



A Potential Local Socio-Ecological Disaster? Artisanal Small-Scale Gold Mining At Old Mutare Mission Area In Mutasa District, Zimbabwe

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Abstract-Today, artisanal small-scale mining (ASM) in Zimbabwe is dominantly characterised by destructive mining and wasteful mineral extraction. Such activities have severe impacts on the environment which include deforestation, over-stripping, burning of bushes, and use of harmful chemicals like mercury and cyanide. From a community perspective, this article explores the ecological concerns resulting from artisanal small-scale gold mining (ASGM) at Old Mutare Mission area in Mutasa District of Zimbabwe, focusing on the extent to which the activity has damaged the environment and created several social problems. A qualitative inquiry was conducted utilizing interviews and onsite observations. The results from the study showed that ASGM at Old Mutare is undertaken by unskilled and under-equipped gold miners known as the *Makorokoza*, who destroy lands by burning, as well as massive digging which leads to a substantial disturbance of ecosystems. The paper concludes that ASGM is an ecological time bomb, 'a potential disaster' which requires appropriate regulating and management to promote sustainable use of natural resources and safeguard the environment.

Index Terms- Socio-Ecological Impact, Artisanal Small-Scale Mining, Artisanal Small-Scale Gold Mining, Makorokoza, Old Mutare Mission.

1. INTRODUCTION

Since 1995, the Zimbabwean economy has been declining and worsened by the agricultural interruptions brought about by the government's fast track land reform program (2002). The foreign investment policies, such as the domestic policy, has seen a significant decrease in foreign investors in the manufacturing industry. Due to the lack of foreign currency and hyperinflation peaking at more than 450 billion %, manufacturing has reduced. The economic decline has brought about subsequent job losses, and the unemployed population is now estimated to be more than 87 % (Chimhowu, 2009). Abundant mineral resources in the country are viewed as a viable income source for impoverished families. Therefore, the discovery of gold in different areas of the country has led to an influx of people hoping to earn an income to sustain their socio-economic livelihoods. By 2001 an estimated 350000 people, more than half of which were women, were participating in legal or illegal small-scale mining. The small-scale mining contributed about 15% of Zimbabwe's gold export (Chimhowu, 2009). However, according to Edwards (2014), mining in Zimbabwe has struggled to live up to its potential. Among the reasons is reduced maintenance and management of the mines, resulting in ASGM activities. While small-scale miners are thought to operate with a higher degree of legal legitimacy; it is widely asserted that the majority of ASGM in Zimbabwe is illegal. The unregistered or illegal miners are called *Makorokoza* or *Amakorokoza*, meaning 'panners'. Their mining activities are characterised by low productivity, a lack of capital, inadequate technology, and hazardous working conditions argued to have caused severe environmental disruptions, land degradation, and pollution.

The primary objective of this article is to assess the impacts of ASGM on the environment and socio-economic livelihoods of the local community in Old Mutare area of Mutasa, in Zimbabwe to;

1. Provide a framework for the understanding of socio-ecological problems associated with ASGM.
2. Raise community awareness of the risks associated with ASGM.

Research questions guiding this paper are

1. How has ASGM affected the environments and livelihoods of people in Old Mutare area?
2. What are the risks of ASGM from the perspectives of the locals in Old Mutare?

Artisanal Small-Scale Gold Mining activities have not received enough attention from the Zimbabwean government. As a result, there is a potential danger of local rivers such as Mutare River and other surrounding streams getting contaminated by mercury and other chemicals used by panners in the process of purifying gold. Studies have not been carried out to predict the potential impacts of mercury poisoning on humans and aquatic life not only in Old Mutare but several areas across Zimbabwe. There is a lot of environmental degradation and pollution caused by ASGM which have gone with no meaningful reaction from the Zimbabwean government. This paper, therefore, seeks to provide a foundation for a better understanding of the nature and degree of environmental problems at Old Mutare as a result of ASGM so that environmentally friendly gold mining practices can be promoted in the Old Mutare and other areas. The research will also equip the communities involved, thereby reducing hazards caused by mining.

The first section of this paper presents background literature of ASGM in Zimbabwe while drawing upon cases of literature on ASM mining in Africa and beyond. Next, the paper explores the impacts of ASGM drawing upon conventional narratives of the *Makorokozas* in Old Mutare? This paper concludes, arguing the need for the government to formulate clear policies aimed at mainstreaming risks and disaster resulting from ASGM activities, as well as implementing proper institutional frameworks which can hold small-scale artisanal miners responsible and accountable for socio-ecological disruptions caused by their activities.

