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Gender and artisanal and small-scale mining: Exploring women's livelihood and occupational roles in formalised settings

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ABSTRACT

Artisanal and small-scale mining (ASM) has often been touted as an employment-creation avenue for millions of operators worldwide, including women. This employment-generation narrative has, however, been occasioned by the immense scholarly focus on the informal and labour-intensive segments of ASM operations. Exploring the livelihood and occupational roles of women in formalised ASM settings, data for our inquiry comes mainly from employees of two formalised ASM firms in Ghana. Our study suggests that contrary to the dominant narrative, women's employment avenues remain minimal in formalised settings through capital-labour substitution mechanisms. Our findings further indicate that women play differentiated, high positional roles in formalised settings, contrary to their lower-to-middle-rung roles in ASM labour structures in informal settings. In addition, occupational health and safety mechanisms differ from those at informal ASM sites. Disaggregation of employment figures in relation to female workers in ASM would help to tailor specific policies that encapsulate the duality of operations and attract more women into formalised settings where employment conditions are better.

1. Introduction

Underpinned by rising levels of unemployment, high gold prices and the negative effects of structural adjustment, artisanal and small-scale mining (ASM) operations have continued to grow over the last two decades (Banchirigah, 2006; Hilson and Garforth, 2013; IGF, 2017a). Although there is no universally agreed definition of artisanal mining (ILO, 1999), a commonly made distinction is between artisanal miners and small-scale miners, with the former using labour-intensive techniques, manual means and low technology methods, and the latter having some degree of mechanisation and sophistication. This distinction often refers not only to differences in technology but also to legality (formality) and illegality (informality), where artisanal mining operations imply operations without the requisite mining and mineral license (Fisher, 2007; Holloway, 1998). According to the IGF (2017b), the ASM sector ranges from poverty-stricken informal individual miners and groups seeking to eke out or supplement a subsistence livelihood to small-scale formal commercial mining activities that can produce minerals in a responsible way, respecting local laws.

Although the sector is associated with high rates of informality, it continues to serve as an engine of employment in many mineral-rich rural communities, especially in sub-Saharan Africa (IGF, 2017a, 2017b; Ofosu et al., 2020). Although the numbers are hard to come by, due to the high rates of informality associated with ASM, recent estimates suggest that over 40 million people were directly involved in ASM in 2017, with more than 150 million people directly dependent on the sector (IGF, 2017a). With particular reference to Africa, the figures indicate that there are about nine million ASM operators with about 54 million livelihoods (in)directly dependent on the sector (IGF, 2017a). With regard to women's engagement in ASM, the numbers suggest that, globally, women comprise about 10%–50% of the ASM workforce. Africa has the highest percentage, ranging between 40% and 50% (Hinton et al., 2003). According to Danielsen and Hinton (2020), for example, the ASM workforce producing 3Ts and gold in the Great Lakes Region (GLR) is estimated to be in the order of 300,000, with women and girls constituting significant proportions of the workforce (ca.10–15% of workers at 3 T sites and 25–50% at gold sites are women). In Ghana, McQuilken and Hilson (2016) estimate that the ASMindustry serves as an ideal income-earning opportunity for about one million people and supports approximately 4.5 million others, with women representing about 50% of the workforce.

Despite the growing number of women involved in the sector and the

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fact that it serves as an economic stepping-stone for them (Arthur--Holmes and Busia, 2022b; Labonne, 1996), findings have revealed that gender norms, especially, negatively impact women's roles and opportunities (Arthur-Holmes and Abrefa Busia, 2021;Arthur-Holmes, 2021a, b; Rutherford and Buss, 2019). The more lucrative tasks in ASM, such as 'digging or excavation' and 'supervision', are out of reach of women employees at the ASM sites (Koomson, 2019). These tasks are often perceived as 'masculine' and thus become the preserve of men (Danielsen and Hinton, 2020). The widely held belief that 'the man is the miner' limits women's access to a range of resources, including skills and higher incomes (Danielsen and Hinton, 2020). When ASM is done as a family business or within a family unit, women's work is quite often unpaid (Amutabi and Lutta-Mukhebi, 2001). Even when women are paid for their labour, they are often constrained to the lowest paid positions (Danielsen and Hinton, 2020). In sum, women's work in ASM, as highlighted by Jenkins (2014), is 'under-recognised'.

As indicated, the issue of women's involvement in ASM and its livelihood implications has been the focus of many studies. Themes such as women's participation and roles (Yakovleva, 2007), safety and environmental concerns (Arthur-Holmes and Busia, 2022a), bargaining and income power (Arthur-Holmes and Busia, 2020), and women's migration and occupational choices (Bashwira and van der Haar, 2020) have been highlighted. This present research seeks to complement these studies. Our point of departure, however, is that our study is focused on an overlooked segment of the ASM sector, namely formalised (legalised) and mechanised ASM operations. Notwithstanding the fact that observations have shown that formalised labour protection regulations have positive effects on the workforce, and that in formalised ASM settings, labour and remuneration conditions are far better (Ofosu and Sarpong, 2022), the immense scholarly focus on informal ASM has meant that our understanding of how formalised operations affect women's livelihoods in terms of employment generation, occupational roles, and health and safety mechanisms has remained incomplete. Although reports indicate the existence of a duality of ASM operations (i.e. informal and labour-intensive operations vis-a-vis formal and mechanised operations), as indicated in the introductory paragraph of this section, the activities of the formal operators have remained as marginalia in the scholarly literature.

