The Extractive Industries and Society 12 (2022) 101179

Contents lists available at ScienceDirect

The Extractive Industries and Society

journal homepage: www.elsevier.com/locate/exis

Original article

"We have done nothing wrong": Youth miners' perceptions of the environmental consequences of artisanal and small-scale mining (ASM) in Ghana

Osei Lydia [a,*], Arku Godwin [b], Luginaah Isaac [b]

[a] Department of Geography and Resource Development, University of Ghana, Ghana
[b] Department of Geography, Western University, Canada

ARTICLE INFO

Keywords:
Artisanal
Small-scale mining
Youth
Perceptions
Environment
Ghana

ABSTRACT

Artisanal and small-scale mining (ASM) has gained prominence across sub-Saharan Africa for generating employment and ameliorating hardships for rural populations, especially, the youth. However, the associated destructive environmental impacts raise questions about its suitability as employment avenue for the youth when considered within the mining-sustainability discourse. This article contributes to the discussions on ASM and its effect on the environment by investigating how youth artisanal and small-scale miners perceive the environmental implications of their own operations in the Upper East Region (UER) of Ghana. The study adopted a qualitative approach involving semi-structured interviews and focus group discussions with forty-five (45) 'youth' miners and three (3) purposely sampled government officials. Overall, the findings suggest that ASM operators do not consider themselves perpetrators of environmental destruction. More importantly, most youth ASM operators seem to lack considerable knowledge on the long-term harm their work may be posing to the environment. Those who acknowledged that activities resulted in environmental degradation, argued that their financial needs for survival supersedes any immediate or long-term environmental cost. Given the low level of education among miners about the environmental implications of their activities, the findings call for an urgent need for proper education among ASM miners. Furthermore, in lure of the fact that government's policy of criminalizing ASM seems to constantly fail, there needs to be a shift from criminalizing ASM operators towards collaborative engagements in their quest to protect Ghana's fragile environment.

1. Introduction

Among the many challenges facing sub-Saharan African countries, youth unemployment ranks prominently. Africa's population is the youngest globally, and an estimated 226 million persons aged between 15 and 24 will triple to over 830 million by 2050 (AfDB, 2016). Annually, an estimated 10–12 million new entrants into the labour market must compete for only three million new job opportunities in the formal sector, resulting in a huge mismatch between demand and supply for employment opportunities (AfDB, 2016). Thus, in most global south contexts, the informal economy is a primary source of employment for millions of youth. Artisanal and small-scale mining (ASM) is one of the informal avenues which generate employment for opportunity-seeking youth (Arthur-Holmes *et al.*, 2022). ASM, a low-tech, labor-intensive, mineral extraction and processing activity – has been gaining prominence for the past two decades. Even though ASM operations is generally deemed as illegal (and informal) mineral extraction activities mostly carried out on the fringes of large-scale mining, it contributes nearly 20% of total global mineral production and is a major source of foreign exchange earnings (Carstens, 2017).

The rapid growth of the ASM sector has provided jobs for over 40 million people globally as of 2017 (IGF, 2017) and contributed significantly to reducing hardships in many rural areas. The significance of the ASM sector in sub-Saharan Africa is its ability to provide livelihood opportunities for many people compared to large-scale mining. According to Buxton (2013), ASM employs ten times more people than large-scale mining. ASM's ability to provide employment is especially evident in rural Ghana where it is estimated that the sector directly employs at least one million people and another five million engaged in its associated services (Lynas, 2015). By employing local people at the

* Corresponding author.
E-mail address: losei@ug.edu.gh (O. Lydia).

https://doi.org/10.1016/j.exis.2022.101179
Received 14 July 2022; Received in revised form 7 November 2022; Accepted 7 November 2022
Available online 18 November 2022

micro level, miners and non-miners alike enjoy improved standards of living, showcased by asset acquisition, access to education and healthcare and improved well-being (Hilson and Osei, 2014; Arthur *et al.*, 2016; Osei *et al.*, 2021; Arthur-Holmes *et al.*, 2022). In fact, ASM is now a platform for wealth creation for its participants (Hilson and Yu, 2022). It also contributes to regional employment at the macro level as foreign nationals from neighboring African countries and Asian nationals working at ASM camps form part of the gold value chain (Armah *et al.*, 2013).

Despite the sector's ability to create employment, promote improved livelihoods (IGF, 2017), and contribute to national economies, it is fraught with many challenges. ASM is known for its perceived high environmental impacts and poor occupational health and safety consequences (Armah *et al.*, 2013; Kyerematen and Clarke, 2015). The ecological impacts present a worrying situation for governments and policymakers who intend to manage the sector for optimal benefits. Against the backdrop of this dilemma, governments and international organizations interested in poverty reduction and youth (un)employment are uncertain about how to deal with ASM.

The extant literature on ASM mostly treats the participants in the sector as a homogenous group or, at best, showcase the evidence of gender streams in the sector (Yakovleva, 2007; Arthur-Holmes and Abrefa-Busia, 2021). Many also focus on the environmental impact of ASM (Ncube-Phiri *et al.*, 2015; Armah *et al.*, 2016; Bansah *et al.*, 2018; Ofosu *et al.*, 2020). Although such studies provide useful insights, they fail to explore the perspective of an important group; "youth miners" – whose activities are generally seen as having destructive impact on the environment. The knowledge on 'youth' miners' experiences and perceptions, regarding the effect of their activities on the environment is scarce. To this end, this paper explores the youth's perspective about the impacts of their activities on an ecologically-fragile environment in the UER of Ghana. Understanding youth perceptions would help in the development of policy that is aiming at encouraging youth to be stewards of the environment. Our paper reveals that government's repetitive 'war' against ASM operations due to environmental challenges associated with the sector can only be won by establishing policies targeted at the underlying challenges that these youth miners face in their livelihood struggles due to the high rate of unemployment within this group. Furthermore, there is need for educational programs on environmental degradation caused by ASM activities. First, the miners should be educated on the detrimental effects of their operations on the environment. Second, mining communities should be educated on the long-term effects of the bad practices of miners to incense them against bad mining operations. This will go a long way to minimize such practices among miners. Furthermore, traditional and community leaders must also be empowered to curb environmental problems associated with ASM.

The rest of the paper is structured as follows: in section two, we provide an extensive scholarly review of the environmental costs associated with the expansion of the ASM sector and describe the theoretical framework of the study. Subsequently, a description of the research methods is provided. Next, the study results are presented; and the final sections provide a discussion and conclusion.

2. ASM and environmental risk: a conceptual overview

The connection between the environment and mining in general presents much for scholarly investigations. Presently, there are several discussions on environmental protection championed by both governmental and non-governmental agencies (e.g., UNEP, Global Forum on Environment by the OECD). In the context of safeguarding the environment for future generations, proposal for sustainable mining is on the ascendency within policy circles. Sustainable mining, as explained by Allan (1995), includes an environmental component which considers adopting acceptable mining processes which do not compromise the needs of future generations. Sustainable mining involves reducing the negative socio-economic and environmental effects of mining and processing activities, and at the same time limiting extraction of minerals to cater for the needs of future generations (Gorman and Dzombak, 2018).