11. LITERATURE REVIEW

ASM operations feature several rudimentary practices that pollute the air and contaminate resident water bodies and soils, for example, through the use of mercury (Hilson & Van der Vorst, 2002). Mercury is used for gold amalgamation in artisanal mining. The amalgamation process transforms elemental mercury into methyl mercury (United Nations Environment Programme [UNEP], 2002). Methyl mercury, one of the most toxic organic compounds, is a potent neurotoxin that works its way up the food chain through bioaccumulation, posing a threat to the health of animals, humans (International Council for Science, 2007) and aquatic life (Tunhuma, 2007). Mercury is also poisonous when inhaled (Larceda, 1997), as it causes lung cancer and skin disease. The mercury used by panners is also discharged into ecosystems in an abusive manner (Pfeiffer & Larceda, 1988; Meech et al., 1998).

According to Shoko (2002), problems caused by the clearing of land include soil erosion, siltation, and soil compaction, destruction of ecosystems and loss of biodiversity. Water pollution destroys aquatic ecosystems, plant life and depletion of freshwater resources. For Babut et al. (2005) and Hinton, Veiga and Veiga (2003), the effect of artisanal small-scale gold mining on the ecology is the fragmentation of ecosystems and habitats, obstructing migratory routes to breeding and feeding grounds used by wildlife, and depletion of fisheries. Miththapala (2008) argues that land degradation leads to loss of livelihoods and reduced food security. Shoko (2002) also lists problems caused by air pollution, such as ozone depletion and global warming, in which greenhouse gases trap long-wave radiation, thereby increasing the temperature on the earth's surface. Noise pollution from stamp mills, pan dishes and blasting also cause ill health, loss of hearing and migration of wildlife and birds. Land degradation also results in the loss of aesthetic value of the landscape as mining activities leaves open pits and mounds of sand.

Establishing sound knowledge systems of hazards and risks associated with small-scale mining helps communities develop relevant coping strategies (Wisner et al., 2004). An understanding of the ecological disasters associated with gold panning is critical to decision-making, planning and implementation of

development projects that are competing for the same resources in the district, for example rural, urban, legal mining, illegal mining, and irrigated commercial and subsistence agriculture. This article, therefore, provides a step towards good land management practices, crucial in sustainable utilisation of natural resources. The paper also contributes to the fundamentals of formalising illegal gold mining and promoting community participation in policy-making and environmental protection, as the same community is involved in these illicit activities. Community participation helps promote efforts that 'advocate for cleaner production techniques to be used in the purification of gold to reduce impacts on gold panners and environment' (Ghose, 2003).

111. BACKGROUND ON THE ASGM IN THE ZIMBABWEAN CONTEXT

The upsurge of ASGM across sub-Saharan Africa is labour-intensive, and the miners use no machinery resulting in extensive debates regarding how poverty-driven gold mining remains imperceptible within academic discourses on rural livelihoods, and development (Hilson & Maconachie (2017). According to Donkor et al., (2006), there is a general failure of policymakers, as well as researchers to engage closely with the concerns of ASGM-dependent communities. The latter has led to a severe lack of nation and state support measures for regulating ASGM and a poor understanding of small-scale mining in Africa. Weng et al., (2015) further postulate that underpinning ASGM deliberations in many countries is the broader issue that structural adjustment and market liberalisation has induced significant unemployment which has forced many people into illegal artisanal mining to supplement their incomes. Even so, in countries such as Ghana, Tanzania, Senegal, and Mozambique, artisanal mining has become a supplementary economic activity to alleviate poverty (Weng et al., 2015).

Zimbabwe, which gained independence in 1980, is a landlocked, low-income country located in the southern part of Africa, sharing borders with Botswana, Zambia, South Africa, and Mozambique. Of the country's 390,000 square kilometres of surface area, 99% is land, and the remaining 3,900 square km is water (Jerie S. and Sibanda E., 2010). Only 8.2% of the land area is arable. The population of Zimbabwe was measured in 2012 at 13 million and is currently estimated at 15 million, with 52% of citizens being female (Population Services Zimbabwe, 2013). The majority of people are Zimbabweans of African origin. The major ethnic tribes are Shona and Ndebele. The country is divided into eight administrative provinces, two cities with provincial status, and 62 districts (subdivisions of the provinces). The executive, legislature, and judicial system constitute the three pillars of government. There is a multi-party-political system. The major sectors of Zimbabwe's economy are services, agriculture, mining, tourism, and manufacturing. Overall, in 2014 the mining sector contributes 9% to GDP, more than 55% of exports, 11% of fiscal revenue, and 50% of foreign direct investment (Chamber of Mines of Zimbabwe, 2017).