Thus, moving beyond the 'doom-and-gloom' narratives usually associated with the saturated, informal ASM operations (popularly known as galamsey in Ghana), this study unpacks the operational outcomes of two formalised small-scale mining settings. In doing so, we examine the following research questions: 1) how do formalisation and mechanisation of small-scale mining operations impact employment generation and occupational roles of women? 2) In what ways do occupational and health hazard mechanisms at formalised ASM sites differ from those of informal settings? Drawing on fieldwork carried out in Ghana between 2020 and 2022 and complemented by semi-structured interviews undertaken mainly with employees and the management of two formalised mining companies, our findings bring evidence to contradict the popular perception that ASM serves as an employment engine for the vast majority of female miners. In formalised and mechanised small-scale mining settings, women's basic, direct and unskilled roles are eroded through capital-labour substitution mechanisms – replacement of manual work or workers with machines in an attempt to increase productivity and reduce the unit cost of production. Our findings, however, indicate that women play differentiated, high positional roles, in contrast to their lower-to-middle-rung roles in ASM labour structures in informal settings. In addition, ASM workers in general, and women in particular, experience better occupational health and safety mechanisms, unlike those at informal ASM sites.

These findings present important challenges to policymakers in the development community and ASM scholars: first, the ASM employment generation numbers and figures, as exciting as they may be, would need to be disaggregated to determine which group plays what role, and in which setting. The evidence sends a second important message: the nuances in ASM are important for formulating effective policies, and without proper recognition of these nuances, any blanket policies aimed at addressing the challenges faced by women in the sector would be ineffective. This points to a third important message in this study: female artisanal miners, or small-scale female miners, have to be targeted each on their own merit. The calls for ASM formalisation, with its attendant mechanisation mechanisms, would need to be tailored to attract more women into formalised ASM settings where employment outcomes and labour conditions are better.

1.1. *Women in ASM: previous studies*

The importance of ASM operations to the economic empowerment of women and the urgent need to reform the sector has been a recurring theme in most studies by ASM scholars (Bashwira et al., 2014; Buss et al., 2020; Byemba, 2020; Geenen et al., 2022; Hilson et al., 2018; Orleans-Boham et al., 2020). The causes and 'choices' of female participation in ASM have received extensive coverage in the literature (Buss and Rutherford, 2020; Huggins et al., 2017; Lahiri-Dutt, 2012; Yakovleva, 2007). Obviously, economic or financial-cum-subsistence needs are the underlying reasons for women's engagement in ASM (Yakovleva, 2007; Hinton et al., 2003). Poverty and lack of access to formal employment opportunities combine to form a major problem in most rural areas in the developing world. This is connected with a lack of education, which limits employment opportunities (Banchirigah, 2006, 2008). Thus, women, just like men, migrate into ASM areas to look for employment opportunities (Hilson et al., 2013; Yakovleva, 2007). However, other observations have shown that the motivation or individual decision to migrate to ASM sites has many facets and is not only a response to poverty (Werthmann, 2009). In some cases, migration to ASM sites also allows for a different lifestyle and greater personal freedom for women (Werthmann, 2009).

It has been noted that female participation in ASM can be either direct (i.e. primary engagement in mining operations) or indirect (i.e. servicing the mine sites) (Danielsen and Hinton, 2020; Heemskerk, 2003). With regard to women's direct involvement in ASM, Arthur-Holmes (2021)and Danielsen and Hinton (2020), for example, sum up their roles, determined by socio-cultural norms, thus: provision of water on mineralised sand, transportation of mineral ores, and serving as forewomen. Malpeli and Chirico (2013) weigh in on the debate and explain that the geologic and geomorphic expressions of mineral deposits, which primarily determine their location and accessibility, and the types of effort and skill required, influence the roles of women in ASM. Indirectly, women play roles such as cooks, nightclub entertainers, sex workers and merchants (Heemskerk, 2003). In some instances, women are excluded from mine shafts altogether for taboo-related reasons. In some communities, it is thought that menstrual blood or traces of sexual activity on the bodies of women may chase away mineral ores, especially gold (Werthmann, 2009).

