number of persons per productive unit
- c. Intensity (volume) of capital employed
- d. Labour productivity
- e. Size of mine claim
- f. Quantity of reserves
- g. Sales volume
- h. Operational continuity
- i. Operational reliability
- j. Duration of the mining cycle (Hentschel et al, 2002)

Since there is no clear-cut difference between artisanal mining (use of rudimentary tools) and small-scale mining (use of reasonably sophisticated equipment), this study refers to both as small-scale mining as used in similar researches.

2.1 Policies and Legislation on artisanal mining in the country/district

Pre 1980s, artisanal mining otherwise locally known as “*galamsey*” and marketing of the realized minerals especially gold is said to be illegal. The industry like similar ones in most developing countries was for decades treated as an informal sector with unmonitored and uncontrolled practices. For over two decades, gold mining activities were managed and monitored by local chiefs who are traditionally entitled to one-third of the gold realized since they largely own the areas being mined (Aryee et al, 2003). The Ghanaian small-scale mining industry which is mainly for gold and manganese is well over 2,000 years old. The industry is highly unregulated and requires government policies and regulation to bring the industry under a national framework, (International Council on Mining and Metal (ICMM), 2009; Hilson, 2001; 2009).

As a result, several legislations were enacted (from 1980s) by the government to bring the activities of the industry across the country under control. Such legislations include; The Ghana Minerals and Mining Act (1986 PNDCL 153) whose section (1) states thus; “*Every mineral in its natural state in, under or upon any land in Ghana, rivers, streams, water-courses throughout Ghana the exclusive economic zone and any area covered by territorial waters or continental shelf is the property of the Republic of Ghana and shall be vested in the Provisional National Defence Council for and on behalf of the people of Ghana*”.

Another legislation is the Small-Scale Gold Mining Law (1989 PNDCL 218) which aims at who is entitled to small-scale gold mining, etc. The other mineral related legislation is the Mercury Act of 1989 (PNDCL 217), which controls mercury handling in the country especially in mining activities. The (PNDCL 219) created the Precious Mineral Marketing Corporation (PMMC) from the state owned Diamond Marketing Corporation (DMC) with an expanded mandate to deal with buying and selling of gold and diamond (Aryee et al, 2002).

The small-scale mining law requires miners to register with the Minerals Commission who would assign them specific areas to operate. But because of the several frustrations they (small scale miners) meet in the process of obtaining mining license(s), many of them opt to operate illegally (without mining license). This has given rise to two groups of small scale miners in Ghana, those registered and licensed, who are in the minority, and those operating illegally (galamseys), who forms the majority (Awumbila & Tsikata, w.y).

Ghanaians largely dominate the small-scale mining in the country because legislation reserves small-scale mining for local investors. It was expected that artisanal miners in the country should abide by these laws; however, investigations revealed that such has not been the case as illegal mining has still persisted even at a higher rate (Global Economic Report on Africa), 2010; Hilson, 2001; Tschakert & Singha, 2007.

2.2 The economic strategy of artisanal mining in the country

Pre 1960s, mining sector was one of the major revenue contributor to Ghana economy. However, there was a massive decline in mineral output between 1960s – 1980s. For example, gold production declined from 900,000oz (in 1960) to 232,000oz (in 1982); manganese output had dropped from 600,000t (in 1960) to 160,000t (in 1982); bauxite production declined from 407,000 (in 1974 to 64,700t in 1982; and diamond output had declined from 2,340,000 carats (in 1975) to 683,524 carats (in 1982), (Hilson, 2001). In addition, it was estimated that about 60,000 to 80,000 ounces of gold was loosed via smuggling and other consequences of illegal trading (PMMC).

These downward trends and fluctuation in prices of these minerals in the global market caused huge insufficiencies that put the economy in a bad shape. In a desperate move to revitalize the

dwindling economy, the Provincial National Defence Council (PNDC) consulted with the International Monetary Fund (IMF) and the World Bank to assist in drafting the national economic plans and policies. The small-scale mining reform which target mainly gold and diamond was introduced to the Ghana mining sector (in 1980s), as an Economic Recovery Policy (ERP) to sustain the dwindling economy. As a result of the (ERP) and other policy measures, significant growth has been recorded in the mining sector (Hilson, 2001; GMC, 2010).

As at the year 2009, over 1 million people in Ghana were directly dependent on ASSM for their livelihoods. Gold recorded a substantial growth from 287,124oz in 1986, to 3.12 million ounces by 2009. Bauxite increased from 226,461MT in 1986 to 420,477MT in 2009, and similarly manganese increased from 262,900 MT to 1,007,010 MT over the same period of time. It is worth mentioning that the mining sector has become the highest foreign exchange earner for the country as a result of the Economic Recovery Policy (ERP), Draft National Mining Policy of Ghana (DNMPG), 2010. Currently, the re-named the Precious Minerals Marketing Corporation (PMMC) provides a ready market for both gold and diamond produced by resident small-scale miners (Aryee et al, 2003; PMMC; Hilson 2009; Armah et al, 2013).

Recent reports revealed that gold mining still dominates the mining sector, accounting for 97.8% of total mineral export earnings in 2010 Economic Report on Africa (ERA) 2013.

2.3 Characteristics of Small Scale mining in Ghana

- a) Estimated 30,000 persons working on registered plots, 170,000 + illegal galamsey.
- b) 15% female participation in legal segment, 50% female participation in illegal segment.
- c) 60% of the known Ghanaian mining labour force is employed at small-scale mines.
- d) Approximately two-thirds of the Ghanaian small-scale mining industry is engaged in the extraction of gold, with most of the balance involved in diamond mining.
- e) Over \$117 million in gold and \$98 million in diamond product has been obtained from small-scale mining operations since complete legalization of the industry in 1989.
- f) Gold production from the small-scale gold-mining industry has increased nearly tenfold since 1989, from 17,234oz in 1990 to 107,093oz in 1997, (Hilson, 2001).

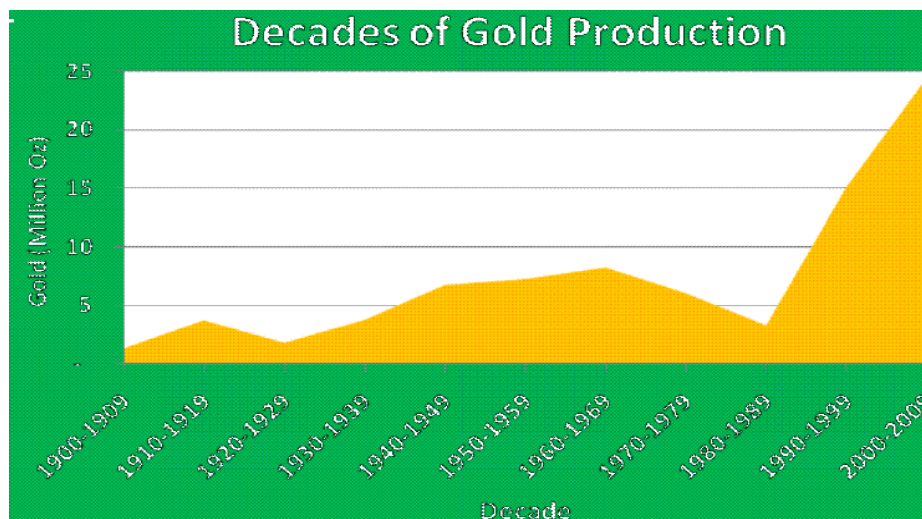


Figure (1): Gold production trend in the country before and after the Economic Recovery Policy (ERP) of 1990s. Source; (Ghana Mineral Commission, (2010).

3. Wassa Amenfi East district

Wassa Amenfi East district is located in the Western Region of Ghana. The district lies between latitudes 5, 30' N, 6, 15' N, longitudes 1, 45' W, and 2, 11' W, with an estimated total land area of about 16000 square kilometers; about 8% of the size of the region.

The Administrative District capital is at **Wassa Akropong**. The District shares boundaries with Mpohor District to the west, to the east with Twifo/ Heman/ Lower Denkyira and Twifo-Ati Mokwa, to the south with Shama District and Komenda/ Edina/ Eguafo/ Abirem Municipal. Wassa Amenfi East is a predominantly rural area with a population of one hundred and fifteen thousand ninety-two people (115,092). The availability of infrastructural development in the area is said to be critical. The district falls within the wettest part of the country with an average annual rainfall ranging between 140mm to 173mm. Occasionally extreme rainfall may reach 211mm mainly from March to July.