Mining activities expose communities to significant discharge of various toxins into the biosphere, adversely impacting the natural environment. More importantly, ASM communities are prone to hazards especially due to toxic chemicals such as mercury and sodium cyanide used in extracting the gold (Taylor *et al.*, 2005; Kitula, 2006; Armah *et al.*, 2016; Emmanuel *et al.*, 2018). For the past three decades, several studies have emphasized the adverse impacts of small-scale mining on the environment: the principal ones being mercury contaminations, land degradation and water pollution. For instance, Ncube-Phiri *et al.* (2015) indicate that vast amounts of loose silt and heavy metals are discharged into river systems, resulting in high risks of water siltation and flooding in Zimbabwe. Banza *et al.* (2009), also report that community members (miners and non-miners) in the Katanga Province are exposed to cobalt and other toxic metals, which negatively affect their health. The effects of mercury on miners' health and the environment are undoubtedly grave: mercury poisoning, for instance, can cause different skin rashes and inflammations, and when inhaled, it attacks the central nervous system leading to brain malfunctioning and lungs and kidney damage (Gibb and O'Leary, 2014). Indeed, one of the most pressing concerns associated with mercury pollution is not only the immediate detrimental effects to human and environmental health but its potential to affect future generations since mercury typically resides in the environment and can pose a significant threat for decades even after mining has ceased (Clifford, 2017). The discharge of toxins also causes severe eco-complications, including contamination of biotic and abiotic resources such as water bodies, sediments, soils, and plants in ASM sites across Ghana (Akpalu and Normanyo, 2017; Basu *et al.*, 2015; Emmanuel *et al.*, 2018; Tschakert and Singha, 2007) and water pollution is one of the core propellers of communal agitations against ASM activities in the country as witnessed in recent times.

According to Baah-Ennumh and Forson (2017), ecosystem destruction and environmental degradation are major environmental problems associated with ASM activities. This is experienced in Ghana widely through clearing of farmlands or lands otherwise demarcated for agricultural production, which leads to removal of vegetation cover and other layers of the topsoil during the construction of mining pits (Taabazuing *et al.*, 2012; Kessey and Arko, 2013). The various layers of soils removed and lumped together around the pits are washed away by the rains, which eventually results in land degradation and other problems such as soil erosion, loss of biodiversity, the extinction of plant and animal species and shortage of land for farming activities (Garvin *et al.*, 2009; Adomako *et al.*, 2014; Awatey, 2014; Kessey and Arko, 2013). This ecological cost is the main reason why governments, host communities and civil society organizations alike advocate for a crackdown in ASM activities.

In studying the environmental challenges associated with ASM, scholars have applied the risk perception concept. Risk perception, in general, constitutes a culturally complex and uneven social experience and conviction. Hence identification of levels of risks and responses to such risks can be based on both objective and subjective evaluations of the individual (Armah *et al.*, 2016). The concept of risk perception has been commonly used to investigate two strands of issues; first, the views of miners on occupational health hazards and communal health (Akabzaa, 2009; Dooyema *et al.*, 2012; Nyanza et al., 2014; Shandro *et al.*, 2009); and second, community members' perceptions about environmental challenges associated with mining (Antabe *et al.*, 2017, Armah *et al.*, 2011; Lawson and Bentil, 2014; Taabazuing *et al.*, 2012). There are only a few studies that elucidate miners' perception on environmental repercussions of their operations. For instance, investigations on miners' knowledge of the environmental effects of their activities by Armah *et al.*, (2016) report that miners who were actively engaged in the mining operations were less knowledgeable on the environmental effects of mercury compared with their non-engaged counterparts. Actions

aimed at reducing the risks associated with gold mining are relevant and must consider the perceptual dimensions of the problem at the local level (Sana et al., 2017).

Furthermore, environmental risk perception is an individual's understanding of the importance and urgency of environmental protection and the relationship between people and the environment. The tendency of an individual to protect the environment can be dependent on his perceived environmental risk, which is influenced by socio-demographic characteristics such as age, gender, education, income levels, religious belief among others (Wilkinson, 2001; Wachinger *et al.*, 2013; Sana et al., 2017). For example, when an individual perceives a high level of environmental risks, the person may decide to change habits and lifestyles to protect the environment (Zeng *et al.*, 2020). Environmental risk perception stimulates people's sense of urgency and responsibility to protect the environment and encourages more environmentally friendly behavior. The anticipation of danger or damage can influence an individual's actions in the context of ASM. Miners may decide to change their practices to protect the environment when they perceive a high level of environmental risk. But, since the perception of risk is subjective, there may be differences in the perceptions of miners regarding environmental destruction.

In this paper, we explore 'youth' miners' perceptions about the environment because they are considered the perpetrators of environmental destruction. Thus, this study is relevant as it engages the miners and seeks their views on issues involving their operations and the environment. An examination of the environmental risk perceptions of miners provides a good understanding of the attitudes of miners and direct policy pathways in the management of the sector.

3. Methodology

3.1. The study area

Three mining communities in the Talensi District - YamSok, Gbane and Datoko - of the Upper East Region (UER) in Ghana were selected for this study because of the extent of mining activities in these communities (Fig. 1). The district has a population of 81,194, representing about 7.8% of the region's total population. Males constitute 49.7% and females, 50.3% of the region's population. The district also has a youthful population (41.2%) and highly rural with about 84% living in rural settings (GSS, 2014).

Agriculture (with forestry and fishing) is the main occupation for most of the people (78.3%) in the district, but mining and quarrying come next, employing about 5.2% of the population (GSS, 2014). Talensi has some of the newest mining communities in Ghana, with ASM activities dating to the 1990s. The district contrasts with longstanding mining areas in the Ashanti and Western Regions, where commercial small-scale gold extraction activities have continued since the 19th century (Hayford *et al.*, 2009).

3.2. Research design and data collection

This paper is part of a larger project which investigated youth engagement in ASM in the UER of Ghana. The study adopted a qualitative approach to understand 'youth' miners' perceptions of their operations in relation to the environment and the host community. By this approach, we were able to capture the contexts within which the miners interacted with their social and physical environments and the meanings they attached to their experiences (Liamputtong and Haritavorn, 2014). With help from a local research assistant, 'youth' miners were contacted at their various mining sites and introduced to the study. Using the purposive sampling technique, we selected 'youth' miners with varied backgrounds and diverse characteristics (i.e., miners aged 15–24, resident in the study communities and with at least one year mining work experience) to assess different perspectives of the study topic. We conducted forty-five (45) in-depth, semi-structured face-to-face interviews with the 'youth' miners[1] consisting of 33 males and 12 females and three other interviews with government officers – one each from the Minerals Commission (MC), Environmental Protection Agency (EPA) and the District Assembly. All the interviews with the 'youth' miners were held at their mining sites.