Women generally occupy marginal roles in the management of ASM operations worldwide (Arthur-Holmes and Abrefa Busia, 2021; Fisher, 2007). They are rarely identified as miners: 'the man is the miner' syndrome (Danielsen and Hinton, 2020) discriminates against women's access to a variety of mineral resources and mineral rights (Danielsen and Hinton, 2020; Labonne, 1996). Notwithstanding the fact that many women spend long working hours on mining, doing work that is as tedious as that of men, they rarely self-identify or are identified by others as 'miners'; rather, they are often recognised as supplementary workers, working in the sector temporarily (Ibrahim et al., 2020). Women rarely attain the same decision-making positions as their male counterparts, including concession owners and mine operators (Labonne, 1996). Their involvement in ASM is largely affected, negatively or positively, by land tenure systems (Brottem and Ba, 2019). Although women form a substantial portion of the total workforce in ASM, they are usually consigned to low-level, menial-paying operations, and are underpaid (Arthur-Holmes and Abrefa Busia, 2021). The low payment

is, however, not surprising considering that women mostly perform ore processing and ancillary roles (Malpeli and Chirico, 2013). At the same time, women almost never work underground; they participate in the extraction of ores only when deposits have thin overburden layers (Malpeli and Chirico, 2013). They are mostly relegated to other roles when deposits require significant manual labour to access ores due to thick overburden layers (Malpeli and Chirico, 2013). The low-payment phenomenon concerning women's participation in ASM is very worrying, considering that their capital makes important economic contributions to the household; is used to pay for a variety of household expenses, such as school fees and supplies and medicines; and also importantly, in many cases, is reinvested back into farming (Arthur-Holmes and Busia, 2020; Hilson et al., 2018; Maconachie and Hilson, 2011; Zolnikov, 2020).

Other studies have highlighted that the barriers to effective women's participation in ASM are linked to socio-cultural norms, taboos, and structural gender inequalities (Buss et al., 2017, 2020). In Sierra Leone, for example, Ibrahim et al. (2020) note that state interventions and governance issues, which are steeped in pre-existing male-dominated social relations, are factors that contribute to keep women in gendered roles and limit their empowerment and effective participation in ASM (see also Lahiri-Dutt, 2008). In some cases, regardless of the activity pursued, a woman's participation in ASM-related activities at mine camps may ruin her social reputation due to notions of illicit sexual activities occurring at these camps (Werthmann, 2009). In addition, limited access to capital and credit prevents women from effectively participating in ASM operations (Hilson and Ackah-Baidoo, 2011). This relegates them to menial, underpaid jobs (Ibrahim et al., 2020) which, in the face of the depletable nature of natural resources, traps them in poverty (Kumah et al., 2020). Most women in ASM settings lack education and technical knowledge (Arthur-Holmes, 2021a,b; Arthur-Holmes and Abrefa Busia, 2021). This phenomenon, compounded by illiteracy, especially in war-related areas like the Democratic Republic of the Congo (DRC), ultimately inhibits women from fully engaging in the full spectrum of activities and processes of the ASM industry (Buss et al., 2019). Moreover, family commitments and cultural barriers impose heavy burdens on women. This impedes their independence and mobility to take the lead in ASM-related businesses (Yakovleva, 2007). In areas where conflict has been present, such as the DRC, women's vulnerability in mining contexts becomes extremely high (Perks, 2011a).

Women face serious occupational and health safety challenges in the ASM sector because the operators, generally, have a poor reputation for occupational safety and industrial relations (Kitula, 2006; Ofosu et al., 2020). Health and safety issues receive very little attention at most ASM sites, as precautionary measures are neglected, and no training on health and safety issues is provided (Mantey et al., 2016; Stemn et al., 2021). Most women miners are not well versed in work safety regulations, with observations showing that workers do not use personal protective equipment, such as helmets, earplugs, masks, or gloves (Arthur-Holmes and Busia, 2022a). As well as endangering the health of the miners, the involvement of women in small-scale mineral exploration (Yakovleva, 2007) also endangers the life and education of children, since most women are known to take their children to mining sites (ACET, 2017; Arthur-Holmes and Busia, 2022a).

Elsewhere, other studies have explored the 'boom-town' narrative and illicit sexual relationships and their socio-economic dynamics, which are usually present in ASM communities (Bashwira et al., 2014; Kelly et al., 2014; Werthmann, 2009). According to Werthmann (2009), sexual 'relationships with gold miners and the material benefits connected with them are among the lures of the gold mines'. In some instances, some women are sexually harassed by men at ASM camps; while some are forced into sexual intercourse, exchanging sexual favours with ASM bosses for an opportunity to get jobs (Kelly et al., 2014; Yakovleva, 2007). This phenomenon has also been observed in the DRC. In the case of the DRC, however, due to the dangers inherent in women's exposure to a volatile community dominated by men and armed actors at mining sites (Rustad et al., 2016), there are many programmes that are structured to help women exit artisanal mining sites. Accounts show that alternative livelihood programmes have been successful in transitioning many artisanal women miners out of artisanal mining into other economic opportunities in Katanga and other provinces (Perks, 2011a, 2011b). Other studies have, however, argued that the mining reforms have negative consequences for women, and in particular, that the presentation of 'conflict minerals' and the 'rape in war' narratives have provided an inadequate framework for developing effective solutions to the problems of women in ASM towns (Autesserre, 2012; Kelly et al., 2014). Bashwira et al. (2014) argue that although the problem of sexual violence in DRC is a very serious one, the one-dimensional emphasis on rape has risked obscuring the complexity of gender dynamics in ASM, particularly in eastern DRC (see also Bashwira and van der Haar, 2020; Laudati and Mertens, 2019; Maclin et al., 2017). The study further criticises the failure on the part of policymakers to acknowledge the economic importance of ASM in the livelihoods of women, even in war zones. Their criticism borders on 'untested' assumptions that have birthed alternative livelihood reform initiatives aimed at supporting women to leave the rather viable mining industry. In sum, the focus on rape-cum-resource-extraction limits women to the position of victims, disregarding the active role that women voluntarily seek and play in mining (Maclin et al., 2017). The rape-resource toxic framing also masks the economic significance of ASM in the livelihood of women (Laudati and Mertens, 2019).