The interplay of heavy rainfall and soil type manifest in a thick vegetation cover of semi deciduous forest which covers the northern part of the district, while the tropical rainforest is to the south where rainfall is heaviest, and in between is the transitional zone. About 400 square kilometer of land area in the district is covered by forest, which is the abode for a variety of animal species such as Antelopes, Deer, elephants, birds, snails, and other animals

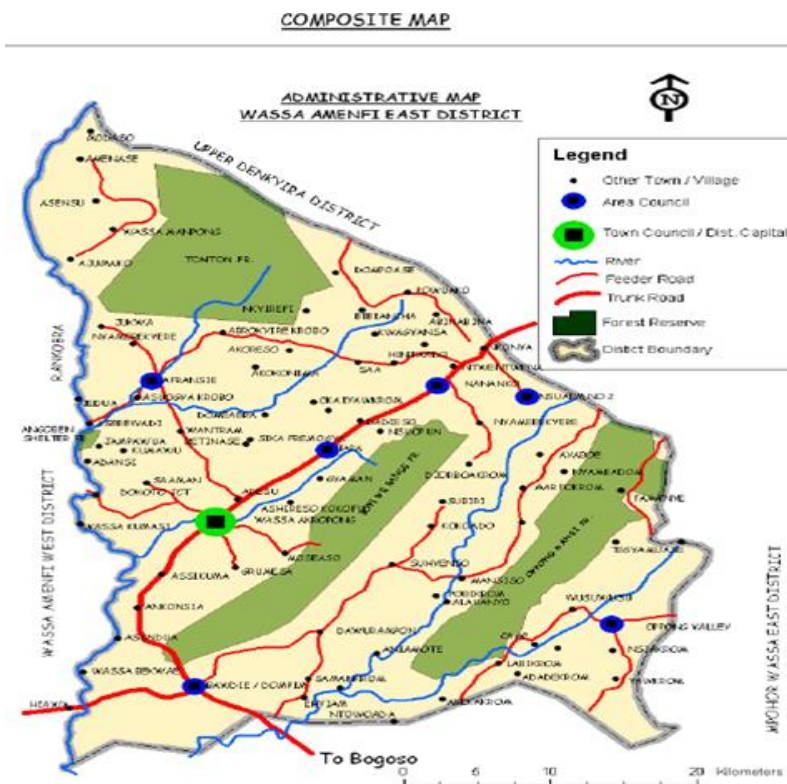


Figure (2): The physical composition of Wassa Amenfi East District.
(Source: http://www.ghanadistricts.com/districts/?news&r=5&_=144)

which serves the locals as a source of meat. The forest also hosts several trees of high medicinal values for the maintenance of good health of the populace within and outside the district. Some of the trees include; Sapele, Odum, Mahogany and Wawa with large tracks of bamboo trees at the transitional areas.

Wassa Amenfi East district has a substantial deposit of mineral resources such as Kaolin, bauxite, diamond and gold. However, agriculture is the mainstay of the districts economy employing about 80% of the labour force. Cocoa, coffee, oil-palm, plantain and cassava are cultivated as cash crops, while plantain, cassava, cocoyam, maize, rice garden eggs, tomatoes and pepper are the food crops. Farming method in the district remains artisanal as mechanized farming is almost non-existence. Studies revealed that farming in the area has been on a free fall as many farmers now engage in small-scale gold mining which they saw to be more lucrative, (online journal).

3.1. Small-scale gold mining in Wassa Amenfi East district

The district like many others districts in the country has witnessed the activities of the small-scale miners whose influence has altered the structural and environmental compositions of the district since inception. Small scale mining activities has been and still going on in villages such as Bibieni, Japa/Dadieso, etc. The major mineral mined here is gold; however, diamond and sand mining are not left behind. Mining in the district depicts the true composition of artisanal mining which is made of local populace using



Figure (3): Local mining site in the district
(Picture source: Ezeji Emmanuel, 2013)

absolute rudimentary tools in their operations. This is possible because the target mineral could be found almost at the top layer of the soil. The operators of the small-scale industry is highly made up of locals who have almost no other source of living, with little or no education and hence has almost no chance for formal employment.

It is important to clarify that in Ghana, significant numbers of rural inhabitants are attracted to small-scale mining because the industry pays substantially higher wages than most other sectors of industry (Hilson, 2001).

3.2. Level of production

Through the Economic Recovery Policy (ERP) in late 80s, gold production and mining activities by the small-scale miners in the country has been on a rapid increase. Though there was no available data for gold production in the Wassa Amenfi east district, however, an overall data for small-scale gold production in the country shows the correlation between an increase in the activities of the small-scale gold miners and gold produced. This is data is shown in table (1) below.

Table (1): Gold Exports from Artisanal Mining in Ghana (1989 – 2011).

Data Source; Precious Mineral Marketing Company, (PMMC), Ghana.

YEAR	OUNCES(000)	VALUE (\$ MILLION)	AV.PRIZE/OZ(\$)
1989	9.27	3.73	402.37
1990	17.23	6.26	363.32
1991	15.60	5.33	341.67
1992	17.30	6.15	355.49
1993	35.14	12.65	359.99
1994	55.23	21.29	385.48
1995	55.54	21.33	384.05
1996	51.32	20.29	395.36
1997	58.86	20.10	341.49
1998	59.72	17.10	286.34
1999	74.49	20.20	271.18
2000	62.00	17.31	279.19
2001	50.87	12.64	248.48
2002	40.17	12.53	311.92
2003	43.87	15.74	358.43
2004	17.59	6.24	354.58
2005	29.74	13.13	509.19
2006	23.49	14.27	607.49
2007	18.60	11.71	629.61
2008	38.12	32.87	861.79
2009	76.88	75.48	981.78
2010	384.51	463.42	1205.22 ave.
2011	254.05	393.91	1550.50

Despite the Economic Recovery Policy on small-scale mining, several researches have shown that artisanal mining activities in Ghana remained largely unregulated as many people engaged in the business illegally (Hilson 2009). It is important to note that even the multinational companies employ artisans to work for them in the same manner they do in small scale mining.



Figure (4): *Mining using rudimentary tools by locals.*
Source: (Ezeji Emmanuel, 2014)

The production process in artisanal gold mining includes; first, rudimentary tools such as picks, axes, sluice boxes, shovels, although occasionally Honda water pumps, explosives and locally designed washing plants are put in place. After excavation, the ore is crushed into pebbles by hand or machine. The pebbles undergo primary, secondary and tertiary grinding in preparation for washing. It is then carried to the riverside in cloth bags; the finely crushed sediment is laid along riverbanks and washed by hand to separate gold particles. The sediment is then panned using mercury and the resulting amalgam is roasted over a charcoal fire in the open air, (Hilson, 2001).

4. The Impacts of ASSM in Wassa Amenfi East District

The impact of artisanal small scale mining in the district has been of major concern to the people, district authorities and the central government. The truth remains that the advantages of the activities of small scale miners in the community cannot be ignored while the disadvantages are substantially significant. Since the district is highly disadvantaged in terms of rural infrastructure, it is physically characterized by;

1. Deplorable physical state of roads which become unmotorable during the rainy season, thus, providing limited accessibility to various parts of the district.
2. Poor housing surroundings, exposed foundations, leaking roofs and non-existing utility and other facilities, such as potable water, electricity, telephone services, school buildings, kitchens and toilets

3. Very low per capita income, indicating a low level of standard of living in the district.
4. Production mainly at the subsistence level with only 10% of farmers having access to extension service
5. Markets with small physical spaces either without sheds or with weak temporal structures and lacking adequate parking space and good access roads, (online journal).

4.1. Advantages and Disadvantages of ASSM in Wassa Amenfi East District

The advent of small scale mining in Ghana has completely altered the physical and psychological profile of the people including the land-use practice by the people, who have virtually abandoned their traditional livelihood activities in exchange of mining. Small scale mining in the district has had a serious impact on the economic, social, environmental and health aspects of the district and the people therein (Tom-Dery et al, 2012). Here, the impacts of small scale mining are drawn from district indigenes interviewed and reports from small scale mining at other locations in Ghana.

4.2.2 Advantages

- I. **Employment:** There is lack of clarity in the number of people employed in the SSM industry in the country or district as the district authorities does not make such data available to public domain. However, it is estimated that ASSM have employed about 200,000 people nationwide. Small scale mining in Ghana contributes to about 60% of the labour force in the mining industry. This is by no means a small achievement in a country with high rate of unemployment, (Hinson, 2001; Hentschel et al, 2002).
- II. **Education:** In recognition to Mineral policy of Ghana to include women in all areas of decision making with to mining in general, From 2006 to 2009, 101 women have enrolled at the University of Mines and Technology (UMAT) in Tarkwa, Ghana, alone, average yearly enrolment increase of 28 % (Aryee 2010; Lawson and Bentil, 2013).
- III. **Economy:** Through collection of mining levies and royalties, the district authorities would be able to repair some roads and bridges without tasking the poor indigenes for such. Some individuals have been substantially empowered financially which is one

of the motives of the central government to apply it as a tool for sustainable development and to alleviate poverty (Awumbila and Tsikata, 2007). Small and medium scale businesses have suddenly sprung up at various locations in the district as money exchange hands. ASSM is not capital intensive; thus sufficient manpower. With investment cost per job of 10-12 percent as those in large mining operations, it is said s to be economically feasible. By formalizing SSM, losses from illegal trade and smuggling of these minerals were captured back thereby contributing to the economic growth of the district and increase the foreign exchange earnings of the country (Hilson, 2001).

- IV. **Social:** The liberalization of small scale mining in Ghana has also kept the people (men, women & youths) away from engaging in other social vices, (Hinson, 2001; Hentschel et al, 2002).

4.1.3 Disadvantages

“The ASSM sector at its current scale, is leading Ghana to an increased state of environmental degradation, with a cost that is yet to be quantified” (Consultancy African Intelligence, 2013). Some of the disadvantages of ASSM in Wassa Amenfi East district and indeed the country as a whole include;

- I. **Deforestation:** A 2010 report by the Global Forest Resource Assessment (GFRA) has it that between 1990 and 2010, deforestation in Ghana is assumed to be at an annual rate of 135 394.86 ha. Surface mining in Ghana has resulted in deforestation (58%), and a substantial loss of farmland (45%) within mining concessions, (Schueler et al, 2011).