Besides the in-depth interviews, additional data was collected through five focus group discussions (FGDs) with 45 participants - three sessions at YamSok and one each at Gbane and Datoko. The FGDs were made up of four male groups and only one female group. The FGDs provided an avenue to consolidate the responses from the interviews and afford participants, especially the female miners, the opportunity to articulate their views, experiences, and perceptions on their work. Liamputtong (2010) suggests that a focus group should consist of individuals with shared experiences from similar social and cultural backgrounds. These group dynamics were considered during the formation of the focus groups for this study: first, the groups consisted of miners and their team leaders who shared similar work experiences, and second, they had comparable characteristics such as gender and age. Participants were grouped by age (15–17 years and 18–24years); the female group consisted of individuals between 15 and 17 years, and only one of the male groups consisted of this age category. The focus group sessions lasted between 60 and 90 min, and none of the participants of the FGDs participated in the in-depth interviews.

3.3. Data analysis

We sought the consent of all participants before inviting them to participate in the study. Participants were also informed of their right to end their participation at any point in time voluntarily. All the data collated from the field was transcribed, thematically coded, and processed using NVivo12. First, the main codes were identified (e.g., water pollution and land degradation), and later sub-themes were developed to follow the process of conducting thematic and reflexive thematic analysis suggested by Braun and Clarke (2006). In the results section, direct quotations from the interview transcripts and focus group discussions are used to illustrate the themes and serve to contextualize the youths' responses. To ensure anonymity and confidentiality, considering that most of the mining activities the youth engage in are criminalized, quotes are identified with pseudonyms. The respondent's group, gender (M = Male, F = Female), age and ASM site are provided at the end of each quotation in the analysis section.

4. Findings

The results are organized around the main objectives of the study and themes related to: surface and underground miners' perceptions of water pollution and land degradation, the role of traditional leaders in environmental protection in the context of ASM, and the role of policy-makers in the ASM processes and environmental impacts.

4.1. ASM perceptions of water pollution: surface mining

Overall, surface miners opposed a generalization of all ASM miners as perpetrators of water pollution. Surface miners either collect water from rivers to wash ores or carry loads of ore to riverbanks for washing. According to respondents, collecting water from the river to mining pits for washing their ore was more convenient and less cumbersome, since they do not have to carry the heavy dugout material to the rivers and this practice saved them energy since the digging itself is tiresome. The participants perceived fetching water from rivers to the mining sites as safe and not a direct cause of water pollution in the communities. A miner in one of the FGDs expressed this opinion as follows:

[1] *The study uses the age bracket for youth - persons between the ages of 15 and 24 - as defined by the United Nations.*

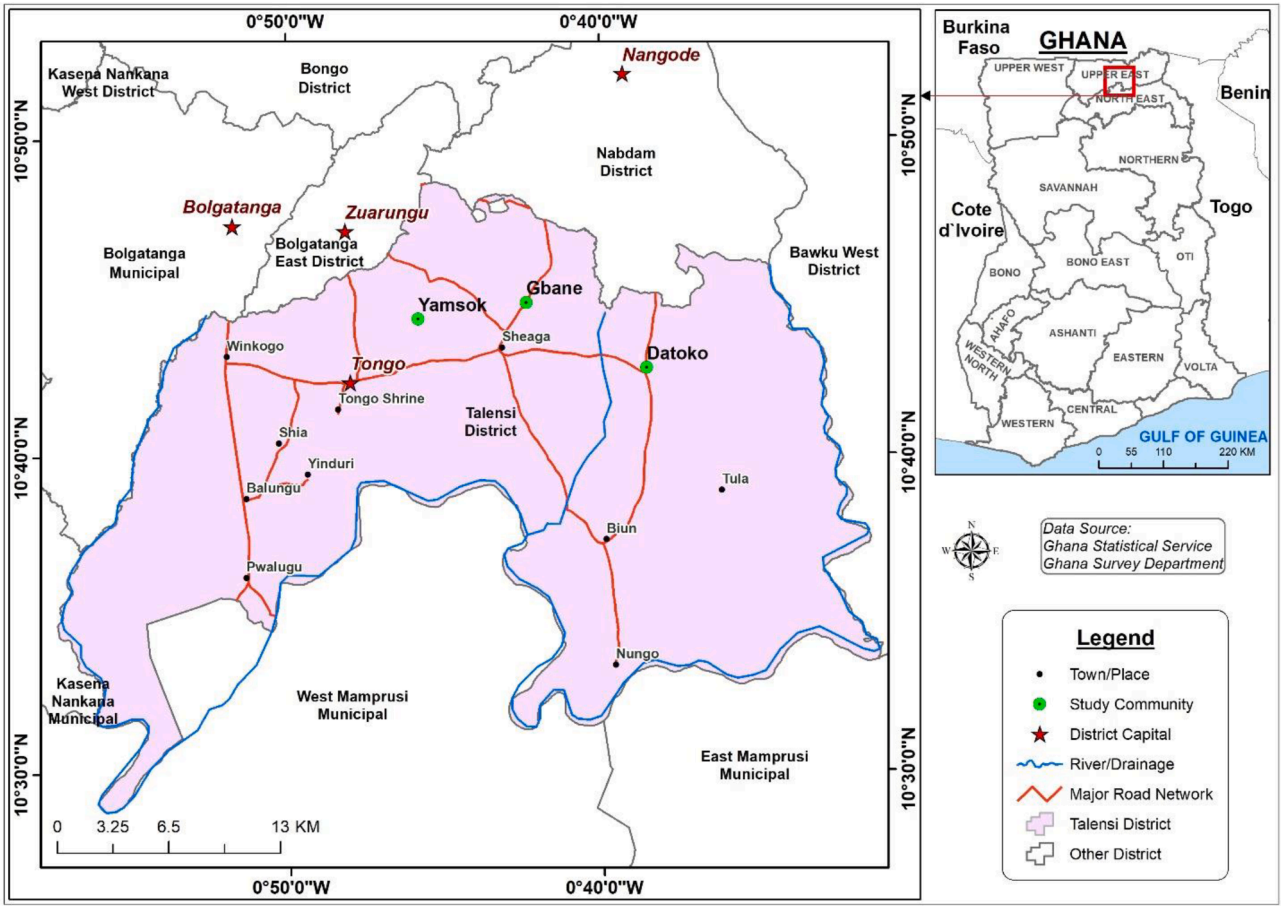

Fig. 1. Map of study sites.

You can't say we are all the same or we are like the other people who are washing in the rivers. As for us, we do not harm the river nor the people who use it. All of us use it, so why should we pollute the water? (FGD1; Abuba M, 18 years, YamSok).