In sum, the main messages delivered by the literature are as follows: that the ASM sector serves as an economic stepping-stone for women; that their movement into the sector is underpinned by poverty; that they mostly occupy the lower-to-middle rungs of ASM labour pyramids; and, as a result of being confined to this work, that most struggle to advance or make significant progress in the sector (Kumah et al., 2020). A reading of these studies, however, reveals a certain particularity – a focus on informal ASM. As such, notwithstanding the fact that some research works have shown that formalised labour protection regulations have positive effects on the workforce, and that in formalised ASM settings, labour and remuneration conditions can be better (Martinez et al., 2021; Ofosu and Sarpong, 2022), our understanding of how formalised ASM affects women's livelihoods and occupational roles has remained incomplete. There is little to no knowledge on the disaggregated number or percentage of female workers in formalised settings, or the kinds of roles they play. This has occasioned a lack of understanding of the strategies to be implemented to address the challenges that female miners face in formalised settings. We address this issue by turning towards the operations of two formalised small-scale mining operators after the presentation of our empirical research setting section.

1.2. Empirical research settings

We develop our contribution in the context of two mining companies. The first Company Hope (hereafter CH) has been in the extractive business for more than a decade and has secured mining concessions in some mineral-rich regions in Ghana. A section of the concession has, however, been given to Company A (hereafter CA) – a small-scale mining company. Interviews with the management and employees of CA were undertaken between 2020 and 2021. We found peculiar and distinct labour management practices, different from those that have been unearthed at artisanal mining sites. However, in order to examine whether these practices were unique to the operations of formalised small-scale mining companies, contact was made with another similar small-scale mining company, our second case organization.

This second small-scale mining company examined is Company B (hereafter CB). Just like CA, CB is registered with the Minerals Commission (MC) of Ghana and has obtained the necessary permits to undertake small-scale mining operations in the Eastern Region. However,

unlike CA, the concession granted to CB is registered in its own name. Thus, it has no partnership agreement with any other mining company. It is therefore directly answerable to the MC in terms of labour and environmental management practices. The operations of the two companies are highly mechanised, with machinery such as tractors and bulldozers as the main equipment employed in operations. Thus, their activities differ from the labour-intensive, manual operations associated with artisanal mining operations. Upon agreement, interviews with the second mining company were conducted in early 2022.

2. Method

This present study employed a qualitative approach to exploring women's livelihood and occupational roles in formalised settings. 'Rooted in the embodied wisdom of a group of individuals' (Shepherd et al., 2021), working at the coalface of artisanal and small-scale mining, the empirical analysis was based on semi-structured, in-depth interviews involving women (n = 7) working for companies CA and CB. Interviews with the women, on average, lasted an hour and half, and took place in the mining workspaces. Each interview began with the collection of the interviewee's socio-demographic data, after which we invited them to tell us a bit about their membership in the mining community (Lucas, 2011). We then drilled down to their prior career experiences, and how they got into mining work. The interview then moved on to focus on eliciting information on their work conditions, including incomes, occupational roles, safety conditions, and other persistent challenges they faced while working in the mines. We also interviewed some of the male workers and the management of both companies (n = 30). Each interview lasted approximately 1.5 h, and in addition to covering most of the questions in the women's interview, also focused on the men's path into mining work, the structural dynamics of work at the mining sites, how work-gender roles are defined and distributed, and their subjective views on what they think the companies could do to better support the women they work with. All interviews were digitally recorded and transcribed within 24 h of collection.

The full data analysis followed three main stages. The full data analysis then followed three steps. First, following our exploratory research design, we employed an inductive approach (Azungah, 2018) to code our textual data. We did this by continuously probing the data to identify and note what Draucker et al. (2007) refer to as recurrent comparative phrases to develop our provisional categories. In our effort to avoid our knowledge of the literature influenced our codes (Blair, 2015), we revisited and discussed all the provisional categories to make sure they were guided solely by the emerging patterns in our data set. Here, we also focused on our interactions with our research participants in their working spaces in formalised settings to help us identify the intractable challenges that women working in formalised settings encounter in their situated practice, and the need to support them to thrive at the workplace.