Due to an upsurge in the activities of the small scale miner and wood lodging, large forest reserved areas are now cleared and excavated by the miners in search of minerals. This has led to loss of precious flora and fauna that give the people a local sense of place.

Deforestation via mining activities is also responsible for the shortage of food and herbs for local treatment of diseases. Deforestation in the area has also resulted in the loss of top soil through wind, increased water erosion and exposed the lives of living organisms in the area to both internal and external threats (Tom-Dery et al, 2012).

II. **Pollution and environmental degradation:** Surface and underground water has suffered contaminations especially in the areas where small scale mining are going on including Wassa Amenfi East. Heavy metals such as Mercury (Hg) and Lead (Pb) are heavily used during gold mining activities such as mineral exploitation, ore transportation, smelting and refining, disposal of the tailings and waste waters around mines (Tom-Dery et al, 2012).

Small scale gold processing releases toxic substances such as mercury from amalgamation process, and several pollutants were discharged from abandoned mines direct to the environment. It is well known that these chemicals, in sufficient quantities, pose a serious threat to human health and is deleterious to a



Figure (5): Small scale gold processing in Ghana. Source: (Gavin Hilson, 2001)

wide-range of ecological entities through eco-toxicological effects, (Obiri et al, 2006). Wassa Amenfi East like many other rural communities in Ghana highly depends on open water bodies as their only source of water for domestic consumption. Open and abandoned mining sites are common scenes which have also altered the traditional landscape of the area.

Ghana News Agency (Aug. 6th, 2013) announced that the traditional ruler (the queen-mother of Wassa Dawurampong) in the Wassa Amenfi East District, Nana Akua Ampomaa II, has appealed to government to as a matter of urgency, construct bore-holes in the area to serve as alternative water sources for the people. She said “close to 99% of the water sources has been polluted by the activities of the small scale miner locally called “galamseys”. Report also has it that some food items and vegetables in the area have been contaminated by heavy metals. In fact, the activities of the small scale miners have negatively affected the quality and quantity of portable water in the community, (Hilson, 2001; 2002; Aryee et al, 2003; Ahiamadjie et al, 2011; Tom-Dery et al, 2012).

III. **Occupational health and hazards:** Heavy metals such as Mercury (Hg), Lead (Pb), Cyanide, etc. are highly consumed in processing minerals such as gold. Studies have revealed that between 1994 and 1999, Ghana imported roughly 25,000 kg of mercury mostly from

Europe and Canada, 97% of which was destined for the small scale mining sector, (Tschakert & Singha 2007). Artisans without any form of protective, carry bags of mud on their heads or backs to sieving and washing sites.

Mercury is usually mixed, washed and squeezed with bare hands with the concentrate forming a lump or ball of mercury–gold amalgam. In addition, the gold amalgam is squeezed and placed over a coal pot to roast



Figure (6): Locals screening ores for gold
(Picture source: Gavin Hilson, 2001)

for 15 to 40 minutes to recover the gold. During burning, the mercury with its high volatility is released into the atmosphere as vapor. This air is inhaled by the small scale miners having little or no knowledge of the environmental and health hazards they are being exposed to. Clinical studies have shown that increasing exposure to mercury could cause health challenges such as; kidney pain, respiratory problems, neurological damage, dizziness, gingivitis, muscular tremors and psycho-pathological symptoms such as depression and exaggerated emotional responses, which can be mistaken for alcoholism, fever, or malaria; dysfunction of kidneys, memory loss, miscarriages, vomiting, and potentially death, (Tschakert & Singha, 2007).

Apart from heavy metal exposure, accidents such as tunnel collapse are frequent in Ghana and have been responsible for the deaths of substantial number of miners including children, (Tschakert & Singha 2007; Armah et al, 2013).

- IV. **Child labour:** Globally, Artisanal and small scale-gold mining involves an estimated 10-15 million miners including 4.5 million women and 1 million children (UNIDO, 2006; Buxton, 2013). According to a report (Tschakert and Singha, 2007), roughly 85% of the total labor force operates without an official license. *Hilson and Potter* (2003) estimated that half of those employed in the sector are women, one of the highest rates in Africa. The involvement of women and children in mining contradict the International Labour Organization (ILO) conventions No. 182 of 1999 and (ILO) convention No. 138 of 1973 which Ghana is a

signatory to. Reports reveal that though they (children) may not necessarily be involved in gold digging, children as young as ten years old crush, wash, mill, haul and process ore, (Armah et al, 2013; Tschakert & Singha, 2007).

Overall, it is clear that both the involvement of children and the occupational health hazards which the miners are exposed to contradict the International Labour Organization convention (1998), on the declaration on Fundamental Principles and Rights at Work (whose principles include the abolition of child labour). This declaration is universal and applied to all people regardless of the level of economic growth, (United Nations).

- V. **Resource waste:** The legalization of small scale mining in Ghana has led to the proliferations and widespread mining activities with increased pressure on the environment and the ecosystem. Artisanal miners with or without technology could only extract gold in its simplest form (not in its compound form or rock). This is why in Ghana; the activities of small scale miners are usually at the river beds or along the river. With the traditional method which includes sluicing, it yields a recovery rate of approximately 60%. They can only obtain some fractions of gold from the ore while the rest is washed away into the nearest water body, (Aryee et al, 2002).

Agricultural farm lands are largely destroyed through mining thereby reducing the availability of farm land, reducing agricultural activities and consequently increasing shortages of food and other agricultural produce. (United Nations Industrial Development Organization (UNIDO), 2006; Tschakert & Singha, 2007).

- VI. **Social insecurity:** One of the negative consequences of the mineral liberalization in Ghana is that resources, which belong to the district for the development of the area, are now being mined by some individuals. Ownership of the minerals has become through “survival of the fittest” thereby fueling insecurity in the area. Other social vices that emanate from small scale mining in Ghana include; increased drug use, alcohol abuse, prostitution, communicable diseases (e.g., HIV/AIDS), school drop-outs, rivalries and conflicts. Small scale mining has also lead to the militarization of some “galamsey” groups due to a growing inflow of firearms in the area. There are indications that the activities of small scale miner are responsible for land and water conflicts in the area (Tschakert & Singha, 2007).

VII. **Education:** Giving the fact that small scale gold mining has become the fastest way of becoming rich, it has actually become a threat to the future of the youths in the area (Hilson, 2001). This is because many who joined the business earlier has become more financially empowered, hence has no high regard for education anymore. Even those who are already in schools are easily dropping out citing lack of professional jobs at the end of their education. Small scale mining “*Galamsey*” they say requires no formal education.

As highlighted at the beginning of this study, the aim of the government through the Economic Recovery Policy (ERP) was to stabilize the Ghana economy which resulted in the liberalization of the mining industry, (Hilson, 2001; GMC, 2010). However, it was not clearly stipulated how the government intend to deal with the negative ripple effects (as highlighted above) which has surfaced as a consequence of this policy. This study became imperative to determine whether the policy (liberalization of small scale mining) has actually favoured the country economically, social and environmentally using Wassa Amenfi East district as a case study.

5. Material and method

A semi-open questionnaire (Appendices. i & ii) was developed with stringent and specific questions that will generate a good picture of the situation on the ground. The questionnaire was divided into three parts; **economic, social and environment** so as to cut across all aspects that support life in the district. The questionnaires were made open/available to people from all works of live in the municipality (responedence). The expected outcome of the questions is either “YES”, “NO” or “DON’T KNOW”. However, if the answer is yes which indicates that there is an impact, and then to what degree was the impact. The impact(s) were then categorized into three and labelled or indicated with low (insignificant) impact, medium (significant) impact, and high (very significant) impact. A total number of eighty-five (85) copies of questionnaires were used though some questions were not answered in few cases.

A visit to the district was carried out and small-scale mining sites were visited. Although involving all stakeholders (mining district authorities, district administrators and the host community member) was necessary, more attention was paid to ordinary individual indigenes in the studied district. Relevant questions regarding small scale mining in the district were asked

through which data were generated. The generated data was statistically processed on Microsoft (2010) excel sheets (Attach. iii). Informations from respondents on the ground were also utilized. Several relevant research materials from online search engines (google & springer link) were used to shed more light on the topic.

6. Result

6.1 Part one: Impact on the economy

The economic impacts of small scale mining in Wassa Amenfi East district was divided in to two categories; impact on the economy of the district government and impacts on individuals.

I. Q: *Has ASSM helped to improve the economy of the municipality/district?*

I. District economy:

Data collected indicated that Nine (9) individual representing 11% of the people interviewed said that small scale mining has had no impact on the district economy. A total of seventy-six (76) individuals or 89% said “YES” indicating that small scale mining in the district has improved the districts economy. Among the “YES” people, sixty-eight (68) individuals representing 90% of them described the impact as low (insignificant). Seven (7) individuals representing 9% gave the impact grade as medium (significant), while one (1) individual gave graded the impact as high (very significant) as indicated in figure (7a), (7b) below.