Some surface miners at YamSok admitted to the possible impacts the washing ore could have on the water bodies, but also indicated they make conscious efforts to avoid polluting the stream that serves the entire community, given that they know fully well the usefulness of the water bodies to their personal needs.

Nevertheless, some participants at YamSok were aware of how ore-washing in rivers in neighboring communities had led to contamination of water bodies, thereby instigating agitations in some host communities. During a focus group discussion, a participant incensed by discussions revolving around water pollution caused by ASM retorted:

I know why you are talking about this; this happens in some of the mining communities around and even in other places in the South….and that is making people complain that galamsey is destroying the rivers (FGD1; Abuba, M, 16 years, YamSok).

Another respondent [with a finger pointed at a location] of one of such supposedly polluting communities, angrily remarked:

Go over there…the bush area! and you will see what they do with the river; it is not us! You go and see for yourself and you will know that as for us we are not doing anything wrong (FGD2; Abdallah, M, 17 years, YamSok).

Against the backdrop of this information, we visited the other case study sites (Gbane and Datoko) reported as places where miners washed ore in the river.

4.2. *ASM perceptions of water pollution: underground mining*

Based on our conversations with the research participants, it emerged that, underground miners at the Gbane and Datoko communities indeed washed ores in the river. Generally, underground miners indicated that they needed the water resources for washing and extracting the ore in order to retrieve the gold nuggets. In the comment below, an underground miner explained that:

Ah! But we are here for gold and not for the water. We need the water for the work and that is what we are doing … so you can say we are polluting it (Amidu, M, 18 years, Gbane).

Underground miners focused on their primary motivation for their participation in ASM as expressed by this other participant:

I am doing this work because I want money. If I overthink about how galamsey is polluting the water, I can't do this work. I want money to feed my family and so I have to do this work (Alhassan, M, 23 years, Datoko).

The aforementioned depicts the mindset of some underground miners concerning the implications of their actions on the environment and host communities. It demonstrates a certain level of insensitivity to the environment at the expense of the dangerous environmental problems associated with their activities.

Although underground miners wash their ore in the water bodies, some community members still rely on the polluted water for bathing, cooking, and performing household chores, as narrated by a miner who had about six years of mining experience in Gbane:

Ah, you see those girls over there? [pointing at girls carrying buckets] …They are going to collect some of the water. They cook with this water, and we buy their food…sometimes they don't even have to wait to cook with it, others fetch and drink it (Aminu, M, 19 years,

Gbane).

Invariably, community members reported adverse effects including skin diseases and bowel disorders likely resulting from being exposed to the contaminated water through bathing or from injecting the water through drinking or from food. Respondents suggested that it was challenging to avoid contact with the polluted water, contaminated and degraded lands because they had no alternative source of clean water and had to rely on the contaminated water for their daily activities

4.3. Surface miners' perceptions of the impact of their activities on land degradation

Most surface miners (at YamSok) explained that their work had no or minimal effect on the land and its fertility. The miners' argument is based on the premise that their activities occur on non-farmlands. Most participants agreed that the land in the mining communities was primarily for agricultural purposes, and therefore, gold prospecting was usually undertaken only on uncultivated lands which tend to have poor soils and were barren. A respondent during a group discussion made this clear by stating:

We mine at the bushy areas where no one is farming […]and because the places are rocky and always weedy you will have nothing when you farm there (FGD 2; Aliu, M, 19 years, YamSok).

Nevertheless, in some instances, participants reported that both farming and mining activities take place on the same piece of land, depending on the season. For instance, youth miners claimed that the long dry season was a desirable time for mining, during which period landowners are typically willing to lease their lands for ASM activities until the farming season during the rains. In one of the group discussions, a female participant explained that "once the rainy season begins, they [landowners] ask us to leave their land because they are going to farm". This arrangement flourished among the miners and landowners; hence, there is usually no conflict when land is taken back for farming purposes by its owner. Under such arrangements, the youth miners, would relocate to a different community where there is an opportunity to renew their activities.

Youth miners' perceptions of how their activities help degrade the land, is underpinned by the types of lease arrangements they may have with landowners. The participants explained that in some instances, landowners lease the lands to prospective miners at a fee that is paid either in cash or kind. In the comment below a female participant described such a transaction between her parents and a landowner:

You don't get the land for free […] sometimes you will have to pay some money to the owner or give him some of the load [ore] you extract when you work (Asana, F, 17 years, YamSok).

In other instances, landowners enter into a shared agreement with youth miners whereby the minerals extracted from their land is shared between the two parties. Some participants argued that such arrangements, especially cash payments by miners have contributed to the negative attitudes youth miners have towards the land. For example, participants indicated that pre-arranged payments resulted in some open pits being left unattended after mining closures. A male miner indicated that "the landowner collected money from the miners that is why they left the place like that". Miners who pay cash to landowners do not feel obliged to spend time and money reclaiming the land because they feel they paid for their activities. In a few instances, the participants reported engaging in the reclamation of the lands they have worked on, and this is frequently done by simply refilling of pits with topsoils, and this forms the basis of surface miners' argument that their activities have no adverse effect on the land.

Given the overall poor nature of the land in the study context, some respondents were unhappy about sentiments from the public that ASM activities resulted in land destruction. According to this group, the agricultural yield has been declining over the years because of the poor soils long before the inception of ASM activities in the communities. A focus group participant commented that:

You can't blame us for any poor agricultural yield. For some time now, we have been experiencing this problem […] even before we realized we had gold on this land. The gold business, therefore, cannot be considered as the reason for our agricultural problems (FGD3; Ayariga, M, 21 years, Gbane).

Some miners argued that the infertility of the land in general has necessitated the use of unused land spaces for ASM activities: "we are rather mining because the land is not good for farming", a participant claimed.

Surface miners regarded underground mining as more destructive due to the latter group's use of heavy machines, which made their operations "intense" and "serious cause of environmental destruction".

4.4. Underground miners' perceptions of the impacts of their activities on land degradation

When asked about the views of land degradation due to their mining activities, some underground miners grudgingly argued that their work was acceptable and elaborated that their activities were at locations on the outskirts of the communities. Indeed, for the two communities (Gbane and Datoko), although the land was used for farming and mining activities, mining was ongoing in the "bush where there were no farms", and such areas were indeed specifically allocated for mining. In such areas, settlements have sprung up out of the ongoing mining activities. By stating that their work was acceptable, 'youth' miners inferred the support received from the government, which is exhibited by the involvement of the District Assembly, the MC and the EPA at the various stages of their operations. One of the respondents expressed this view in the statement below:

[…] but all that we are doing here is legal; otherwise, the staff from the Assembly and the other agencies that give the licenses will not come here to collect money from our bosses (Apusigah, M, 21 years, Gbane).