Zimbabwe is well endowed with deposits of an estimated 60 minerals, approximately 40 of which historically have been exploited. The Zimbabwe Geological Survey (1990) identified more than 500 individual deposits of base metal and industrial minerals in the country (Dube, 2011). Its potential gold reserves are estimated at 84 million tonnes at an average grade of 4.9 grams per tonne. Zimbabwe is rated sixty-seventh-most attractive mining jurisdiction in the world in terms of geological prospectively, out of 104 mining countries, by the Fraser Institute (FI). According to Shoko (2002), the geological map of Zimbabwe shows the Great Dyke running North East-South West through the middle, in association with greenstone belts. The Great Dyke of Zimbabwe is a layered mafic invasion of igneous, metal-bearing rock that has been dated to approximately 2.5 billion years old. Greenstone belt is a zone of variably transformed mafic sequences associated with sedimentary rocks, gold and granite. The great dyke is usually associated with economically important metals such as chromium, nickel, copper, platinum, titanium, iron, vanadium, and tin. Chromium, in the form of the mineral chromite, and platinum are particularly abundant in the Great Dyke and actively mined (Kamete, 2007). Major known diversified minerals in dyke feature for Zimbabwe include Platinum Group Metals (PGMs) and chrome.

Gold mining makes up a significant part of the mining sector and is broadly divided into large-scale gold mining (LSGM) and ASGM. Zimbabwe's Environmental Management Regulations (2014) define an artisanal miner as one "who carries out mining activities using simple tools and employs up to 50 people; these include Government-registered groups or syndicates or co-operatives." It is generally accepted in Zimbabwe that the distinction between ASGM and LSGM (and further, between artisanal gold miners and

small-scale gold miners) is based on the scale of operation and degree of mechanisation. However, the law makes no distinctions among the property rights that the different scales of mining can apply.

Overall, the Zimbabwean gold industry's contribution to the economy comes in several forms which are:

- Direct contribution to GDP
- Employment creation
- Foreign exchange generation
- Gross national investment
- Social infrastructure development through corporate social responsibility activities
- Direct contribution to government revenue (tax revenue)

Gold mining also provides indirect contributions, including the development of upstream (supply) and downstream linkage industries and the induced effects of household spending, which together result in multiplier effects on the economy. While LSGM continues to be seen as the primary contributor to gold output, its contribution has declined over time relative to ASGM. ASGM makes both macro-economic contributions to the national economy and micro-economic contributions to livelihoods and, therefore, directly alleviates poverty. However, ASGM is associated with environmental degradation, social ills, and poor health and safety records. The sector faces many constraints ranging from the paucity of finance (due to lack of collateral security against bank loans) and technical expertise to inefficient mining and processing methods (leading to low recoveries).

IV. LEGISLATION OF ASGM IN ZIMBABWE

Actors within the ASGM sector must comply with multiple pieces of legislation to operate legally. The two critical pieces of legislation governing the ASGM sector in Zimbabwe and the related gold trade are the Mines and Minerals Act (MMA), which forms part of the Mining Code, and the Gold Trade Act. Other legislation includes the Explosives Regulations, Environmental Management Act, Forestry Act, Water Act, and Zimbabwe National Water Authority Act, among others (Government of Zimbabwe). The MMA vests ownership of all minerals to the President as a steward. A wide-ranging piece of legislation, the MMA contains regulations for prospecting, working, maintaining, and abandoning claims. The MMA provides for three types of exploration for mineral titles: Exclusive Prospecting License, Special Grant and Prospecting License. It also provides the framework for establishing title over a mine development, such as through leases and claims. The MMA establishes the Mining Board to manage the administration of the Act effectively. Whereas the MMA deals with property and rights over mining property, the Gold Trade Act focuses on the possession and dealing in gold. The Gold Trade Act prohibits the possession of gold by unauthorised persons and regulates dealings in gold, detailing the necessary licensing and permits (Government of Zimbabwe).