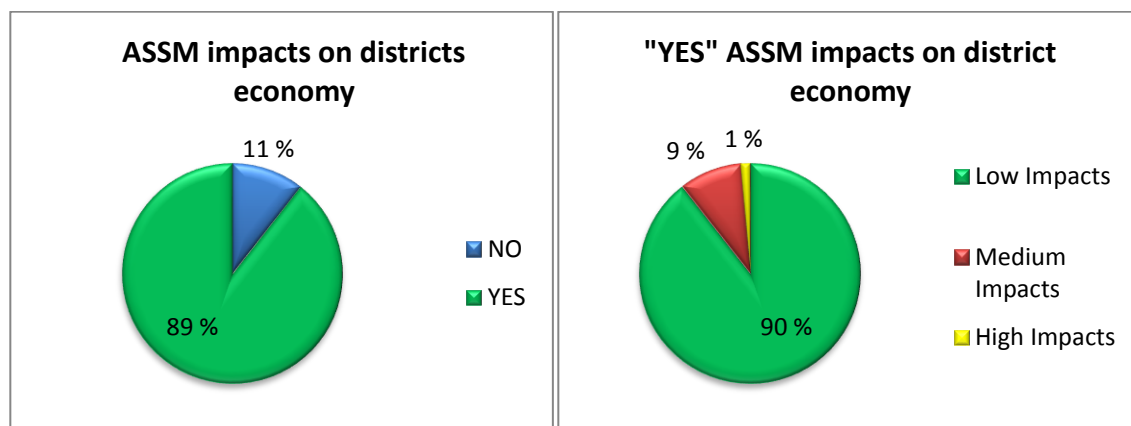


Figure (7a): Illustrates opinion on ASSM impact on the district economy.

Figure (7b): Illustrates ASSM wide but low degrees of economic impacts on the district.

II. Individuals' economy

The result indicated that only three (3) individuals or 4% out eighty-five (85) individuals said that small scale mining in the district has not benefited individuals. On the other hand, eighty-two (82) individuals representing 96% of the people interviewed said "YES", indicating that small scale mining in the district has benefited the economy of individuals. However, looking at the degree of benefits, sixty-eight (68) individuals representing 83% of the "YES" people apportioned the benefit as low (insignificant). Eleven (11) or 13% of the "YES" individuals apportioned the benefit as medium (significant), while three (3) individuals or 4% of the "YES" people gave the benefit grade as high (very significant) as shown in figure (8a), (8b) below.

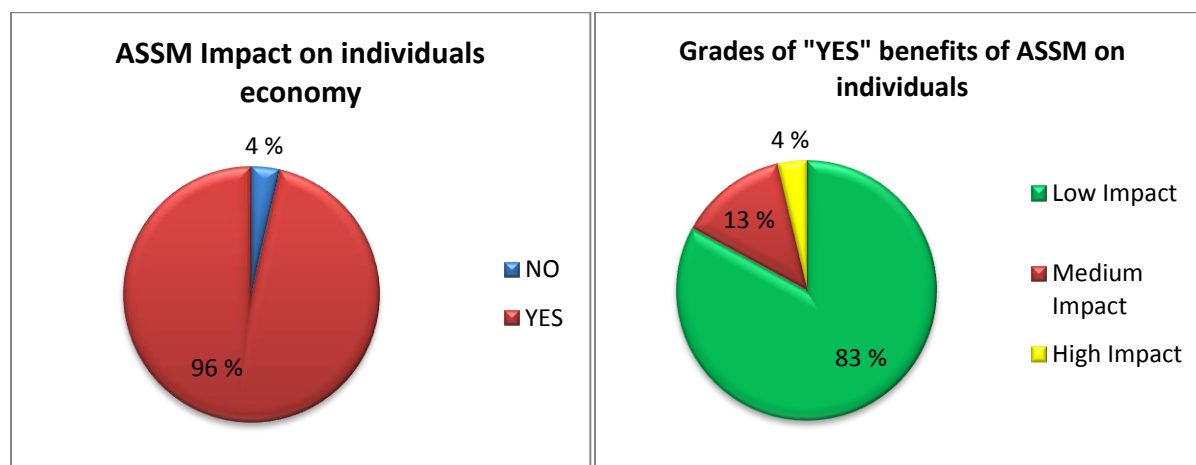


Figure (8a): ASSM impacts on individuals' economy.

Figure (8b): Minimal degrees of ASSM impacts on individuals' economy.

6.2. Part Two: Impact on Environment

I. Q: What has been the impact of ASSM on the forest (deforestation)?

The result shows that there was a unanimous response of "YES" from all the people interviewed regarding the impacts of ASSM on the forest. However, to ascertain the degree of the impact of small scale mining in the districts forest, five (5) individuals or 6% of the people apportioned the impact as low (insignificant). Twenty-seven (27) or 33% of the individuals gave the grade as

medium (significant), while fifty-one (51) or 61% of the people described the impact of small scale mining on the district forests as high (very significant) as shown in figure (9) below.

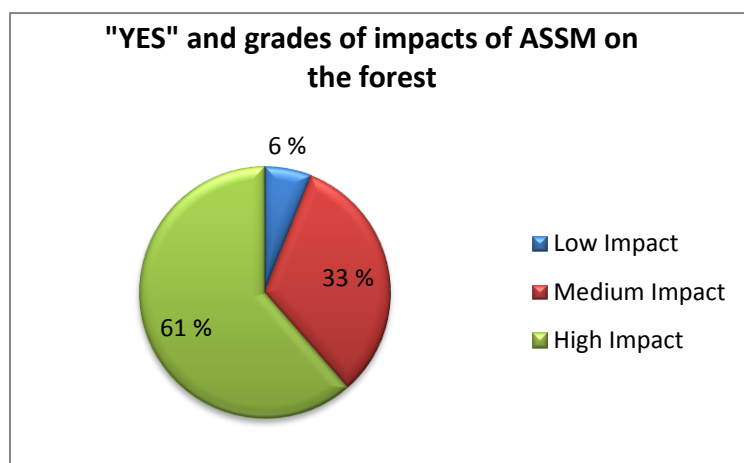


Figure (9): ASSM high significant impacts on the forest

II. **Q:** Does ASSM have any impact (Pollution) on surface or ground water?

Regarding the impacts of small scale mining on surface and ground water (pollution), all interviewees responded "YES" indicating that there have been pollutions of various degrees as a result of small scale mining in Wassa Amenfi District. However, their opinion varies regarding the degree of pollution impact (s). From the data obtained, only one (1) individual categorized the impact as low grade (insignificant). Fourteen (14) or 17% of the individuals categorized the impacts as medium grade (significant), while seventy (70) or 82% of the people categorized the impacts as high grade (very significant) as shown in figure (10) below.

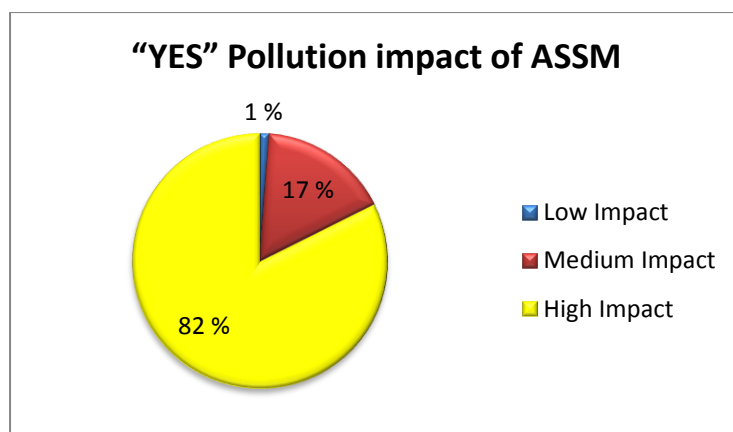


Figure (10): High ASSM impact through pollution of surface and ground water.

III. *Q: Has ASSM contributed to soil contamination by heavy metals such as Mercury?*

On the possibility of contamination of the soil by heavy metals such as mercury or cyanide from small scale mining activities in the district, there was a unanimous “YES” response from all eighty-five (85) individuals interviewed. However on the degree of the impact, fourteen (14) or 16% of the individuals graded the impact as low (insignificant), eleven (11) individuals or 13% of the people graded the impact as grade medium (significant), while sixty (60) individuals or 71% of the people interviewed categorized the heavy metals contamination of the soil through small scale mining activities In Wassa Amenfi East district as grade high (very significant). This result is shown in figure (11) below.

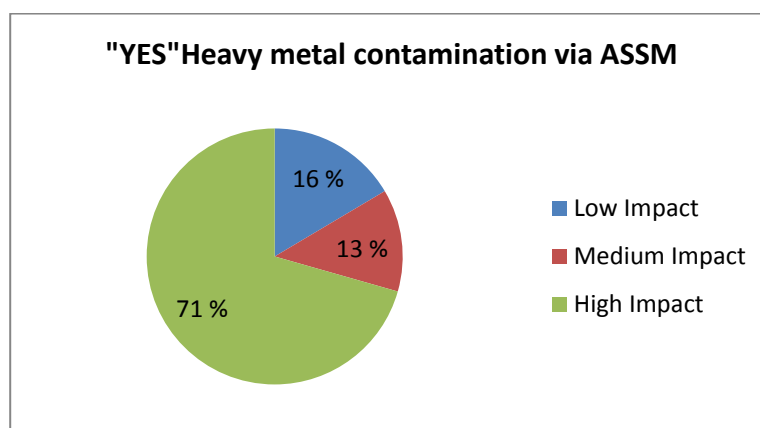


Figure (11): High impact of ASSM through heavy metal contamination.

IV. *Q: Has ASSM affected farm land availability (Decrease)?*

Data obtained in this regard revealed a unanimous “YES” response from all eighty-two interviewed individuals. Variation on the degree of impact is such that four (4) or 5% of the individuals categorized the impact as low (insignificant), thirteen (13) or 16% of the individuals described the impact as medium grade (significant), while sixty-five (65) individuals representing 79% of the people interviewed categorized the negative impact of

ASSM on farm land availability in the district as high (very significant). Figure (12) below explained the findings.