Miners recounted that, occasional visits by tax-collecting staff from the Assembly to the mining sites demonstrated the legality of their work and the recognition of such by the national government. They claimed that if their work resulted in any devastating ecological problems, this would have been a good reason for the government agencies to stop their operations. Therefore, the continuous issuance of licenses from government agencies and the collection of taxes from them implied their activities do not cause land degradation or environmental burden to the host communities. A participant agitated by the land degradation insinuations argued that:

Even before you start the work, you have to register with these government people and obtain a license; and they come here to check our work so if it is very deleterious as you people claim, why are they not stopping us? (Awennam, M, 20 years, Datoko).

Miners were certain that the government would not abolish ASM activities due to the substantial financial contributions the sector adds to the national coffers, as argued by an interviewee in the following comment:

This work generates a lot of revenue for the government, do you know that? How do you stop something that brings in money to undertake other projects in the country? (Alhassan, M, 18 years, Datoko).

Reacting to the increasing public outcry about their activities, almost all miners interviewed reported that complaints about ASM activities and their connection with land degradation usually did not emanate from members of the host communities. According to participants, the negative sentiments about the expansion of ASM in the region and the destruction of land and other resources were "often aired on the radio by non-community members and panelists on talk shows" in the capital of the UER. When asked whether these sentiments expressed via the media and specifically radio panelists, had any influence on their activities, many underground miners were appalled by such suggestions, as exemplified in the following quote:

Ah what is their problem? …. okay, their problem is we are destroying the land but if I stop will they give me food to eat? They can't

feed my family, so it is better they keep quiet (Apana, M, 20 years, Gbane).

Thirty-six out of the forty-five miners interviewed in three communities were not bothered about the negative opinions voiced by the public regarding their activities, given the miners general view that such sentiments tend to be expressed by people in non-mining communities. As indicated in the preceding comment, the participants' perceptions about their activities are influenced by their ability to 'make ends meet' in terms of provisioning for their families, hence any move to halt their activities was unacceptable to them, unless this came from the community's Tindaana (custodian of community land).

4.5. The role of traditional community leaders in protecting the environment

The participants recognized the potential role traditional leaders can play in mitigating the environmental impacts of ASM activities. The participants generally agreed that in the communities they operate, the traditional leadership such as the Tindaana has the power to stop any unwanted activities on their community's land if they deemed such activities would result in negative impacts on their land. For instance, in the comment below a participant described how in one community 'youth' miners who had attempted to wash ore in river bodies were stopped with a stern warning from the Tindaana:

Some galamsey boys wanted to wash in the river, but Tindaana warned them not to do so because that will pollute it […] so they have to fetch the water and use it at their work area. We need to preserve the water because that is all we have. The animals also drink from it and if it is not wholesome, then they can die from drinking from the river (Anaba, M, 18 years, YamSok).

During an interview, the Tindaana confirmed this decision and explained his responsibility to the community included protecting the environment; and that his position as the custodian of the community's land required him to instill an attitude of preserving communal resources among his subjects. According to him:

Since animals also use the water, any harm caused to the animals for drinking from the river could cause a conflict between families of the miners and the owner of the animals (Tindaana, M, YamSok).

The miners agreed that they must obey the Tindaana's directive as a sign of reverence to his authority as he wields the utmost power over them. One of the participants, in emphasizing the authority of the Tindaana exclaimed:

Here when Tindaana gives an order, who are you to disobey?! (Asana, M, 19 years, YamSok).

Overall, the youth miners indicated that customary rules enacted and enforced by the Tindaana have no room for disobedience, and any sign of disrespect, especially among young people, could lead to hefty punishments, including fines and banishment from the community. This suggests that the local political system and traditional beliefs can potentially influence miners' attitude towards environmental protection.

4.6. Policy-makers within ASM in context

In our discussions with the staff at the Minerals Commission (MC) and the Environmental Protection Agency (EPA) regional offices, water pollution and land degradation in these communities did not come across as a critical problem observed by these offices. The MC representative described his office's fundamental responsibility and mandate to include ensuring mining activities do not create "much environmental harm to the miners and the host communities". The officer continued that "the role of the MC is to see to the regularization of mining activities within the district and also the monitoring and supervision of mining operations". This role, as mentioned, did not seem to include preventing pollution of or safeguarding communal natural resources such as water bodies. At the EPA office, the representative referred to the "giving of approvals to projects that have a less significant impact on the environment" as the sole mandate of the EPA. Counting mining as one of the operations that demand the EPA's approval, the EPA officer further explained the field assessment process before awarding a concession as follows:

Initial visit to the proposed concession site is made to solicit baseline information especially on sensitive features such as water bodies, railway lines and other social amenities. We consider the water body a critical resource to the community since members use it for domestic purposes; thus, the miner or concessionaire has to provide an initial report of the quality of the water body (EPA Officer, M, Bolgatanga).

Bearing in mind the possible effects of ASM on water bodies, the EPA representative explained that through their mandate, they typically demand for a pre-assessment of the water quality levels as part of the documentation process to "enable the EPA to identify the effects of mining activity would have on the water parameters after some time when the operations have begun". Unfortunately, the EPA's supervisory role, especially over the destruction of sensitive features, is limited as the Agency is only moved to act after promptings from community suggest the depletion of these delicate features as noted by the EPA officer who argued that:

We make sure they [miners] do all these and then we study it so that when they start their operations and the community agitates, we can tell whether they are the causes of what the community is kicking against or it is just from the preconceived perception the community has about mining activities (EPA Officer, M, Bolgatanga).

Surprisingly, as at the time of this study, there were no protests from the host community members to suggest their displeasure of the adverse effects of mining activities on their water bodies despite the noticeable depletion. This, therefore, meant the EPA does not have to implement its laws even though the findings indicate ongoing water pollution and land degradation in the mining communities.

5. Discussion

This paper addresses 'youth' miners' perceptions of the environmental implications of their activities. The findings suggest mixed perceptions of 'youth' miners. Majority of the 'youth' miners do not consider their activities as environmentally destructive. Those who admitted that their mining activities could be causing environmental damage in terms of water pollution and land degradation, preferred to prioritize the financial benefits of ASM which is their main source of livelihood.

Furthermore, this study corroborates with the extant literature that indicates pollution of water bodies and land degradation as two most significant impacts of ASM on the environment (see Bansah *et al.*, 2018; Ofosu *et al.*, 2020). The pollution of water resources has health implications for communities that rely on such water bodies for domestic use. As one of the poorest regions in Ghana, many communities in UER, including those in the study area, lack various infrastructure, including potable water. Whilst the government has initiated sinking boreholes in the district, our research shows that most communities are still heavily reliant on the local rivers and open water bodies as they are either without the boreholes or the boreholes are dysfunctional. The individual rewards from ASM are more prioritized over the collective good. Like other parts of Ghana, surface water pollution in the study area is due primarily to ASM operations (Armah *et al.*, 2013; Agyarko *et al.*, 2014; Bansah *et al.*, 2018). This situation, Armah *et al.* (2013), attribute to lack of enforcement of mining regulations which is also the result of resource constraints of mandated institutions such as the MC and EPA.