It is also critical to note that mining licenses are only granted if the miners satisfy laid down criteria that are also compliant with environmental regulations stipulated by the Environmental Management Agency (EMA). The majority of the Small-Scale Artisanal gold miners in Old Mutare area have been mining gold illegally because they do not possess the requisite mining licenses and environmental certification. To circumvent this legal requirement, the illegal miners simply pay bribes to the police to facilitate their illegal mining operations. More so, the police are also receiving bribes from the unlicensed miners who intend to sell their gold. Even so, mining laws in Zimbabwe are clear that only licensed dealers can sell or buy gold. By allowing unlicensed dealers to sell or buy gold on condition that they would have paid the police a bribe, distorts information of how much gold has been extracted and the revenues it generates. In other words, gold that traded illegally does not find its way to the Reserve Bank but is usually shipped out of the country, thereby depriving the country of the much-needed revenue.

V. THEORETICAL FRAMEWORK

Among the several theories to explain Artisanal Small Scale Gold Mining; this study employed the Structural Functionalism and the Social Network Theories to explain societal responses to the discovery of gold along riverbeds and ploughing fields against the background of poverty and unemployment.

Structural Functionalism Theory-According to structural Functionalism theory, the society functions as a system with interrelated parts which are dependent on each other to achieve maximum function (Haralambos and Holborn, 1995). On that account, the principles of moral and social responsibility that people in most communities embrace are urgently needed to manage the environment and alleviate the destructions caused by Artisanal Small Scale mining activities. All structures and institutions have complementary roles which help to maintain a balance in the way society functions. A break down in any part of the system affects the overall function of the societal system.

In this context, the functionalism theory assists in the understanding of how a breakdown in rules governing the behaviour of family, groups or community towards the ecosystems can negatively impact other structures. Structural functionalism also helps in understanding the various response strategies that societies come up with in adjustment to the adverse effects of ASGM on both the local environment and community livelihoods. The theory also provides a useful framework for studying community structures which can be utilised to foster awareness of the environmental damages caused by the use of mercury and other chemicals in gold panning.

Social Network Theory-According to Castells (2002), a social network is a social structure made of individuals or organizations called nodes, which are tied or connected by one or more specific types of inter-dependence, such as shared interests as in individuals, families, community leaders, friendship, kinship and the government. He further postulates that social meaning arises primarily from challenges posed by certain kinds of social structure, notably those that generate social conflict, social inequality and the destruction of social solidarity. Moreover, there is one unitary kind of social structure as well as the unitary base for resolving the challenges and problems associated with it. In the context of this paper, various factors drift artisanal miners into their conditions as the challenges that are caused by their economic, social structures especially the erosion in community values of social cohesion and failure of the rule to govern the operation of individuals and families against its environment making it a potential disaster. For this study, by maintaining social networking, the communities can find some innovative ways to sustainable development programmes and projects without damaging the environment and create a better future.

VI. METHODOLOGY

A qualitative method specifically interviews, and onsite observation were used to collect data on the impacts of ASGM in the Old Mutare area of Mutasa. Purposive sampling was used to select three areas that are at the hub of panning activities, namely Nyagambu and Mutare rivers around Africa University, Premier, Grange and Old Mutare Mission Centre. Purposive sampling is selecting a sample based upon the researcher's judgement and specific purpose rather than randomly (Teddlie & Yu, 2007). As suggested by Teddlie and Yu (2007), purposive sampling allowed for ease of access to artisanal small-scale miners. The research assumed that artisanal small-scale miner, in general, share common socio-economic circumstances in rural areas of Zimbabwe, therefore, the sample selected for this study are considered representative of other miners in the area.

So as to capture the narratives of the miners, interviews were conducted with five groups popularly known as syndicates within the mining camps, nurses from local clinics, Mutare City Council (MCC), the Ministry of Mines and Mining Development (MMMD), the Mutasa Rural District Council (MRDC), Zimbabwe National Waters Association (ZINWA) and the Environmental Management Agency (EMA). Field visits were also carried out for ground truth to validate the data from the interviews. Pictures of disruptions to riversides and riverbeds areas and degraded land were taken for the analysis. However, it was not possible to involve more participants because of time and financial constraints.

VII. STUDY AREA

Old Mutare Mission Area, in the Mutasa district of Zimbabwe, is located in Ward 21 of Mutasa South Constituency, Mutasa District, one of the seven districts in Manicaland Province. The area is endowed with gold deposits and fertile red agricultural soils. The Manyika people are traditional subsistence

agriculturalists and gold-mining descendants of the area. Traditional knowledge of the geological formation of the landscape is passed down from generation to generation. Historically, artisanal gold mining has also been passed from generation to generation. The gold belt forms a narrow range of hills cutting across the watershed and the drainage platform of Mutare River (Swift, 1956). Mutare River flows over the Mutare-Odzi (MO) gold belt in a south-easterly direction. There are three communities around Old Mutare which are also at the hub of panning activities, namely Premier, Africa University and Grange. It has a population of over 20 000 people. *King's Daughter Mine* (formerly Redwing Mine), owned by Metallon Gold is the biggest gold mine in Old Mutare area. Old Mutare is located 17 km north-west of the City of Mutare. Apart from gold mining, the Old Mutare Mission area and its surrounding communities sustain their livelihoods through farming activities.