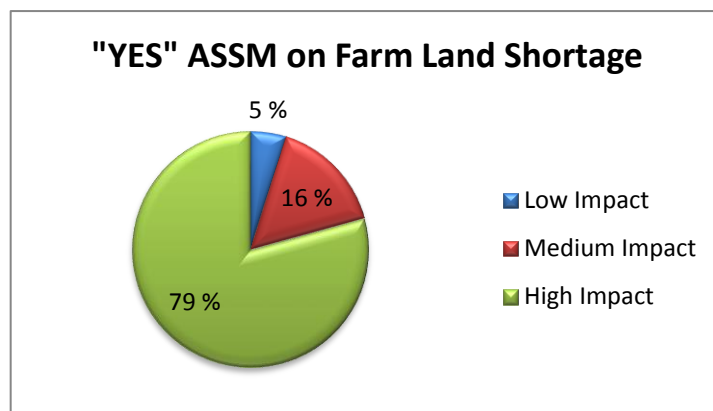


Figure (12): High impact of ASSM on farm land

V. *Q: Has ASSM related activities brought disturbances such as noise?*

The result from the public opinion varied widely on noise impact generated from small scale mining activities in Wassa Amenfi East district. Data obtained shows that fourteen (14) or 17% of the eighty-five (85) individuals responded “NO”, while sixty-seven (67) or 83% of the people responded “YES”. In addition, fifteen (15) individuals representing 22% of the people with the “YES” answer described the noise impact as low (insignificant) impact, while ten (10) individuals or 15% of the people described the noise impact as medium (significant) impact. However, forty-two (42) individuals representing 63% of the people with the “YES” answer described noise disturbance emanating from small scale mining activities in the district as high grade (very significant) impact. Figure (13a), (13b) below illustrated the result.

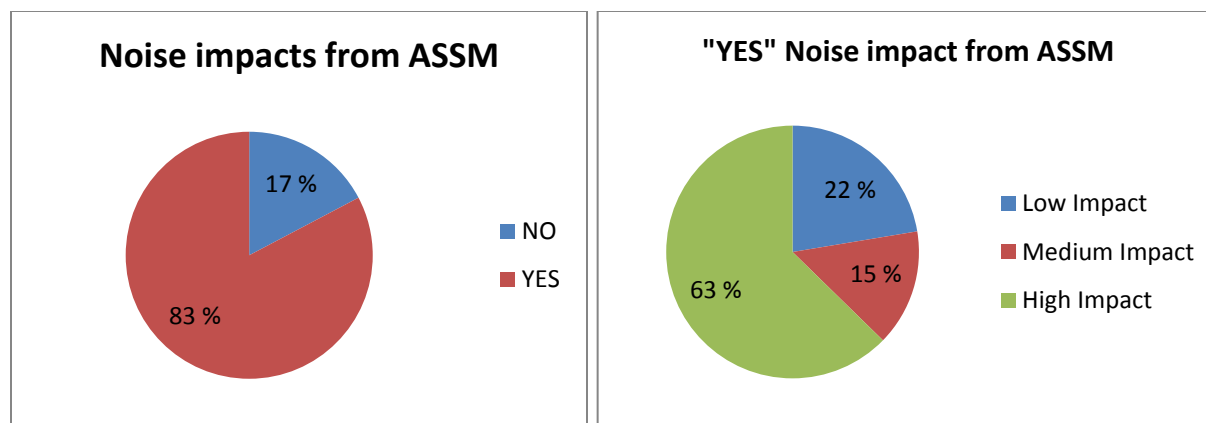


Figure (13a): ASSM has noise impact.

Figure (13b): High noise impact from ASSM.

6.3. Part Three: Impact on Social Activities

I. Q: Has ASSM related activities increased social in problems such as land/water conflict?

There was a unanimous response of “YES” from all eighty-three (83) individuals interviewed indicating that there has been an increase in land and water conflict in Wassa Amenfi district as a result of small scale mining. However, their opinion varied on the degree of land and water conflicts associated with the small scale mining. Seven (7) or 8% of the people interviewed categorized such impact as low grade (insignificant) impact, fourteen (14) or 17% of the people categorized land/water conflict as medium grade (significant) impact, while sixty-two (62) people representing 75% of those interviewed described land and water conflict impacts in the district as high grade (very significant). Figure (14) below explained the result.

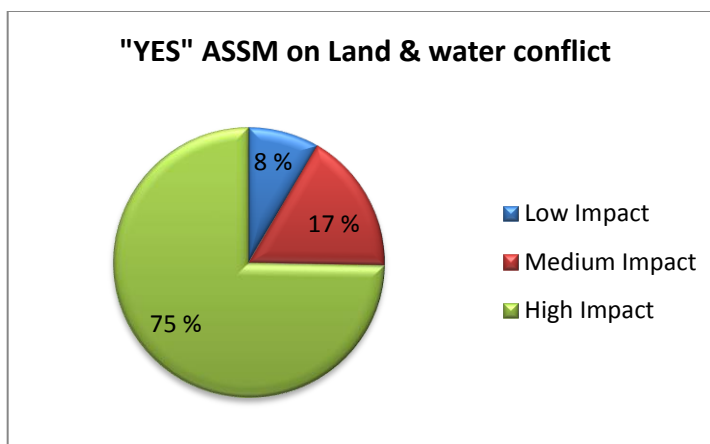


Figure (14): ASSM high contribution to land and water conflicts.

II. Q: Has ASSM affected the Health (diseases & life span) of people in the area including the miners?

There was a mixed response from the result on eighty-four (84) individuals' interviewed. Though eighty-two (82) individuals or 98% of the people answered "YES", while the rest or (2%) of the people could not produce any answer. However, the opinions of those who answered "YES" also varied. Thirteen individuals (13) representing 16% of the "YES" people categorized small scale mining impact(s) on the health of the people in the district as low grade (insignificant) impact, while nineteen (19) people representing 23% of the "YES" answers categorized the impact as medium grade (significant) impact. In addition, fifty (50) individuals or 61% of the people with "YES" answers categorized the health impact of small scale mining in the district as high grade (very significant) as explained in figure (15a), (15b) below.

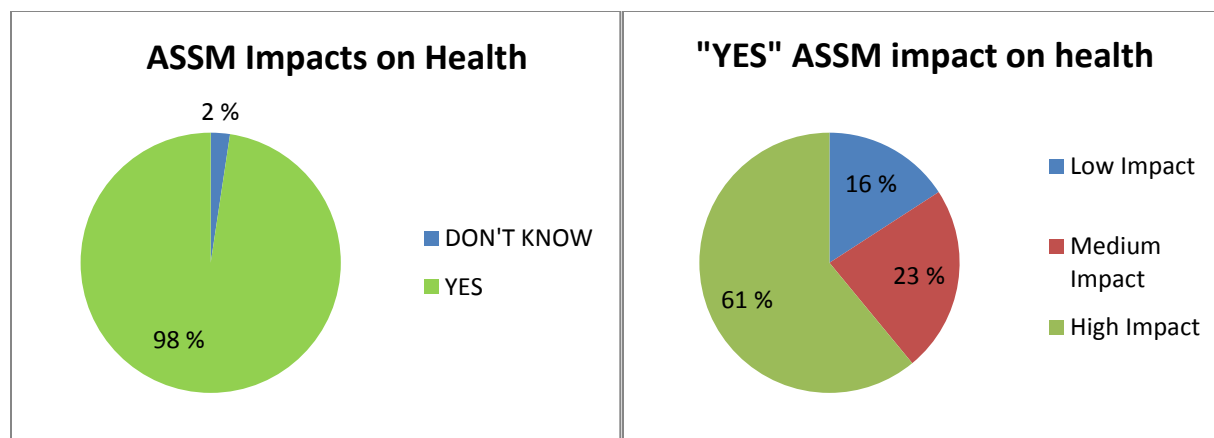


Figure (15a): ASSM has had high impact on health.

Figure (15b): ASSM substantial impact on health

III. Q: Has ASSM improved the living standard of the people?

Data obtained from eighty-five (85) individuals interviewed, shows that there was a significant variation in their opinion regarding improvement of the living standard of the people in the district via ASSM. Though seventy-eight (78) individuals representing 92% of the people responded with a “YES” answer indicating that SSM has improved the living standard of the people in the district, five (5) and two (2) individuals responded “NO” and “DON’T KNOW” respectively. However, opinions also varied on the degree of improvement on the living standard of the people through ASSM. Sixty-five (65) individuals representing 83% of the “YES” people categorized the improvement as grade low grade (insignificant) impact. Twelve (12) individuals representing 16% of the “YES” answers categorized the improvement on the living standard of the people as medium grade (significant) impact, while only one (1) individual among the “YES” people categorized the improvement as high grade (very significant) impact as illustrated in figure (16a), (16b) below.

