



Livelihood coping strategies among displaced small scale miners in Ghana

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ABSTRACT

One major sub-sector that contributes immensely to job creation among people in rural Ghana is small scale mining. Notwithstanding, it has spawned land degradation, water pollution and regular reports of death attributed to pit collapse but these do not deter the miners from such enterprise. Government's attempt to streamline the sector through a moratorium has deprived the miners from their livelihood, compelling them to adopt alternative livelihood strategies. This study investigated the livelihood coping strategies adopted by the displaced miners. Cross-sectional data were collected using a semi-structured questionnaire. A multivariate probit model was used to analyze the determinants of the coping strategies. The three livelihood coping strategies adopted by miners were farming, trading, and labor supply. Of the three, farming emerged as the most dominant livelihood coping strategy. Institutional factors, personal characteristics, and location-specific factors influenced the adoption of livelihood coping strategies. The paper suggests the need to understand the far reaching livelihood implications of policy decisions on regulating the small scale mining sector. Therefore, there is the need for duty bearers to design tailor-made training programmes for the displaced miners and the employers to capacitate them in coping with the ban. This paper highlights that good policies also have negative consequences that need to be managed well by the government and other stakeholders.

1. Introduction

Mining of precious minerals is done on small and large scales. Mining is one of the major sectors contributing significantly to Ghana's Gross Domestic Product (GDP). It contributed as much as 11.9% to the country's GDP in 2016 (ISSER, 2017). Whiles as high as 1 million people are employed in small mining, only 29,000 are engaged in large scale mining activities (Minerals Commission, 2013). In fact, small-scale mining operations are widely spread in Ghana. Ghana, Brazil, and Indonesia are among the countries with the most extensive artisanal small-scale mining (ASM) activities (Macdonald, 2016). For Ghana, it has been established that ASM activities of gold date back to several years before the arrival of the Portuguese in 1474 (ISSER, 2017). Some minerals such as gold, bauxite, diamond, and manganese are mined in commercial quantities in many parts of the country.

According to Hidrón and Koepke (2014), artisanal mining or small-scale mining is subsistence in nature and is done using manually-intensive and rudimentary methods. As noted by Teschner (2012), ASM activity involves using rudimentary techniques to extract minerals under hazardous working conditions, which are characterised

by low capital investment and extensive manual labour. They operate under the informal sector, which is driven by poverty. Their activities are classified into permanent artisanal mining, seasonal (annually migrating during idle agriculture periods), rush-type (massive migration, often pulled by commodity price jumps), shock-push (poverty-drive, following conflict or natural disasters) (Hidrón and Koepke, 2014). The people involved in these ASM activities are in two folds. Some are legally registered and have the license to operate, while others are not registered and illegally do the mining. The illegal mining activity is locally called *galamsey* (meaning gather and sell). According to Brayon (2008), licensed ASM and *galamsey* activities involve land dredging and river dredging. Some also do underground and open-pit mining. Over the years, it has been very difficult to distinguish between the operations of the licensed miners and the *galamseyers*.

The operations of both have degraded the land, caused water pollution, destroyed forest and farmlands etc. Forest, for instance, is an environmental resource that is the last resort or safety net coping strategy to crop failure (Pritchard et al., 2020). These are constantly being destroyed by both ASM and *galamsey* activities in Ghana. Sometimes, these unsustainable mining activities result in land conflicts and

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human rights abuses. The difficulty is how to streamline the licensing policy, monitor and ensure the sustainability of the environment, and collect taxes (Svensson, 2013). Another worrying trend is the huge number of children engaged in mining in the country. It has been estimated that as high as 1 million children from age 5–17 years are working in the mining and quarrying industry (Azumah et al., 2020). This is derailing the government's efforts in increasing access to education through several interventions that have been rolled out. Social exploitation of children and no regard for social customs are other consequences of small-scale mining. According to Mandishekwa and Mutenheri (2020), mining is the principal cause of displacement and disruptions of rural household economic activities.

According to Abdulai (2017), the ultimate cause of the rush into mining by the youth in the country has been political and therefore requires political solutions. These political problems include corruption, nepotism, unequal relations of power in the acquisition of concessions and granting of the mining license, connivance with foreigners, etc. Also, unemployment and climate change are major push factors for illegal mining in the country. Meanwhile, for the past one and half decades, several governments have tried to streamline the activities of *galamsey* and licensed ASM in the country. The latest occurred IGF, 2017 with the Republic of Ghana's president, Nana Addo-Danquah Akuffo-Addo, declaring war against ASM and *galamsey*. It was started with Ghanaian media forming a coalition against *galamsey*. During the period, 14 courts were set up to handle *galamsey* cases. There was an inter-ministerial task force and operation vanguard (military and police) against *galamsey*. The security involvement under the auspices of "Operation Vanguard" has been described by Hilson (2017) as a "war" against ASM. Also, the issuance of the license for ASM activities was suspended. The initial six-month ban on ASM and *galamsey* activities were extended indefinitely. "Operation Vanguard" arrested many miners and seized and destroyed many mining equipment.