VIII.FINDINGS AND DISCUSIONS

Artisanal Small-Scale Gold Mining Activities and its popularised narratives

The scene in Old Mutare Mission area, is a hive of activity with people clutching shovels, picks and buckets all in search of the precious yellow mineral that is gold. Unregulated gold panning has devastatingly exhausted both the environment and the society. Trails of open pits and heaps of soil are visible as one walks past illegal gold panning sites such Africa University, Mawoyo, Premier and Grange. Morning to evening days are filled with hyper energy as hordes of men and women hustling into what used to be thick bushes that are now open and barren track of lifeless land. These artisanal gold miners operate in individual organised into groups (four to eight members) or syndicates (ten or more individuals), which are entirely financed by limited resources and undertaken full-time, using simple techniques and traditional instruments with low level of mechanisation (Dreschler, 2001), and they generally comprise people who share kinship ties, are extended family members, or friends who have known each from their place of origin or those who have worked together at different mine sites over a long period of time. Some syndicates are made up of wage labourers employed by a sponsor. Although syndicates predominantly comprise male members (due to heavy manual work involved), women are also involved in syndicates either as sponsors who hire labour or as gold buyers or dealers who buy gold for resale locally or to gold smuggling syndicates. Women can also act as co-managers of a syndicate with their husbands.

The central feature of Chikorokoza is the use of rudimentary tools as opposed to large machinery used in industrial mining. The activities are also regarded to be highly mobile, labour intensive and they generally exploit marginal small deposits, which occur near the surface and become exhausted after only a few years. However, in most developing countries, artisanal miners/makorokozas are regarded as illegal villains who recklessly pollute the environment and are also stereotyped as criminals, which is a common label for marginalised people in the informal economy (Chipangura, 2017).

From the interviews it was understood that the locals had no joy in the land and the rivers, where the gold miners have ravaged through their surrounds. Most of the interviews mentioned that the miners leave a shadow of vegetation destruction, as well as an oasis of pollution and litter. Prime farming land has also not been spared the wrath of the illegal gold miners or *Makorokoza*. The name given to these panners '*Makorokoza*' symbolises their lawlessness and immoral behavior among the locals. In Premier and Grange areas many cropping fields have been dug up and might not be useful for any form of agriculture. Many of the subsistence farmers in these parts have also turned to these artisanal illegal mining activities.

Makorokoza are known for their criminal activities and their unquenchable thirst for violence and blood (Mandava, 2012). They have resisted the call to stop riverbed mining as well as the one to stop using dangerous substances like mercury. Even strong-arm tactics like utilizing the police to forcibly remove them have only worked for a short- while. As per the interviews with the local police, they mentioned that there are many incidents of confrontations between the police officers who regularly patrol the areas to make arrests and the *Makorokoza*. Sometimes police officers are beaten during the confrontation and had to flee from these gangs. However, such incidents are usually followed by heavy presents of the anti-riot support unit police and soldiers who can arrest and charge them for violence and illegal mining. During these operations the law enforcement agents can even cause havoc to innocent residents and travelers. Such

violence is usually witnessed by villagers who live nearer to the places where the violent confrontations took place.

Based on the observation of the areas around Old Mutare, most villagers living around gold panning areas lose their livestock which usually fall into unclosed pits that are left by the illegal miners especially during the rainy season. The open pits have become a hazard even to humans as people often fall into them during the night. Some of the pits are as deep as six metres. The growth of illegal gold mining has encouraged the eruption of informal shanty settlements around the gold producing areas. Some of the locals that were interviewed also showed concern for having no toilets or sources of clean water in such settlements, hence exposing the community to diseases. The nurses emphasized the widespread cases of malaria, diarrhea, and sexually transmitted diseases in such informal settlements. Among the narratives that were commonly shared by the church authorities as well as locals was that prostitution was becoming a brisk business whereby young girls faced with financial difficulties leave their homes and resorting to having sex with the illegal gold miners in return for money.

The nearest health centres; Premier Clinic and Old Mutare Hospital have been battling against sexually transmitted infections (STIs) that are rampant amongst the panners and their partners.