In terms of land degradation, the findings show that irrespective of the method of mining employed, miners usually remove the topsoils leaving behind degraded landscapes after mining closure; and their operations expose the land to erosion with the least rainfall, making such lands almost incapable of supporting agricultural production. Given that agricultural production has been declining due to climate

change and other factors in this context (Laube *et al.*, 2012; Tambo, 2016), the devastation caused by ASM to agricultural lands could further exacerbate food insecurity in the UER, but especially in the study locations. The miners argued that ASM is undertaken in distant locations from communities; as such, there is no impact on the environment and therefore, the land does not need to be reclaimed. This notwithstanding, in many locations in sub-Saharan Africa, systematic land cover change due to ASM activities has been associated with habitat and biodiversity loss (Meaza *et al.*, 2017; Mhlongo and Amponsah-Dacosta, 2016) which have negative consequences for non-ASM livelihoods and regional climate. The fragility of the dry guinea savannah vegetation in the study area requires some environmental protection to reduce rapid desertification.

Our findings also reveal young miners' belief that the government, and its agencies, should be held responsible for environmental protection. The fact that some miners in this research are licensed and tax-paying operators known to the EPA and MC; and yet the latter seem to turn a blind eye to the environmental harms caused by these operations portrays a dysfunctional policy environment (Taabazuing et al., 2012; Hilson et al., 2022), with government regulatory agencies somewhat shifting responsibilities in the execution of their mandates. The (in)action of these state agencies goes to support the idea expounded in the literature that the state concentrates on and prefers large-scale mining to ASM (see Hilson and Hilson, 2015; Yankson and Gough, 2019) Furthermore, the idea that the collection of taxes by the government and the continuous issuance of licenses for mining operations meant miners work has no devastating consequences on the environment is very disturbing as this shows young miners total disregard for the environment. This confirms Wray-Lake *et al.*, (2010) study which note that youth tend to assign responsibility for the environment to the government rather than accepting their individual responsibility.

The findings also show how miners' perceptions of the environment impacts of their activities are influenced by deep-seated poverty and glaring government neglect in terms of opportunities for the youth in this study context. Generally, as far as the youth are concerned, the socio-economic benefits of ASM activities outweigh any perceived environmental risk, and this is disturbing. Youth miners are prioritizing the financial rewards from their activities for their livelihoods over any risk, including environmental destruction (Fadlallah et al., 2020).

Overall, our findings are consistent with earlier work that indicated that environmental awareness within the ASM sector across the developing world is generally low (Hilson, 2002; Smith et al., 2016). In our study context, the low level of environmental awareness is likely reinforced by the desperation among the unemployed youth miners, some of whom are the sole bread winners for their families. This low awareness is further complicated by the ineffectiveness of the government in enforcing its own regulations as indicated above. As these challenges persists, the possibility of having an environmentally friendly ASM sector and practice in Ghana and in fact sub-Saharan Africa, will remain contested (Hinton *et al.*, 2003; Hilson et al., 2022). Consequently, we re-echo the call by the current Secretary-General of the United Nations, that the 'consequences of failing to sensibly and effectively manage the environment are profound' (Guterres, 2017) and especially for the youth. Hence a sense of environmental stewardship is paramount.

The study's findings reveal that the government's repetitive 'war' against ASM operations due to environmental challenges associated with the sector can only be won by considering miners' mindset. Clearly, this study has shown a need for behavioral or attitudinal change among youth miners as most consider themselves non-culpable to environmental depletion. Although it is argued that knowledge *does not always* translate into action (Armah *et al.*, 2016), and there is a discrepancy between environmental risk perception and environmental protection behaviors (Zeng *et al.*, 2020), education is still key in minimizing environmental degradation caused by ASM activities. Until this deliberate change, the government's efforts will remain unfruitful. A relevant aspect of this education that deserves consideration is community awareness. Miners (and government agency per our findings) seem to thrive on the negligence of community members. Until agitations from community members increase, miners consider their work and practices acceptable. Like Lawson and Bentil (2014) observations, this study suggests that mining communities should be educated on the long-term effects of the bad practices of miners to incense them against bad mining operations. This will go a long way to minimize such practices among miners.

More so as indicated by (Ofori et al., 2021), there are different layers of politics operating at different scales which have shaped ASM governance in Ghana, thus, the current messy and dysfunctional situation being faced in the sector. We therefore recommend a shift of some authority to local-level actors such as leaders/chiefs in mining communities. Traditional and community leaders must be empowered to curb environmental problems associated with ASM. As custodians of the land, these leaders must control land leased for mining activities and be involved in monitoring ASM operations. As shown by this research, especially in YamSok, traditional leaders are highly respected by their subjects thus, the latter's involvement in safeguarding the environment is very much needed. The environmental challenges associated with ASM operations can be reduced and the benefits from the sector enhanced when these suggestions are considered by governments and policymakers involved in managing the sector.

6. Conclusion

In conclusion, given the lack of environmental awareness reported in this study, there is a need for educational programs targeted at youth miners and local community leaders on the negative long-term effects of their operations on the environment. Furthermore, traditional and community leaders who wield significant power as custodians of community lands, must be incorporated into government's environmental management efforts. Invariably, the findings in this paper have revealed that underlying the Ghana government's 'war' against ASM activities due to the notion that these activities are damaging the environment, are several complexities starting with youth miners struggles for their livelihoods. Furthermore, it is ironic that youth miners who are frequently accused of destroying the environment are registered, licensed, tax-paying ASM actors whose operations are actually known to the mandated state regulatory agencies. Nonetheless, the miners actively perpetuate environmental harms to local communities, without significant interventions from these state regulatory agencies. This supports the argument by Hilson et al. (2022), that until the government decides to strengthen its decentralization efforts and support such efforts in the real sense of the word, water pollution and environmental degradation as a result of ASM activities will remain.

References

Adomako, E.E., Deacon, C.S., Meharg, A.A., 2014. Impacts of gold mining on rice production in the Anum valley of Ghana. Agric. Sci. 5 (09), 793.
Agyarko, K., Dartey, E., Kuffour, R.A., Sarkodie, P.A., 2014. Assessment of trace elements levels in sediment and water in some artisanal and small-scale mining (ASM) localities in Ghana. Curr. World Environ. 9 (1), 7–16.
Akabzaa, T., 2009. Mining in Ghana: implications for national economic development and poverty reduction. In: Campbell, B. (Ed.), Mining in Africa: Regulation and Development, pp. 25–65.
Akpalu, W., Normanyo, A.K., 2017. Gold mining pollution and the cost of private healthcare: the case of Ghana. Ecol. Econ. 142, 104–112.
Allan, R., 1995. Introduction: sustainable mining in the future. J. Geochem. Explor. 52 (1-2), 1–4.
Antabe, R., Atuoye, K.N., Kuuire, V.Z., Sano, Y., Arku, G., Luginaah, I., 2017. Community health impacts of surface mining in the Upper West Region of Ghana: the roles of mining odors and dust. Hum. Ecol. Risk Assess. 23 (4), 798–813.
Armah, F.A., Boamah, S.A., Quansah, R., Obiri, S., Luginaah, I., 2016. Unsafe occupational health behaviors: understanding mercury-related environmental health risks to artisanal gold miners in Ghana. Front. Environ. Sci. 4 (29), 1–16.
Armah, F.A., Luginaah, I.N., Taabazuing, J., Odoi, J.O., 2013. Artisanal gold mining and surface water pollution in Ghana: have the foreign invaders come to stay? Environ. Justice 6 (3), 94–102.