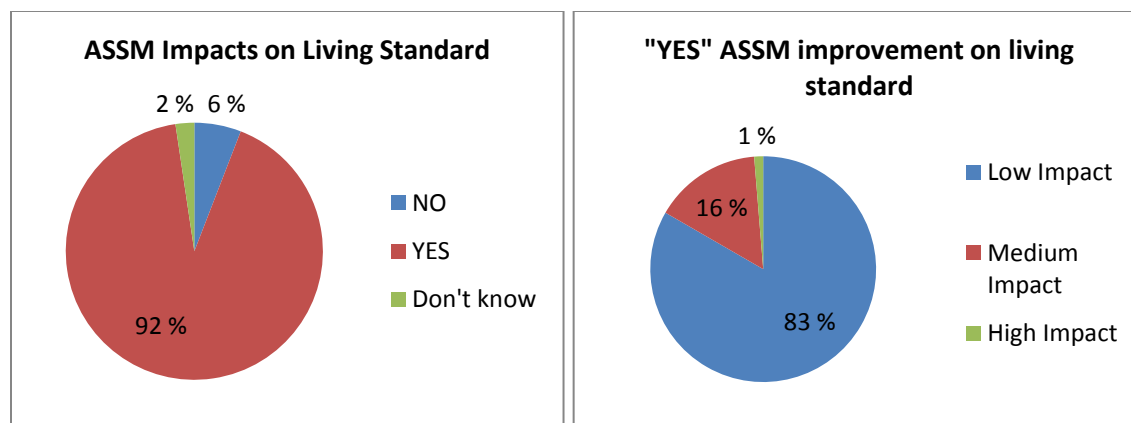


Figure (16a): ASSM high impact on living standard.

Figure (16b): ASSM wide but minimal degree impact on living standard.

IV. Q: Has ASSM created employment in the municipality?

Data obtained from the study shows that among eighty-two (82) individuals interviewed, five (5) or 6% of the people responded with a “NO” answer, indicating that SSM has not created employment in the district. However, seventy-seven (77) or 94% responded “YES” indicating that SSM has created employment in the district. However, opinion varied on the degree of the employment created by small scale mining in the district. Sixty-nine (69) or 90% of the “YES” answers categorized its impact on employment as low grade (insignificant) impact. Six (6) individuals representing 8% of the “YES” answers categorized the employment impact as medium grade (significant) impact, while two (2) individuals from the “YES” answers categorized the SSM impact on employment as high (very significant) impact as illustrated in figure (17a), (17b) below.

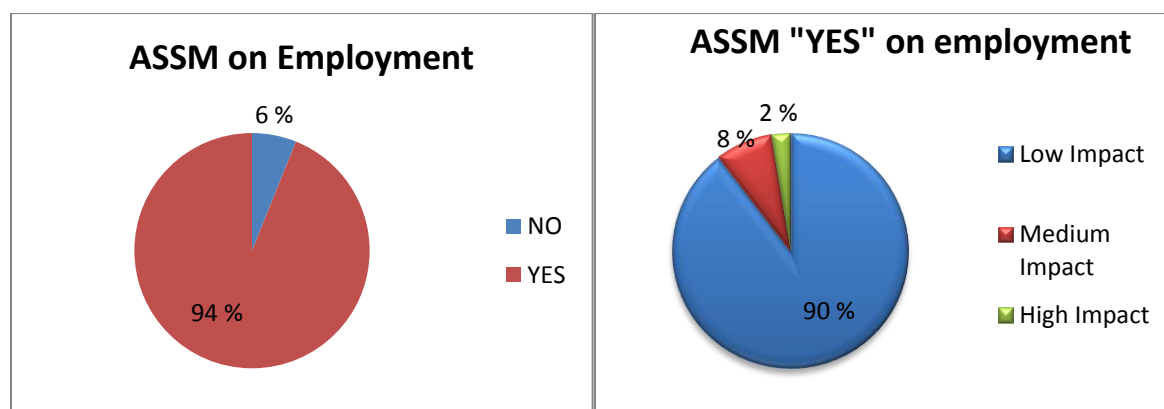


Figure (17a): ASSM has created employment?

Figure (17b): ASSM employment is negligible.

V. Q: *Has ASSM activities helped to improve security of lives and properties?*

Data obtained shows variation in the opinion of the people on whether small scale mining in the district has helped in improving the security of lives and properties. Eight (8) individuals or 10% of eighty-one individuals responded “NO” indicating that SSM has not improved security in the district, while seventy-three (73) or 90% replied “YES” indicating the opposite. However, to ascertain the level of security improvement among the “YES” people, sixty-three individuals representing 92% of the “YES” people categorized the improvement as low grade (insignificant) impact. Five (5) individuals or 7% of the “YES” people categorized the security improvement as medium grade (significant) impact, while only one (1) person categorized the improvement on security as high grade (very significant) impact. The result is illustrated in figure (18a), (18b) and table (13) above.

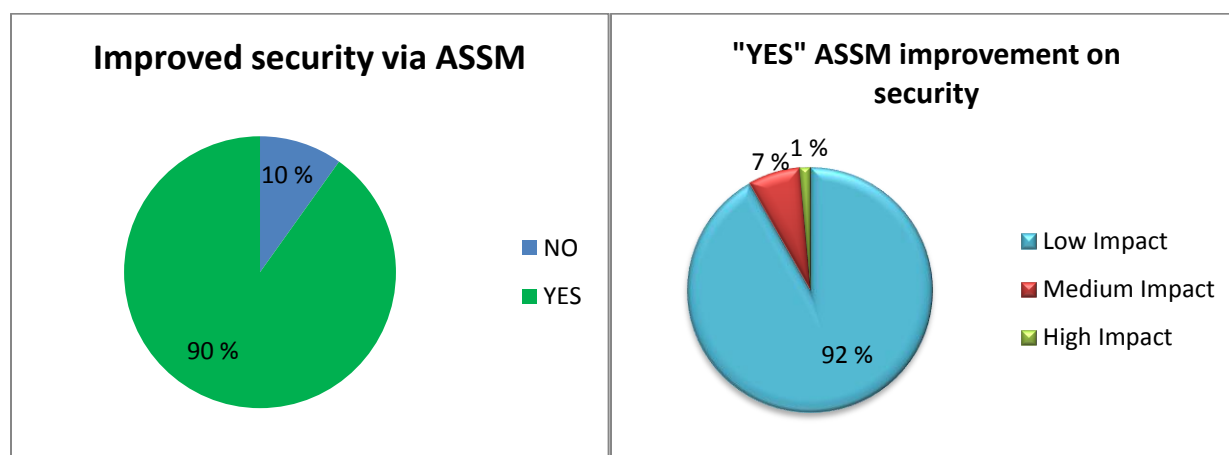


Figure (18a): ASSM has improved security

Figure (18b): ASSM high but fragile impact on security.

VI. Q: *Would you like the government decision to be reversed?*

From eighty-five (85) individuals interviewed on whether they were of the opinion that the government should reverse the small scale mining policy. Four (4) or 5% of the people responded “YES”, eighty (80) individuals representing 94% of the people interviewed responded “NO”, while only one person (1%) could only offer “Don’t know” response. Figure (19) and table (14) above illustrated the result.

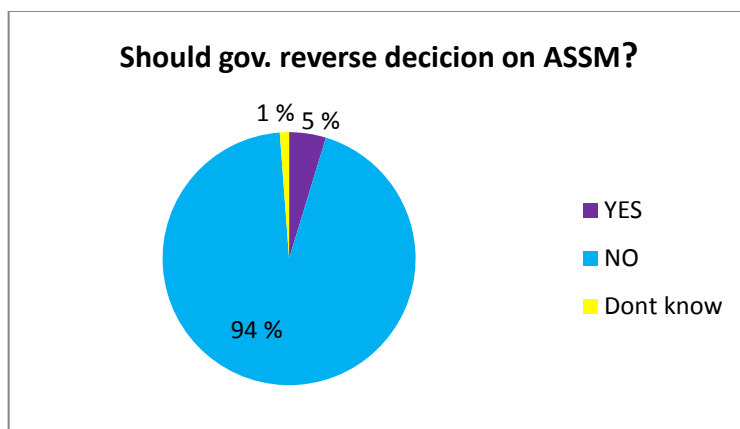


Figure (19): Liberalization of ASSM should not be reversed.

7. DISCUSSION AND CONCLUSION

The Economic Recovery Policy (ERP) which led to the liberalization of small scale mining in Ghana could be simply said to be a step in the right direction. Because of the economic state of the country at that point, one could not argue substantially about the government decision to lay hands on her natural resources to supplement the financial deficiencies in the economy.

However, the myopic focus on the economic recovery and actions that could be taken to aid the economy alone without considering the side effects of those actions, has brought about the negative pictures illuminating from small scale mining and even all mining in the country today.

Though the government has been able to quantify the amount of income generated since the advent of small scale mining in the district which amount to millions of dollar, it is not clear if anyone has been able to recognize and then quantify the amount of lose the country has incurred through this policy alone. The negative impacts of this policy, cuts across all spheres of life in Wassa Amenfi East district and the picture could not be different in other districts in the country. As discovered from the results of this study, the liberalization of small scale mining in the country has affected not only the economy but the environment and the social lives of the people. For example the economy; though this study could conclude that small scale mining has had a very insignificant but impressive impact on the district cum individuals' economy as indicated in (fig. 8a and 8b), it is not enough to say that the practice has been the best so far. The district authorities have been able to provide amenities and infrastructures such as new school buildings, public toilets, bridges, boreholes, rural electricity etc. through the revenues partially generated

from small scale mining. However, the environmental costs involved in this business cannot be underestimated.

Deforestation and loss of biodiversities in the district is occurring at an alarming rate as confirmed in (fig. 9) above. The loosing most of the ecosystem service which significantly supports

lives especially in the rural communities will be to the detriment of everyone but mostly the poor.