The second step in the analysis involved comparison with the extant gender-mining literature. In drawing on theoretical insight from the literature, we focused on how the intersection of gender, artisanal mining as context, and the occupational roles reproduce women livelihoods; more precisely, how the women 'make meaning' of their work and livelihoods in the context of informal mining settings. We subjected our data to these processes continuously and interpreted them until common themes emerged and became saturated (Hagaman and Wutich 2017). The emerging themes were then categorised based on their thematic similarities.

The final step involved the identification and codification of the common themes across the data, and the subsequent development of viable theoretical explanations of women's livelihood and occupational roles in formalised settings. Probing further the connections and conceptual properties of the respective categories, we developed four aggregate theoretical dimensions (recruitment, employment generation, occupational roles, renumeration, Security at the workplace, and health and safety) which we used to explore viable theoretical explanations. This involved zooming in and out of the discursive experiences of our research participants to building our understanding of specific facets of their lives, and how they get enacted in practice. Finally, we followed the emerging patterns from the data to develop further interpretive insight, form descriptive explanations of women's livelihood and occupational roles in formalised settings. We present the fine details of our research finding in the next section.

2.1. Research findings

2.1.1. Recruitment

The two companies serving as our empirical research sites are comparable in size and have similar recruitment policies. Most of their current workers (about 80–85%) have worked with the companies for more than two years. According to the management of CA, for example, some of the workers have worked for the company since it was formed, and the first concessions were secured more than a decade ago. The employees are mostly sourced from the illegal and legal mining sites around the area. According to management, the basic requirements for securing a job in the company are 'work experience' and 'competence'. Competence is usually ascertained through on-the-job assessment in the first week.

When vacancies become available, they are usually advertised on the local radio stations and newspapers, especially in the Eastern Region locality, where the two companies are located. Sometimes, workers also recommended certain people to be recruited. In the recruitment process, there is no regard for gender, age, ethnicity, or religious background. The director of CB explained:

> We recruit our workers without considering their social status. What we are interested in is experience, hard work and competence. We have invested a lot of money in this business and therefore productivity is our main concern. Workers' salary alone sometimes costs us in excess of Ghc 250,000[1] (ca. US$ 35,000) monthly. So, we don't care where the person comes from or where they worship. Once they can do the job, we offer it to them.

Both companies also engage in comprehensive apprenticeship programmes at the mine sites. The apprenticeship involves the recruitment of young men and women (between the ages of 17 and 20) into the firm to learn the skills of mining. The programmes are ultimately meant to offer skills and employment opportunities to young men living in the rural areas or communities around the mine site.

2.1.2. Employment generation

As noted earlier, research (e.g.,Arthur-Holmes, 2021a,b; Bashwira and Cuvelier, 2019; Maclin et al., 2017) has shown that in mainly informal ASM areas, the operations generate high levels of employment for both men and women, with women constituting a substantial portion of the labour force. This, to a large extent, is the case with the mining project of CA. As of the time of the research, a total of 98 Ghanaians were employed. However, contrary to the dominant narrative, a very low rate of female employees was observed: out of the total number of employees, only five were females, constituting about 5%. According to management, about 150 workers were employed during the peak period when the mining project started. However, due to dwindling levels of production, about 50 of the workers (49 males and one female) had been retrenched. Thus, before retrenchment, the total number of female workers was six out of 148 (4%). Interestingly, all the women had post-secondary education. This is in sharp contrast to the education levels of women who are mostly found in informal ASM sites (see, for

[1] As of the time of this research at CB in 2022 $1= Ghc7.2. However, in 2020-2021 when interviews were conducted at CA, 1$=6 Ghc. This ought to be noted throughout this study.

example,Arthur-Holmes, 2021a,b). When the present study's researcher quizzed the project manager of CA as to why there were so few female employees, he explained it as follows:

> The work is intensive and mechanised, so women are not needed. It also depends on the qualification of the women. In my long history in this mining business, I have rarely come across women as engineers and machine operators.

At CB, the number of employees was exactly 100, of whom only three were females (3%). Before the research was completed, however, one of the female workers left the company. It was revealed that she had joined one of the large-scale mining companies somewhere in the Western Region. During interviews, the director explained the reasons behind the low rate of female employees. Confirming that the roles of women become eroded through capital-labour mechanisms, he said:

> I have been in this ASM business for a long time, and I know the kind of work women do. But here their tasks are being done by equipment. Not that we don't have plans to recruit them, but it is also very difficult to find the kind of skilled women employees we require for our operations. Those who have the skills we require prefer to work for large-scale mining companies where the remuneration, I know, is better.

Confirming to the researcher that the last sentence was indeed a truism, the director continued:

> You know, when you visited us (referring to the researcher) there were three female workers, with one of them working as an apprentice. But as you are aware, one of them left us a few weeks ago because we understand she got a better job offer somewhere else.