“We have treated quite a number of girls from in and around the Premier and Grange areas who have been infected with sexually transmitted diseases and gonorrhoea being the most widespread,” said a nurse from Old Mutare Hospital who requested anonymity due to professional reasons. “Unfortunately, one in a handful of cases come to our attention. I suspect most infected people go on to infect other people in a web of infections as panners move from place to place.”

These unregulated gold mining activities have adversely affected Nyagambu, and Mutare rivers. These rivers supply water to Dams in and around Mutasa South Constituency farming area. Wild animals and livestock also rely on these rivers for drinking water. These rivers are heavily polluted with mercury and cyanide discharged into them by the illegal gold miners. The health of people, aquatic life and livestock reliant on these rivers for their water supplies has been compromised. The people living downstream are the worst affected. It takes times for the negative impacts of water pollution by chemicals to manifest in humans. In Zimbabwe, gold mining is criminalised, but the police and the regulatory authorities have failed to implement the laws and enforce compliance. This has been attributed to lack of compliance and enforcement to conflict of interests in the country’s legal regime and institutions. The government has gone into an over-drive preaching empowerment and this so-called empowerment sometimes is done at the expense of the environment. The country has been continuously losing potential revenue as gold produced by the unregulated illegal gold panners rarely finds its way into the official gold buying company Fidelity Printers. More often than not panners prefer to sell their gold to informal buyers who smuggle the precious mineral out of the country, prejudicing the country of benefits from its own resources.

Potential Disasters

Disasters are a function of the risk accumulation process arising from a combination of hazards, conditions of vulnerability and inability to cope with the negative consequences of risk. According to the United Nations Office for Disaster Risk Reduction (UNISDR, 2009), a disaster is “a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.” This means that a hazard impact, if met with the necessary conditions, can result in huge disturbances of the normal operations of a community, causing economic, material and environmental losses of great magnitude, making it difficult for such a community to recover without external assistance. Although beyond the scope of this article, social disaster – loss of human life, injuries and STIs and even HIV/AIDS was ranked by stakeholders as having high potential within these communities with such activities. However, the panners were in fear of injuries and loss of human life more. This is because panners are directly affected by deaths and injuries. In 2019 alone, more than 15 gold panners got injured for life, whilst more than 4 died as a result of shafts collapse. This information from the panners explain the magnitude of loss of human lives and injuries. The Mutasa Rural District Council officials have expressed

concern about the costs incurred by the council when burying people without relatives who died as a result of shaft collapse.

Environmental Damage-Lack of sanitation facilities in African University, Premier, Mawoyo and Grange campsites made Mutare River the ultimate destination of human waste. Most of the farm families did their laundry in the river. This is, however, typical for rural areas where people fetch water directly from a flowing stream for their home consumption. Mining especially in the Mutare River increased siltation which occurred during heavy rains. There was also evidence of soil compaction and deforestation along the riverbanks which resulted in accelerated run off and the washing away of sifted material piled up loosely on the riverbank and in the riverbeds. The study established that most of the dams were silted and in most of the rivers, it was deemed not economically viable to construct new dams along the rivers where gold mining took place as showed in figure one.



Figure 1: Land Degradation as a result of ASGM

It is also observed that there are open pits everywhere, siltation of major rivers, pollution of dams and some dried rivers showed extensive riverbed damage due to previous gold mining activities. In most cases, dangerous pits created on the riverbeds were not closed. Seventy percent of all trees in the mining sites were damaged. There was, however, no way to estimate the proportion of damage due to gold panners alone. The panners were asked whether they were aware that they were causing serious damage to the environment, most indicated that they were so experienced that they were no longer a threat to the physical and social environment. The panners, however, seemed to be unclear as to what they deemed environmental damage. In contrast to their perceived experience, some of the miners indicated that they did not know or realize the impact of illegal gold mining to the physical environment. While some panners and non-panners acknowledged that siltation arose as a result of artisanal gold mining, stakeholders mentioned that siltation was not only caused by gold mining, but also by stream bank cultivation, poor crop production practices, over grazing and deforestation by people seeking firewood and poles.