Armah, F.A., Obiri, S., Yawson, D.O., Afrifa, E.K., Yengoh, G.T., Olsson, J.A., Odoi, J.O., 2011. Assessment of legal framework for corporate environmental behaviour and perceptions of residents in mining communities in Ghana. J. Environ. Plann. Manag. 54 (2), 193–209.
Arthur, F., Agyemang-Duah, W., Gyasi, R.M., Yeboah, J.Y., Otieku, E., 2016. Nexus between artisanal and small-scale gold mining and livelihood in Prestea mining region, Ghana. Geography J. 1–18.
Arthur-Holmes, F., Abrefa Busia, K., 2021. Occupying the fringes: the struggles of women in artisanal and small-scale gold mining in rural Ghana—evidence from the Prestea–Huni Valley municipality. Gender Issues 38 (2), 156–179.
Arthur-Holmes, F., Abrefa Busia, K., Vazquez-Brust, D.A., Yakovleva, N., 2022. Graduate unemployment, artisanal and small-scale mining, and rural transformation in Ghana: what does the 'educated' youth involvement offer? J. Rural Stud. 95, 125–139.
Awatey, S., 2014. Awareness of residents in small-scale mining communities on the perceived environmental impact of small-scale mining: a case of Amansie West District in Ashanti Region of Ghana. J. Environ. Earth Sci. 4 (10), 161–169.
Baah-Ennumh, T.Y., Forson, J.A., 2017. The impact of artisanal small-scale mining on sustainable livelihoods: a case study of mining communities in the Tarkwa-Nsuaem municipality of Ghana. World J. Entrep. Manag. Sustain. Dev. 13 (3), 204–222.
Bansah, K.J., Dumakor-Dupey, N.K., Kansake, B.A., Assan, E., Bekui, P., 2018. Socioeconomic and environmental assessment of informal artisanal and small-scale mining in Ghana. J. Clean. Prod. 202 (2018), 465–475.
Banza, C.L.N., Nawrot, T.S., Haufroid, V., Decrée, S., De Putter, T., Smolders, E., Nemery, B., 2009. High human exposure to cobalt and other metals in Katanga, a mining area of the Democratic Republic of Congo. Environ. Res. 109 (6), 745–752.
Basu, N., Clarke, E., Green, A., Calys-Tagoe, B., Chan, L., Dzodzomenyo, M., Odei, E., 2015. Integrated assessment of artisanal and small-scale gold mining in Ghana—part 1: human health review. Int. J. Environ. Res. Public Health 12 (5), 5143–5176.
Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. Qual. Res. Psychol. 3 (2), 77–101.
Buxton, A., 2013. Responding to the Challenge of Artisanal and Small-Scale Mining. How Can Knowledge Networks Help? IIED, London.
Carstens, J., 2017. The artisanal and small-scale mining (ASM) sector and its importance for EU cooperation with resource-rich developing and emerging countries. Strategic dialogue on sustainable raw materials for Europe (STRADE). Eur. Policy Brief 9, 21. Online at. https://www.stradeproject.eu/fileadmin/user_upload/pdf/STRADE_PB09-2017_ASM_and_EU-cooperation.pdf. Accessed September 15, 2020.
Clifford, M.J., 2017. Assessing releases of mercury from small-scale gold mining sites in Ghana. Extr. Ind. Soc. 4 (3), 497–505.
Dooyema, C.A., Neri, A., Lo, Y.C., Durant, J., Dargan, P.I., Swarthout, T., Nguku, P.M., 2012. Outbreak of Fatal Childhood Lead Poisoning Related to Artisanal Gold Mining in Northwestern Nigeria, 2010, 120. Environmental Health Perspectives, pp. 601–607.
Emmanuel, A.Y., Jerry, C.S., Dzigbodi, D.A., 2018. Review of environmental and health impacts of mining in Ghana. J. Health Pollut. 8 (17), 43–52.
Fadlallah, M.A., Pal, I., Hoe, V.C., 2020. Determinants of perceived risk among artisanal gold miners: a case study of Berber locality, Sudan. Extr. Ind. Soc. 7 (2), 748–757.
Garvin, T., McGee, T.K., Smoyer-Tomic, K.E., Aubynn, E.A., 2009. Community–company relations in gold mining in Ghana. J. Environ. Manag. 90 (1), 571–586.
Ghana Statistical Service, 2014. 2010 population and housing census. District Analytical Report. Talensi District.
Gibb, H., O'Leary, K.G, 2014. Mercury exposure and health impacts among individuals in the artisanal and small-scale gold mining community: a comprehensive review. Environ. Health Perspect. 122 (7), 667–672.
Gorman, M.R., Dzombak, D.A., 2018. A review of sustainable mining and resource management: transitioning from the life cycle of the mine to the life cycle of the mineral. Resour. Conserv. Recycl. 137, 281–291.
Guterres, A, 2017. UN Environment Annual Report 2017 -Towards a Pollution Free Planet. Retrieved from. https://www.unenvironment.org/annualreport/.
Hayford, E.K., Amin, A., Osae, E.K., Kutu, J., 2009. Impact of gold mining on soil and some staple foods collected from selected mining communities in and around Tarkwa-Prestea area. West Afr. J. Appl. Ecol. 14 (1), 1–12.
Hilson, G., 2002. The environmental impact of small-scale gold mining in Ghana: identifying problems and possible solutions. Geogr. J. 168 (1), 57–72.
Hilson, G., Bartels, E., Hu, Y., 2022. Brick by brick, block by block: building a sustainable formalization strategy for small-scale gold mining in Ghana. Environ. Sci. Policy 135, 207–225.
Hilson, G., & Hilson, A. (2015). Entrepreneurship, poverty and sustainability: critical reflections on the formalisation of small-scale mining in Ghana. Working Paper, International Growth Center. Online at https://www.theigc.org/wp-content/uploads/2015/04/Hilson-Hilson-2015-Working-Paper.pdf.
Hilson, G., Osei, L., 2014. Tackling youth unemployment in sub-Saharan Africa: is there a role for artisanal and small-scale mining? Futures 62, 83–94.
Hilson, G., Hu, Y., 2022. Changing priorities, shifting narratives: remapping rural livelihoods in Africa's artisanal and small-scale mining sector. J. Rural Stud. 92, 93–108.
Hinton, J.J., Veiga, M.M., Veiga, A.T.C., 2003. Clean artisanal gold mining: a utopian approach? J. Clean. Prod. 11 (2), 99–115.
Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF), 2017. Global Trends in Artisanal and Small-Scale Mining (ASM): A Review of Key Numbers and Issues. Winnipeg: IISD.
Kessey, K.D., Arko, B., 2013. Small scale gold mining and environmental degradation, in Ghana: issues of mining policy implementation and challenges. J. Stud. Soc. Sci. 5 (1), 12–30.
Kitula, A.G.N., 2006. The environmental and socio-economic impacts of mining on local livelihoods in Tanzania: a case study of Geita District. J. Clean. Prod. 14 (3), 405–414.
Kyerematen-Amoah, E., Clarke, E.E., 2015. Injuries among artisanal and small-scale gold miners in Ghana. Int. J. Environ. Res. Public Health 12 (9), 10886–10896.
Laube, W., Schraven, B., Awo, M., 2012. Smallholder adaptation to climate change: dynamics and limits in Northern Ghana. Clim. Change 111 (3-4), 753–774.
Lawson, E.T., Bentil, G., 2014. Shifting sands: changes in community perceptions of mining in Ghana. Environ. Dev. Sustain. 16 (1), 217–238.
Liamputtong, P., 2010. The Science of Words and the Science of Numbers: Research Methods as Foundations for Evidence-Based Practice in Health. Research Methods in Health: Foundations for Evidence-based Practice, South Melbourne, Oxford, pp. 3–26.
Liamputtong, P., Haritavorn, N., 2014. To tell or not to tell: disclosure to children and family amongst Thai women living with HIV/AIDS. Health Promot. Int. 31 (1), 23–32.
Lynas, D., 2015. Ergonomic issues associated with artisanal and small-scale mining in Ghana and PNG–"observations from the field. In: *Proceedings 19th Triennial Congress of the IEA* 9. Online at. http://ergonomics.uq.edu.au/iea/proceedings/Index_files/papers/237.pdf. Accessed July 22, 2020.
Meaza, H., Ali, M., Tesfamariam, Z., Abebe, N., 2017. Impacts of artisanal gold mining systems on soil and woody vegetation in the semi-arid environment of northern Ethiopia. Singap. J. Trop. Geography 38 (3), 386–401.
Mhlongo, S.E., Amponsah-Dacosta, F., 2016. A review of problems and solutions of abandoned mines in South Africa. Int. J. Min. Reclam. Environ. 30 (4), 279–294.
Ncube-Phiri, S., Mucherera, B., Ncube, A., 2015. Artisanal small-scale mining: Potential ecological disaster in Mzingwane District, Zimbabwe. Jàmbá 7 (1), 1–11.
Nyanza, E.C., Joseph, M., Premji, S.S., Thomas, D.S., Mannion, C., 2014. Geophagy practices and the content of chemical elements in the soil eaten by pregnant women in artisanal and small scale gold mining communities in Tanzania. BMC Pregnancy Childbirth 14 (1), 1–10.
Ofori, A.D., Mdee, A., Van Alstine, J., 2021. Politics on display: the realities of artisanal mining formalisation in Ghana. Extr. Ind. Soc. 8 (4), 101014.
Ofosu, G., Dittmann, A., Sarpong, D., Botchie, D., 2020. Socio-economic and environmental implications of artisanal and small-scale mining (ASM) on agriculture and livelihoods. Environ. Sci. Policy 106 (2020), 210–220.
Osei, L., Yeboah, T., Kumi, E., Antoh, E.F., 2021. Government's ban on artisanal and small-scale mining, youth livelihoods and imagined futures in Ghana. Resour. Policy 71, 102008.
Sana, A., De Brouwer, C., Hien, H., 2017. Knowledge and perceptions of health and environmental risks related to artisanal gold mining by the artisanal miners in Burkina Faso: a cross-sectional survey. Pan Afr. Med. J. 27 (280).
Shandro, J.A., Veiga, M.M., Chouinard, R., 2009. Reducing mercury pollution from artisanal gold mining in Munhena, Mozambique. J. Clean. Prod. 17 (5), 525–532.
Smith, N.M., Ali, S., Bofinger, C., Collins, N., 2016. Human health and safety in artisanal and small-scale mining: an integrated approach to risk mitigation. J. Clean. Prod. 129, 43–52.
Taabazuing, J., Luginaah, I., Djietror, G., Otiso, K.M., 2012. Mining, conflicts and livelihood struggles in a dysfunctional policy environment: the case of Wassa West District, Ghana. Afr. Geogr. Rev. 31 (1), 33–49.
Tambo, J.A., 2016. Adaptation and resilience to climate change and variability in north-east Ghana. Int. J. Disaster Risk Reduct. 17, 85–94.
Taylor, H., Appleton, J.D., Lister, R., Smith, B., Chitamweba, D., Mkumbo, O., Beinhoff, C., 2005. Environmental assessment of mercury contamination from the Rwamagasa artisanal gold mining centre, Geita District, Tanzania. Sci. Total Environ. 343 (1–3), 111–133.
Tschakert, P., Singha, K., 2007. Contaminated identities: mercury and marginalization in Ghana's artisanal mining sector. Geoforum 38 (6), 1304–1321.
Wachinger, G., Renn, O., Begg, C., Kuhlicke, C., 2013. The risk perception paradox implications for governance and communication of natural hazards. Risk Anal. 33 (6), 1049–1065.
Wilkinson, I., 2001. Social theories of risk perception: at once indispensable and insufficient. Curr. Sociol. 49 (1), 1–22.
Wray-Lake, L., Flanagan, C.A., Osgood, D.W., 2010. Examining trends in adolescent environmental attitudes, beliefs, and behaviors across three decades. Environ. Behav. 42 (1), 61–85.
Yakovleva, N., 2007. Perspectives on female participation in artisanal and small-scale mining: a case study of Birim North District of Ghana. Resour. Policy 32 (1-2), 29–41.
Yankson, P.W., Gough, K.V., 2019. Gold in Ghana: the effects of changes in large-scale mining on artisanal and small-scale mining (ASM). Extr. Ind. Soc. 6 (1), 120–128.
Zeng, J., Jiang, M., Yuan, M., 2020. Environmental risk perception, risk culture, and pro-environmental behavior. Int. J. Environ. Res. Public Health 17 (5), 1750.
African Development Bank (2016). Jobs for Youth in Africa. Catalyzing youth opportunity across Africa. Online at https://www.afdb.org/fileadmin/uploads/afdb/Images/high_5s/Job_youth_Africa_Job_youth_Africa.pdf. Accessed May 18, 2021.