One of the female employees (a forewoman/supervisor at the production unit) gave this explanation as to why there were so few women employees. Also confirming that women's basic roles are eroded in formalised settings through capital-labour substitution effects, she said:

> The carrying, washing and amalgamation work that woman usually do is being done by machines here. My father was a miner and he urged me to attend the school of mining to be trained as a professional miner. In my class, there were very few women. The few women who are trained in the mining school target employment in large-scale mining companies and that's where they end up eventually.

2.1.3. Occupational roles

As shown by research, women usually occupy low-rung positions at mine sites (Yakovleva, 2007; Arthur-Holmes and Abrefa Busia, 2021). Although this was indeed the case with the labour operations of CA, differentiated roles, which are usually not present at artisanal mining sites, were noted. As indicated, CA employed five female workers. Four of these employees were engaged in what can be described as ancillary roles – health assistant (1), cleaner (1), receptionist (1), and secretary (1). Only one female was engaged in direct mining activities. She worked as a production member. The retrenched female employee was a cleaner – an ancillary role. The health assistant, a retired nurse with Ghana Health Service, was stationed at a health post at the mine site. The receptionist and the secretary were stationed at the main administration section building, which was located about 5 km from the mine itself. The cleaner undertook her duties at the main administration section building and an auxiliary office at the mine site.

When the researcher quizzed the female production worker on her views on the low rate of female workers at the site and her perception of her role, her answer reflected the 'man as the miner' phenomenon. In her words:

> Mining is usually for men. Also, the kind of work we do here is difficult, so it's not surprising that almost all the workers are males. However, I sometimes feel that we could have more women at the production unit where we do the washing of the ores.

The men were engaged in direct mining roles such as project manager, mine captain, geologist, environmental and safety officers, machine mechanics, mining engineers, processing supervisors, tractor/equipment operators, and security officers. Also confirming the capital-labour substitution mechanisms, the mine captain, who had extensive experience at artisanal mining sites, gave his perception of the occupational roles as follows:

> If we had skilled female mining workers, we would employ them – why not? But you only find them for ancillary positions, as is the case with this company. Also, they cannot find jobs at this site because their main manual roles have been eroded through mechanisation. Here the loading and washing are usually done by machines. We also don't entertain female sex workers here …

CB employed three female workers, with one of them working as an apprentice. The men worked in similar roles to those observed at CA. Some of the female ancillary roles observed at CA were, however, not present at CB. There was no health post or nurse because the company had arrangements with a local clinic to take care of the workers in case of minor injuries. The cleaning and secretarial positions were occupied by men. Interestingly, however, the two main female employees at CB occupied high-rung positions, contrary to findings highlighted from artisanal mining sites. One of them worked as the forewoman/supervisor at the production unit, which consisted of 16 male workers. The other female worker, who had left the company before the research work was completed, worked as a tractor/equipment operator. The forewoman/supervisor expressed her views as follows:

> Women can also occupy high positions at mining companies. It is about skills and competence. As you are aware, one of my female colleagues was a tractor operator/driver and none of the men had problems with that. In fact, they even sometimes admired her work ethics and competence.

2.1.4. Remuneration

No worker at CA was paid below the official minimum wage. Hence, the prevailing wage is highly satisfactory when measured against the expectations of the workers. When the researcher inspected the payslips of some of the skilled employees, it was found that they earned between Ghc 2500 and Ghc 3000[2] (ca. US$400–500) per month. The salaries of the nurse and the female production member fell within this bracket. According to the employees and management, the minimum basic pay for the unskilled staff, including the other female workers – secretary, receptionist and cleaner – ranged from Ghc 1000 to Ghc, 2000(ca. US $165–335). The financial secretary said:

> We pay our workers by the middle of the month (on time). The monies are disbursed into their bank accounts on time, and their pay slips are also prepared regularly. Since we started our operations, we've not had a single complaint of workers not receiving their salaries. You can ask the workers …

In addition to their salaries, workers are provided with free transportation to and from the workplace and free lunch, which serve as a form of 'social wage'.

At CB, the skilled staff, including the female supervisor and tractor operator, received between Ghc 2900 and Ghc 3700 (ca. US$ 403–514) per month. However, there were no provision of free lunch or free transportation. The female apprentice earned Ghc 550 (ca. US$ 77) per month. The female supervisor intimated that she was satisfied with her salary, although she would have been happier if it was increased. She

[2] As of the time of this research at CB in 2022 $1= Ghc7.2. However, in 2020-2021 when interviews were conducted at CA, 1$=6 Ghc. This ought to be noted throughout this study.

said:

> The salary is fine. Salary increment would not be bad though. I used to work for a mining company before I moved here. And all together, I have been able to save enough to start a building project for family. I have two kids and they are well catered for. I'm planning with my husband to purchase a car for private use.