Figure (20): ASSM and deforestation in Ghana, (Picture source: Tom-Dery et al, 2012)

Deforestation is a recipe for desertification which could consequently expose the soil to wind and water erosion. Unregulated and intensive small scale mining could herald a cascade effect of food shortages both in Wassa Amenfi district and the country as a whole. This is because most of the areas which are initially cultivated before the advent of small scale mining in the district, could no longer be used for agricultural purposes. The reason is either that the lands have been mined upon or they are to be mined. This occurrence was confirmed in our findings in (fig. 14) above which suggest that small scale mining has reduced agricultural land availability.

In addition, contamination of the soil and the pollution of surface and ground water in the district by heavy metals used during ore processing as confirmed in this study (fig. 10) and (fig. 11) respectively, is a call for concern to all stakeholders. The result also concurs with (Donkor et al, 2006a, p. 2–3) studies which indicated the presence of mercury in small scale mining areas of the Ghanaian gold belt, including the Offin, Pra, and Ankobra Rivers. Though the report suggests that mercury contaminations in these places are below the WHO acceptable safety limit, the “abusive manner” which they are being used poses a serious environmental threats, (Tschakert & Singha 2007). Other studies (Golow and Adzei, 2002; Golow and Mingle, 2002) report high

levels of mercury in soils and cassava leaves around Dunkwa-on-Offin, an industrial and small scale mining area in Ghana.

Studies have shown that the consequences of bioaccumulation of heavy metals are lethal and deleterious. Furthermore, in as much as small scale mining has negatively influenced conflicts in resources (land and water) as confirmed by the result in this study (fig. 14) above, significant progress has been made in areas such as health, standard of living, employment, and security as results confirmed in (fig. 15a), (fig. 16), (17) and (fig. 18) above respectively. The result which indicates a positive impact on the health of districts indigenes and on their standard of living, suggests that there could be a correlation between the two.

In conclusion, the aims and objectives of this study were determined. From the government perspective, it could be concluded that the liberalization policy has achieved the goals (economic recovery and poverty alleviation). However, though it has impacted positively on the people, they also see small scale mining as a threat to their normal way of life.

Given the fact that small scale mining has created various problems in Wassa Amenfi district, one could envisage that the people could favor the opinion that suggests the reversing of the liberalization policy on small scale mining. However, the result (fig. 19) was unimpressive from an environmentalist point of view. The result suggests that the people prefer the exploitation of their natural resource to conservation of natural environment. The determining factor(s) which may have influenced their opinions could not be determined in this study. However, poverty, lack of environmental protection knowledge and the lucrateness of small scale mining could not be ruled out. In addition, the stakeholders should understand that economic growth alone is not enough to ensure equity, social progress and poverty eradication.

7.1. The Way Forward

There are several barriers that have hampered the application of environmental friendly practices in the small scale mining industry in Ghana. They include;

- a) **Laws and policy implementation:** There are several laws and policies that could have termed the current trend in the industry. In 1994 Ghana established the Environmental

Protection Agency Act and in 1999, the Environmental Assessment Regulations (Bonsu, 2011). However, the issue is how stringent are these laws and how strictly are they followed by the stakeholders. It is one thing to make good laws and it is another to implement them. Implementing the policies may be more challenging especially in the small scale mining where most of the activities takes place in the remote communities and may be a daunting task to follow.

The authorities should however, establish offices in those mining areas (villages), and involve a number of local individuals as a point of contact for proper information and coordination of mining activities in the areas. Enough security and deterrent measures should be put in place to check those who falter. An obstacle such as extortion by government agents truncates the process of acquiring a prospecting license, thereby forcing people to operate illegally. It is imperative to sanitize the process as to eliminate this obstacle and its consequences.

- b) **Public Education:** it is largely understood that most of the miners are unaware of the environmental damages they are causing through their activities. Most of the miners discover that their activities are hazardous only when they fall sick and through clinical analysis. In this regard, it is imperative for the authorities to engage the local populace on the need to protect the environment. Restrictions should be placed on heavy metals such as mercury and its control should be handled effectively by an appropriate authority. Transactions regarding heavy metals should only be with a client with a prospective certificate or license.

Heavy metal application should be calibrated in such a way that a certain quantity of ore will have a stipulated quantity of mercury. No mining activity should take place within a certain distance to surface water, while sluice should be prevented from having contact with the environment. Enough information should be made available which include a detailed guideline and on how the miners should operate. Defaulters should be punished by withdrawing their mining certificate.

- c) **Provision of Credits:** Lack of self-generated funding as well as difficulties in securing access to credit facilities are preventing miners from exploring sound environmental

management options. The acute shortage of credit/funds to the miners in Ghana leads to a reliance on cheap, haphazard and environmentally unfriendly operational methods (Aryee et al, 2002). Funding should be provided to the miners so that they could use a better available technology in their operations. This will not only save the environment but will reduce stress and improve their health. Environmental rehabilitation fund should also be made available.

- d) **Protected areas:** In search for gold, the miners reserve little or no value for the existing balanced ecological state of the environment. Biodiversities of high values are destroyed and the lives of both terrestrial and aquatic living organisms are jeopardized. There is hardly any systematic exploration over areas in which small-scale mining takes place before exploitation commences (Aryee et al, 2002). The use of remote sensing technology or Unmanned Aerial Vehicles (UAV) could be deployed to capture anthropogenic activities in the area. It is necessary to designate some areas as protected areas with highly visible signs to indicate what the area could be used for.

Agricultural areas should also be designated and could only be used for agricultural purpose to ensure continuous food availability for the people. The sacrosanctity of these protected areas should be well communicated to the people in several forums through local, regional and central authorities. Enough deterrent punishment should also be put in place and communicated to the public. The authorities should also carry out such punishment in a clear manner without delay to deter others from such behavior.

- e) **Proper planning:** A proper environmental plan should be in place. This is because an improper or a lack of planning and the consequent failure to incorporate environmental issues at the planning stages of operations, results in the creation of substantial environmental liabilities. Incentives could be given to miners who rehabilitate a mined area. Otherwise, prospective miners should be made to deposit a sum for the rehabilitation of the place where he mined. As part of the agreement before the mining license is issued, a stipulated time should be giving to him to rehabilitate the site when the license expires. Failure to rehabilitate the site will lead to a forfeit of the deposit which could be paid to any contractor to carry out the rehabilitation. The depth and

surface area which he should mine should be stated in the agreement so that an appropriate sum should be deposited before mining commences.

- f) **Monitoring:** An unbiased monitoring team or a consultant could be contracted by the authorities to maintain the status quo.

8. References

Ahiamadjie H, Serfor-Armah Y., Tandoh J. B., Gyampo O., Ofosu F. G., Dampare S. B., Adotey D. K., & Nyarko B. J. B., (2011): *Evaluation of trace elements contents in staple foodstuffs from the gold mining areas in southwestern part of Ghana using neutron activation analysis*. (Journal) *J Radioanal Nucl Chem* (2011) 288:653–661.

DOI10.1007/s10967-011-0979-0. Received: 19 August 2010 / Published online: 17 February 2011 Akadémiai Kiadó, Budapest, Hungary 2011. Online @ <http://www.akademiai.com/content/f501610731r41n11/fulltext.pdf?page=1>

AllAfrica: *Ghana Takes Action Against Illegal Chinese Miners*; Retrieved on 21-6-1014. Online at <http://allafrica.com/stories/201308231356.html>

Aryee, B. N.A., Ntibery B. K & Atorkui. E, (2002): *Trends in the small-scale mining of precious minerals in Ghana: a perspective on its environmental impact*. *Journal of Cleaner Production* 11 (2003) 131–140. Minerals Commission, PO Box M.248, Accra, Ghana. Received 5 December 2001; received in revised form 26 February 2002; accepted 27 February 2002. Online @ <http://www.unites.uqam.ca/gmf/globalmercuryforum/files/articles/africa/Ghana%20ASM%20JCP%202003.pdf>

Armah F.A, Luginaah. I, & Odoi. J, (2013): *Artisanal small-scale mining and mercury pollution in Ghana: a critical examination of a messy minerals and gold mining policy*. *J Environ Stud Sci*: DOI 10.1007/s13412-013-0147-7. Online @ http://download.springer.com/static/pdf/948/art%253A10.1007%252Fs13412-013-0147-7.pdf?auth66=1408720837_a24bcd5103c6ae18ee382f525c89fb8d&ext=.pdf

Awumbila. M¹ & Tsikata. D² (w.y): *Migration dynamics and small scale gold mining in north-eastern Ghana: implications for sustainable rural livelihoods*: Centre for Migration Studies University of Ghana P.O. Box LG 59 Legon, Ghana¹; Institute of Statistical

Social and Economic Research University of Ghana Legon². ¹ Head, Centre for Migration Studies, University of Ghana and Senior Lecturer, Dept. of Geography and Resource Development, University of Ghana. ² Senior Research Fellow, Institute of Statistical Social and Economic Research, University of Ghana and Deputy Head, Centre for Gender Studies and Advocacy, University of Ghana. Online @ <http://uaps2007.princeton.edu/papers/70506>

Buxton, A. (2013): *Responding to the challenge of artisanal and small-scale mining. How can knowledge networks help?* Sustainable Markets. Online @ <http://www.ddiglobal.org/login/resources/responding-to-the-challenge-of-asm-how-can-knowledge-networks-help.pdf>

Bonsu, O. D (Barrister & Solicitor) (2011): *GHANA'S ENVIRONMENTAL PROTECTION ACT OF 1994 (ACT 490) AND THE OFFSHORE PETROLEUM INDUSTRY - MARINE ENVIRONMENTAL POTHOLE FILLING*. Ghana Oil Watch: Created online on Wednesday, 06 July, 2011. Time 11:36: Reteived on 14-08-2014. Online at <http://ghanaoilwatch.org/index.php/ghana-oil-and-gas-news/931-ghanas-environmental-protection-act-of-1994-act-490-and-the-offshore-petroleum-industry-marine-environmental-pothole-filling>

Draft National Mining Policy of Ghana, 2010 (N A).