Open Mines-One of the main effects of artisanal gold mining on the environment at Old Mutare Mission Area is soil degradation and land damage. Panners do not refill the holes they make after mining. Pits lengths, widths and depths are four, three and two meters on average, respectively. Abandoned after mining, these open mines become traps for animals and breeding grounds for mosquitoes. No plants can grow around the area. Some of the open mines observed are showed in figure two as follows;



Figure 2: *Open and Abandoned mines as a result of ASGM*

Impacts on Vegetation & Social life-Panners cut down trees and destroy bushes in and around mining camps to have larger mining surface areas, and for the purpose of safety. I have observed that the panners fell these trees with axes, machetes and even chainsaws thereby reducing surfaces covered by forest. The opening of artisanal gold mines creates roads and paves the way for small-scale logging/shunts as was observed in the Premier mining camp. These small-scale logging activities are gradually attracting more and more people. The impacts of mining coupled with that of logging is a serious threat to the forest and has some negative social impacts on the population as it leads to the development of activities such as prostitution which spreads of STDS including HIV/AIDS (UNAIDS, 2013). Many children drop out of school to join mining, with children as young as 15 engaged in mining. Hygienic conditions inside mining camps are deplorable and lack of clean drinking water can cause outbreaks of waterborne diseases.

Use of Mercury and other Chemicals-Artisanal Small-Scale Gold Mining in Old Mutare relies on mostly unskilled workforce using rudimentary tools and techniques. Unsurprisingly, it's environmental and health and safety practices tend to be very poor. Inhaling dust and fine particles resulting from blasting and drilling process done on Chiremba, Premier and Chin'ando hills can cause respiratory disease such as silicosis or pneumoconiosis in men and women, and in the children, who often accompany their parents. According to Meech, J.A., Veiga, M.M. & Troman, D (1998), a lack of ear protection to filter noise from equipment like drills or crushers can cause temporary or permanent hearing loss and speech interference. Mercury also damages crop and farmlands, resulting in lost food production. Streams and rivers often become polluted near these ASGM sites, which makes water unsafe for drinking and can also affect fish stocks previously relied upon for food. For example, in 2019, Franklin and Sons Farm located in the Old Mutare area, lost over 150 tonnes of Wheat after the Zimbabwean Grain Marketing Board condemned it unsuitable for human consumption because of higher level of mercury content. The Farm uses irrigation water from Mutare River for its agricultural activities. Artisanal Small-Scale Gold mining is the source of the largest releases of mercury, estimated at 1,400 tonnes per year in 2011 according to the Minamata Convention. Exposure to mercury can have serious health impacts, including irreversible brain damage.

Mercury provides a relatively cheap and fast technique to capture fine gold from the ore. The amount of mercury used, and its emissions are influenced by many different factors; such as the scale of the operation, geological characteristics of the mining site, economic dynamics, policies concerning land use and the formalization of artisanal miners (Larceda, 1997). Mercury is also difficult to contain and can be toxic at even very small doses. It can be transported long distances by air or water, poisoning the soil and waterways, and eventually making its way into the food chain. In sub-Saharan Africa, most of these risks are borne by women. There are clear indications of detrimental impacts on the health of local populations.

Only a few of miners knew about the health problems related to mercury. In addition to mercury, cyanide, borax, and, to a lesser extent, chemicals such as hydrochloric acid and fertiliser, are used to further purify gold. Common assertions are that buyers are the ones facilitating purification, either doing the purification themselves or providing the necessary chemicals to ASGMers (such as cyanide, borax or mercury). Buyers or '*Nyamunda*' meaning the 'owner of the field' where the mining is done usually provides chemicals, including mercury, or conduct purification free of charge to artisanal miners as incentive to sell to them and secure supply chains. The purification is done right in Mutare Riverbed and in the homes of the buyers.

The number of informal gold miners that made use of chemicals such as cyanide and mercury, which may pollute water, was also evident. The damage effected depended on the size of the mining operations. Most of panners use mercury and cyanide to concentrate gold, with only a few of them being aware of the environmental damage caused by chemicals. It is common knowledge that the chemicals and other waste materials from the mining sites are washed into the streams, Mutare Rivers and nearby farm dams. Mutare river is one river that was noted to have evidence of high pollution. The majority of panners have expressed ignorance as to what effect the chemicals had on water. Studies done in Zimbabwe have revealed that mercury levels in open source water were high. The recorded concentrations were above limits and the stream down a nearby mill in Premier contained mercury. This leads to the assertion that water sources within the community could be polluted with heavy metals, hence any use of open water is likely to pose a health threat.