The female apprentice had this to say:

> I'm very glad to have had the opportunity to be at this site as an apprentice. The money I earn supports me and I also give part of it to my mother to support her petty trading business. I hope they retain me after my one-year apprenticeship programme is over. I would be very glad indeed.

These findings run contrary to previous findings in artisanal mining sites that suggest that women are usually underpaid or receive lower salaries than men. They therefore suggest that efforts should be made to enhance women's access to job opportunities in the formal small-scale mining sector where conditions are better. This is very important, considering the empirical evidence that the incomes of women invariably benefit child nutrition and survival rates and reduce poverty (World Bank, 2001).

2.2. Security and occupational health issues

2.2.1. Security at the workplace

Due to the valuable nature of most minerals, mine sites can be very dangerous places, as they can easily be the target of armed robbers and other criminals. Hence, the management of both companies take the issue of the security of the workers and of the workplace very seriously. Thus, various security measures have been put in place. First, there is a security post at the entrance to the main mine sites. This post is usually manned by not less than two security personnel at CA, while three security personnel man that of CB. These personnel are responsible for scrutinising all the people and materials that enter the mine site. In addition, at CA, another security post has been stationed at the main permanent structure inside the mining yard. This post is controlled by the chief security officer together with two other security men. Management of both companies also have direct arrangements with the nearby police staff, upon whom they can call if an emergency response is required. In addition, security cameras (CCTV) have been installed in the main administrative buildings in both mining yards. Especially at times when the processed gold is to be transported from the sites, security is reinforced, with additional security provided by staff of the Ghana Police Service and other private security personnel.

In this regard, the researcher sought to find out from the workers the extent to which they feel secure when undertaking their various duties inside the mining compound. Almost all the workers from both companies expressed satisfaction with the level of security provided. This was captured vividly by one of the female workers at CA:

> As a woman, I know mine work can be very dangerous for me. Women are generally vulnerable to criminal attacks, and this can be no different on mine sites. However, I feel very safe working in this compound. The level of security provided is very good, and so far, no criminal incidents have been witnessed here.

The veracity of the woman's last sentence was confirmed by the mine captain of CA, who explained to the researcher that since operations started, no criminal attacks or incidents have been reported on the site. In addition, the police officers in the nearby towns pay them regular security visits to ensure the work site is safe.

2.2.2. Health and safety

Occupational health and safety issues and women workers' welfare in relation to ASM operations have come to represent a conundrum (Arthur-Holmes and Busia, 2022a). However, this was not the case with the operations of the two companies examined in this study. The management of both companies, aware of the high level of occupational risks involved in mining projects (Kyerematen-Amoah and Clarke, 2015; Stemn et al., 2021), with their significantly negative impacts on productivity, have put in place facilities at the mine sites for both the prevention and the management of occupational injuries. The researcher observed that all workers at both sites wore protective clothing, which included uniforms, masks, boots, and helmets. A health post at CA, managed by a nurse, has also been established at the mine site to provide health services to the workers. As indicated earlier, CB has arrangements with a local clinic to attend to minor injuries. Furthermore, in conjunction with health officials of the nearby hospital, management have put in place emergency response and evacuation plans at the mine sites. In addition, all the employees are insured against occupational accidents and injuries. Discussions with the workers showed that they were aware that they were insured.

With regard to issues concerning the provision of shelter for the employees, permanent structures which serve as shelters have been provided for workers at both sites. Besides, toilet facilities and boreholes, which provide water, are available at the mine sites. The mine manager of CA, however, revealed that some of the workers who had had previous working experiences with illegal mining complained that they were not comfortable with the boots and helmets. They felt that the boots, especially, were too heavy. Nonetheless, the mine manager makes sure that all workers always wear their protective equipment. He said:

> Initially we had problems with some of the workers concerning the use of the personal protective equipment. Some of them were not particularly willing to wear the boots. We, however, insisted that they wear this equipment at all times once they are on our premises. Gradually, they accepted the practice to wear them.

3. Discussion and conclusion

The artisanal and small-scale mining sector has gained prominence as a source of livelihood for millions of people, especially in mineral-rich regions of rural communities. Although the sector comprises informal individual miners and groups, and small-scale formal commercial miners, these two segments are usually lumped together. However, a distinction ought to be made between artisanal miners, who usually employ labour-intensive techniques, and small-scale miners, who have varying degrees of mechanisation and sophistication. As has been noted elsewhere, images of an exclusively informal ASM segment do not always correspond to realities on the ground (Verbrugge, 2015; Ofosu and Sarpong, 2022). Instead, in countries with a long-standing tradition of ASM regulation, such as Ghana (Hilson, 2002), the sector is gradually evolving into a highly intertwined group of formal sectors operating with substantial degrees of legal registrations (Ofosu and Sarpong, 2022). In addition, the injection of capital by financiers has led to a growing differentiation among ASM operations in terms of their level of capitalization and professionalization (Ofosu and Sarpong, 2022; Verbrugge, 2015). One reason why the two segments of ASM are lumped together, however, may be inadequate data that actually quantify the number of artisanal miners due to the high rates of informality that encapsulates the sector.