Economic Report on Africa, (ERA) 2013. (N A)

Golow A. A¹ & Adzei E. A.,² (2002): *Mercury in Surface Soil and Cassava Crop Near an Alluvial Goldmine at Dunkwa-on-Offin, Ghana*: ¹ Department of Chemistry, University of Cape Coast, Cape Coast, Ghana. ² Department of Chemistry, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. (Journal) Bull. Environmental Contamination and Toxicology (2002) 69:228–235© 2002 Springer-Verlag New York Inc.DOI: 10.1007/s00128-002-0051-4. Online @ http://download.springer.com/static/pdf/152/art%253A10.1007%252Fs00128-002-0051-4.pdf?auth66=1408784002_63ba1414bfc778666abfd00d6175d385&ext=.pdf

Golow A. A,¹ & Mingle L. C², (2002): *Mercury in River Water and Sediments in Some Rivers near Dunkwa-On-Offin, an Alluvial Goldmine, Ghana*: ¹ Department of Chemistry, University of Cape Coast, Cape Coast, Ghana. ² Department of Chemistry, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. (Journal) Bull. Environmental Contamination and Toxicology (2003) 70:379–384© 2003 Springer-Verlag New York Inc. DOI: 10.1007/s00128-002-0202-7. Online @ http://download.springer.com/static/pdf/101/art%253A10.1007%252Fs00128-002-0202-7.pdf?auth66=1408783917_fe74396e9360413e110638291e34c0d7&ext=.pdf

Ghana Mineral Commission, (2010): *Gold deposits of Ghana*

Ghana Minerals and Mining Act, (2006). Online @ <http://faolex.fao.org/docs/pdf/gha85046.pdf>

Ghana Mining Portal: Retrieved on 18-5-2014. Online at <http://www.ghana-mining.org/ghanaims/Home/tabid/36/Default.aspx>

Ghana News Agency: *Wassa Amenfi District Cries for Water*: Retrieved on 21-5-2014. Online at <http://www.ghananewsagency.org/health/wassa-amenfi-district-cries-for-clean-water--63144>

Ghana Legal: *Small Scale Gold Mining Laws*: Retrieved 18-6-2013. Online at <http://ghanalegal.com/?id=3&law=556&t=ghana-laws>

Ghanadistricts.com: *Wassa Amenfi East District*; Retrieved, 19-6-2014. Online at <http://www.ghanadistricts.com/districts/?news&r=5&=144>

Hilson. G (2001): *A Contextual Review of the Ghanaian Small-scale Mining Industry*; Imperial College Centre for Environmental Technology, London, UK. (Journal) Mining, Minerals and Sustainable Development (MMSD) No. 76. Online @ <http://pubs.iied.org/pdfs/G00722.pdf>

Hentschel. T (Bolivia), Hruschka. F (Peru), & Priester. M (Germany) Projekt-Consult GmbH, (2002): *Global Report on Artisanal & Small-Scale Mining*. (Journal) Mining,

Minerals and Sustainable Development (MMSD). No. 70. Online @

<http://pubs.iied.org/pdfs/G00723.pdf>

Jadot, S, (2013): *Artisanal and small-scale gold mining, the environment and the new dawn of the Ghanaian gold rush: Ghana's golden future: (Journal) Consultancy African Intelligence (CAI):* Retrieved 18-6-2014. Online at

http://www.consultancyafrica.com/index.php?option=com_content&view=article&id=1305:ghanas-golden-future-artisanal-and-small-scale-gold-mining-the-environment-and-the-new-dawn-of-the-ghanaian-gold-rush-&catid=92:enviro-africa&Itemid=297

Lawson, E.T & Bentil, G (2013): *Shifting sands: Changes in community perceptions of mining in Ghana: Environ Dev Sustain.* DOI 10.1007/s10668-013-9472-y. Online @

http://download.springer.com/static/pdf/511/art%253A10.1007%252Fs10668-013-9472-y.pdf?auth66=1408720911_b9f1ce254edd6bd589896d829c8d0696&ext=.pdf

Modern Ghana: *Chinese operating Galamsey in Wassa Amenfi East District:* retrieved 19-5-2014. Online at <http://www.modernghana.com/news/226149/1/what-is-going-on-in-ghana.html>

OBIRI S., DODOO D. K., OKAI-SAM F., ESSUMANG D. K. & ADJORLOLO-GASOKPOH A., (2005): *Environmental Monitoring and Assessment: Cancer and Non-Cancer Risk From Eating Cassava Grown In Some Mining Communities in Ghana:*

Environmental Research Group, Department of Chemistry, University of Cape Coast, Cape Coast. (*author for correspondence, e-mail: dkdoodoo@yahoo.com) (Received 11

February 2005; accepted 6 July 2005) @ Springer 2006. *Environmental Monitoring and Assessment* (2006) 118: 51–63: DOI: 10.1007/s10661-006-0773-6. Online @

http://download.springer.com/static/pdf/994/art%253A10.1007%252Fs10661-006-0799-9.pdf?auth66=1408783792_b0cf541d5c7bd12a3013b72f515d1f71&ext=.pdf

Precious Mineral Marketing Company (PMMC); Retrieved April 21st, (2013). Online at <http://pmmcghana.com/gold>.

Schueler, V, Kuemmerle, T & Schröder H, (2011): *Impacts of Surface Gold Mining on Land Use Systems in Western Ghana.* (Journal) *AMBIO* (2011) 40:528–539. DOI

10.1007/s13280-011-0141-9. Received: 7 July 2010 / Revised: 13 December 2010 / Accepted: 14 February 2011 / Published online: 18 March 2011. Online @ http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3357810/pdf/13280_2011_Article_141.pdf

Tschakert. P^a & Singha K^b, (2007): *Contaminated identities: Mercury and marginalization in Ghana's artisanal mining sector.* ^a Department of Geography/Alliance for Earth Sciences, Engineering, and Development in Africa (AESEDA), Pennsylvania State University, 315 Walker Building, University Park, PA 16802-5011, USA. ^b Department of Geosciences, Pennsylvania State University, 311 Deike Building, University Park, PA 16802, USA. ScienceDirect: Geoforum 38 (2007) 1304–1321. Received 14 January 2007; received in revised form 24 April 2007. Available online @ http://communitymining.org/attachments/241_Mercury%20and%20marginalization%20Ghana.pdf

Tom-Dery D, Dagben Z. J. & Cobbina S.J, (2012): *Effect of Illegal Small-Scale Mining Operations on Vegetation Cover of Arid Northern Ghana: Research Journal of Environmental and Earth Sciences* 4(6): 674-679, 2012; ISSN: 2041-0492: University for Development Studies, Faculty of Renewable Natural Resources, Tamale, Ghana. Submitted: April 29, 2012. Accepted: May 13, 2012 Published: June 30, 2012. Online @ <http://maxwellsci.com/print/rjees/v4-674-679.pdf>

The Ghana chamber of Mines: *All information on Laws and Policies*; Retrieved on 18-5-2014. Online at <http://ghanachamberofmines.org/en/our-publications.php>

9.1. ARTISANAL AND SMALL-SCALE MINING IN WASSA AMENFI EAST, (GHANA) (research questioner), By Ezeji Emmanuel

The aim of this research is to determine the impacts of government decision to liberalize small-scale mining operations in the country. WASSA AMENFI EAST municipality is taken as a case study; the areas of interest are economic, social and environmental indices. Scale (1 to 3) is used to indicate the extent of impacts(s). (1 = lowest impact, 3 = highest impact)

Occupation: _____

1	Economy	No	Yes (SCALE)			Don't Know
a	Has ASSM help to improve the economy of the municipality?		1	2	3	
	Or individuals		1	2	3	
2	ENVIRONMENT		Yes (Scale)			Don't Know
a	What has been the impact of ASSM on the forest (deforestation)?		1	2	3	
b	Does ASSM have any impact (Pollution) on surface and ground water?		1	2	3	
c	Has ASSM contributed to soil contamination by heavy metals such as (Mercury)?		1	2	3	
d	Has it affected farm land availability (Decrease)?		1	2	3	
e	Has ASSM related activities brought disturbances such as noise?		1	2	3	
3	SOCIAL		Yes (Scale)			Don't Know
a	Has ASSM related activities Increased social problems such as land/water conflict?		1	2	3	

b	Has ASSM affected the Health (diseases & life span) of people in the area including the miners?		1	2	3	
c	Has ASSM Improved the living standard of the people?		1	2	3	
d	Has ASSM created employment in the municipality?		1	2	3	
e	Has ASSM activities helped to Improve security of lives and properties?		1	2	3	
f	Would you like the government decision to be reversed?	No	Yes			Don't Know



Picture Source: Ezeji Emmanuel, 2014