Within Old Mutare Mission area there is the Mission Centre is comprised of two schools: Hartzell High and Hartzell Central Primary school, there is the Mission Hospital and Fair Field Children's Home. The Mission Centre is surrounded by the ASGM sites. The use of mercury and other chemicals by the miners poses a threat to the Centre's safe drinking water. There can be a potential disaster to the waters of residents, students and the hospital patients in the near future. Amalgam burning can take place on site and in processing centres, but also in villages—for instance in miners' kitchens, houses or backyards, putting their health and the health of their families and community at risk of mercury poisoning when no protective equipment is used (Global Alliance on Health and Pollution, 2017). According to UN Environment (2013), ASGM activities emit about 1,400 tonnes of mercury per year on land, air, and water and are the largest source of anthropogenic mercury emissions worldwide, at about 727 tonnes per year. Cattle from school projects and nearby farms can die after drinking water contaminated with cyanide from Nyagambu and Mutare River. The environmentally destructive methods of mining by the panners are a far cry from our time-honoured environmentally friendly and ecologically sustainable mining techniques.

IX. CONCLUSION

The Article established mostly the negative impacts and damages caused by Artisanal Small-Scale Gold Mining activities at Old Mutare Mission Area in Mutasa district. In light of the foregoing discussion, it is evident that ASGM activities pose a serious threat to the ecology, which in turn jeopardises human lives and livelihoods. The proliferation of illegal gold panning is likely to result in serious damage to aquatic life, biodiversity and riverine ecosystems. The loss of habitat has negatively affected aquatic life, terrestrial biodiversity and productivity of both livestock and crops. If the environmental situation at Africa University, Premier and Grange remain unchecked, the area is heading for untold ecological disasters involving ecosystem destruction and loss of biodiversity as a result of the numerous hazards caused by ASGM in search of income and livelihood. ASGM activities could lead to the extinction of plant and animal species, resulting in the disruption of the ecosystem and causing an imbalance in beneficial macro-and microorganisms.

The cascading effects of ecological disasters such as land degradation, loss of biodiversity, water pollution, epidemics, veld fires and desertification may appear insignificant to some populations, but their cumulative effect needs to be mitigated in order to reduce their impact on Old Mutare and the Zimbabwean community as a whole. Lack of employment, drought and limited livelihood options in the district and the country as a whole are the drivers of illicit panning activities in the district. The local community, ZINWA and the Mutare City Council (MCC) are the worst affected by ASGM activities, which cause land degradation and siltation of dams. This has an effect on ZINWA and MCC budgets because of the increased cost of water purification caused by turbidity. The article concludes that lack of effective mitigation measures exposes the district and the nation as a whole to high risks of future ecological disasters.

X. RECOMENDATIONS

Artisanal Small-scale Gold Mining is a significant livelihood option available to the local people. It is therefore recommended that the government implements proper measures for disaster risk reduction in order to safeguard the environment.

Firstly, there is a need for the government to formulate a clear a policy aimed at mainstreaming disaster risk reduction in all ASGM activities. This requires a collaborative effort amongst key ministries and stakeholders, including the local community. As Blackman (200) stresses, for any project to be sustainable, all stakeholders need to be involved. Such a policy needs to recognise that panners are victims too and not only unruly elements, so that they receive due assistance, as suggested by Kambani (2003).

Secondly, it is necessary for the Mutasa Rural District Council (MRDC) together with the Environment Management Authority (EMA) to design environmental education and awareness programmes targeting the local community and gold panners. Panners need to be made aware of the effects of their activities and the need for healthy ecosystems. Mpendazoe (1996) notes that mining requires a skill for sustainable operations; therefore, local leadership needs to take it upon itself to organise training workshops for artisanal small-scale miners in order to reduce associated disaster risks.

Thirdly, land rehabilitation is crucial to reduce land degradation and ecosystem disruptions; therefore, miners have to backfill their excavations. This will help to prevent wildlife and livestock from falling into pits. Taxes and fines paid by offenders should be channeled into projects that seek to mitigate water pollution, deforestation and land degradation.

Forth, it is imperative to regulate and formalise all gold mining activities through licensing, providing panners with permanent claims and operating permits in order to recoup some of the added costs in the form of taxes. Government, through the Ministry of Small Scale and Medium Enterprises, needs to improve assistance given to small-scale miners in the form of loans, safety clothing and machinery that can help improve their activities. Through the implementation of proper institutional frameworks artisanal small-scale miners can be held responsible and accountable for their activities.

Finally, improve panners' livelihoods by

- Teaching sustainable mining techniques to mitigate the negative environmental effects that mining generates;
- Giving them technical assistance by carrying out prospection and allocating zones for artisanal mining activities;
- Giving panners the chance to benefit from social insurance to secure their retirement; creating forums where miners are taught financial management and diversification of their activities that can lead to some miners leaving mining and taking up an alternative activity.

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