This notwithstanding, the sector continues to serve as an ideal income-earning opportunity for millions of people, especially women. Mining towns are seen as economic engines – providing an extremely rare opportunity of employment for women, especially in rural areas, where high-paying jobs are scarce and gender roles are typically more conservative than in cities (Heemskerk, 2003). Some estimates suggest that there are about nine million ASM operators in Africa, with over 54 million dependants. It has been estimated that women can form up to 50% of the entire workforce in the sector. Despite the growing number of women involved in the mining sector, findings have revealed that gender norms, especially, negatively impact women's roles and

opportunities, with men taking up the more lucrative jobs. Women's experience of ASM has been shaped to a considerable degree by gendered stereotypes and discriminatory socio-cultural norms combined with persistent gender inequalities in land rights, education and representation of women in decision-making processes (Ibrahim et al., 2020). In sum, it has been noted that women's work in ASM is under-recognised and under-paid (Jenkins, 2014). This phenomenon is very worrying, considering that higher incomes for women empower them, improve the health of their families, and alleviate poverty in the larger society (Heemskerk, 2003; World Bank, 2001).

One challenge with these research findings is that the literature has mainly concentrated on the informal and labour-intensive segments of ASM. Thus, key questions worth throwing into the mix are: how are operations and management practices (re)negotiated in the formal ASM sector; and what actually is the disaggregated number of female employees in the formal and informal sectors? Hilson (2001), for example, estimated that 'women constitute some 15 per cent of the legalised segment of Ghanaian small-scale mining labour force'. Findings in this present study, however, demonstrate that these numbers would have to be revisited so that specific policy measures can be tailored to address challenges facing the specific number of employees populating the formal and informal segments of the Ghanaian ASM.

In this vein, findings from this study have demonstrated that, contrary to the popular narrative, women's employment avenues remain minimal in formalised small-scale mining settings through capital-labour substitution mechanisms. In addition, although our findings confirm previous findings that women occupy low rung-roles in ASM operations, we also observe differentiated and high positional roles for women. We also observe that formalised labour protection regulations have positive effects on the workforce, and that in formalised ASM settings, labour and remuneration conditions are far better. Although further research in different mining regions would help to bring more clarity to women's roles and labour conditions, especially in formalised settings, we note that the nuances in ASM operations are important for formulating effective policies, and that without proper recognition of these nuances, any one-size-fits-all policies aimed at addressing challenges faced by women in the sector would be ineffective. For example, whereas women in informal settings may require policies that cater for better remuneration and occupational health and safety, those seeking to enter formalised settings may require specific training in relation to the use of mining equipment.

Much has been said about formalizing ASM and providing appropriate technologies and equipment for miners. Obviously, these processes would come with effects on employment generation, especially for women miners. Increased mechanisation would, to a large extent, erode some of the basic operations that provide employment avenues for women. This would mimic large-scale mining operations, with their 'enclavity' phenomenon. Thus, the calls for formalisation, with its attendant mechanisation mechanisms, would need to be tailored to attract more women into formalised ASM settings where employment outcomes and labour conditions are better. Specific policy measures would need to be enacted to get more women into formalised settings. This includes the training of women in skills required for mechanised small-scale mining operations.

In the Ghanaian case, the training of women could be incorporated into the Community Mining Projects (CMPs) that have recently been initiated. According to Hilson et al. (2022), the CMPs are designed to help create opportunities in mining for indigenes in mining communities and to curb the menace of illegal mining. At their base, these projects bid to ringfence specific areas for licensed ASM and to make mining communities own concessions for use by the indigenes (Hawkson, 2022). Some district assemblies have submitted applications to the Minerals Commission (MC) for allocation of mineralised lands. Importantly, these applications have sought to cover all of the fees associated with a license with a view to remove some of the most significant barriers – i.e., costs and bureaucracy – to formalizing ASM in the country (Hilson et al., 2022). Recent reports indicate that about 368 licenses have been issued for the CMP in 2022 (Hawkson, 2022).

With reference to findings in the study which indicate that women usually lack the skills required to undertake employment opportunities in formalised and mechanised settings, we urge the District Chief Executives and the District Assemblies to advocate for the establishment of ASM training schools in district mining centres across the country. The George Grant University of Mines and Technology, Tarkwa, which has the primary responsibility to offer training to miners under the CMPs, is located in Tarkwa in the Western Region, far away from most of the mining districts, which are located in the mineral-rich regions of Eastern Ghana, Ashanti, and Bono (Brong). Thus, the university may not be accessible to most female miners, especially new ones, who are in particular need of training. To minimise the cost of training of would-be female miners, for example, we propose that mining authorities, especially the MC and the District Assemblies, should tap into the knowledge of workers who have employment connections with both large-scale and small-scale mines.

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  - That authors followed ethics guideline.

Data availability

Data will be made available on request.

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