Government moratorium on *galamsey* and ASM rendered most licensed and unlicensed small-scale miners and their labourers jobless. Most of them have lost their livelihoods due to the ban. A recent study by Tuokuu et al. (2020) revealed that the ban on *galamsey* in Tarkwa-Nsuaem Municipality in South-Western Ghana has imposed significant socio-economic hardships on the people, thereby entrenching poverty. As a result, the displaced miners and their employees have to adopt some coping strategies to minimise the effects of the ban on their livelihood. Just as the mining activities displace rural households, the moratorium or ban on mining IGF, 2017 caused the displacement of miners and their employees from sources of livelihood. Poor and vulnerable households use coping strategies to lessen and escape from the livelihood loss, uncertainties, stress, and shocks. Coping strategies are short-term measures or strategies use by households to deal with the crisis and negative impact of an external change (Bhattarai, 2005).

Also, there is a plethora of literature on ASM in Ghana and other parts of the world. Notable among them are those who looked at impacts of ASM on environment (Macdonald, 2016; Kessey and Arko, 2013; Bansah et al., 2018; Owusu et al., 2019), overview of ASM (Tetteh, 2011; Basu et al., 2015; Ofosu-Mensah, 2011), livelihood impacts of ASM (Abbiw, 2020; Osumanu, 2020; Baffour-Kyei et al., 2021; Baah-Ennumh and Forson, 2017; Azumah et al., 2020), implementation of ASM policies (Osei-Kojo et al., 2016; Tuokuu et al., 2019), livelihood consequences of the ban on ASM and *galamsey* (Tuokuu et al., 2020; Hilson, 2017); and economics of ASM (Adjaye and Ampofo, 2017). Whilst there are many scholarly literature on ASM, its operations and impacts, little is known on how miners who are displaced from the mining activities cope with the loss in livelihood. Not only that but also, Osumanu (2020) argued that the proofs that inform small scale mining at the national level in the country are insufficient compared with that of large scale mining, and hence there is the need for better appreciation of the small scale miners' livelihood. Therefore, one of the important researchable questions is what coping strategies have the miners and their employees adopted to respond to the loss of livelihoods from the ban? Also, what factors

influence their choice of coping strategies? Therefore, this paper aims to identify the coping strategies that miners and their employees have adopted in minimising the loss of livelihoods due to the ban on small scale mining in Ghana. It also discussed the drivers of the identified coping strategies. It is worth noting that this study is timely and critical as it would provide researchers, policymakers and development practitioners, and students, current information for further research, policy-making, and advocacy.

2. Literature review

The mining sector is a major economic branch in Ghana that contributes significantly to the country economic growth. Mining has contributed both locally and nationally, providing significantly to livelihoods and serving to alleviate poverty. The country has recorded a notable increase in all her mineral production since 2005, with gold being one of the leading sources of Ghana foreign exchange (Abaje et al., 2015; Rajaei et al., 2015). The country is blessed with mineral resources such as gold, diamond, bauxite, manganese etc. These mineral resources provide foreign exchange. The extraction of these mineral resources is done on small and large scales. Large scale mining is done by companies with foreign or local ownership, whilst small scale mining is reserved for Ghanaians. Large scale mining tends to benefit the country at the macro level. Small-scale mining has equally played a major role in the livelihood conditions of Ghanaians at the micro-level. Abbiw (2020) and Hilson (2002) argued that small-scale gold mining has a major impact on employment in developing countries, especially in rural areas with limited job opportunities. Osumanu (2020) further explains that small scale mining plays a major role in poverty reduction in rural areas of sub-Saharan Africa and contributes significantly to household livelihoods.

Irrespective of the contributions of small scale mining, there are concerns about environmental sustainability. These are based on the wanton destruction of forest resources and agricultural land by small scale miners without regard to mining laws. A study by Baah-Ennumh and Forson (2017) revealed that Artisanal and Small-scale Mining firms could not reclaim the mined land, thereby rendering land unproductive for a long time. Hence, Baffour-Kyei et al. (2021), Banchirigah and Hilson (2010), Hilson (2016) and Kelly (2014) stressed that there is a clear need for enhanced sustainability in the sector. It is important to note that the significance of small scale mining to rural dwellers is better understood at the household level (Yaro, 2013). The impacts of unsustainable mining are highly felt by the rural households depending heavily on the land and land-based resources for livelihoods. There are insufficient proofs that inform small scale mining at the national level in the country (Osumanu, 2020), and hence there is the need for better appreciation of the small scale miners' livelihood. There are things that threaten miners' livelihoods. These, according to Osumanu (2020), Pokorny et al. (2019) and Yaro (2013) include climate change and increasing costs of farming inputs. Abbiw (2020) found out that despite the financial pick up gotten from the mining sector in Juaboso Locale, small-scale gold mining has left significant negative effects on agricultural livelihoods, particularly those who depend on cacao their fundamental source of making a living. Also, government policies that are small scale mining unfriendly have a high probability of exacerbating their livelihood plights. Rural households' adaptive capacity plays quite an important role in shaping their livelihood. Irrespective of the amount of exposure and sensitivity, highly adaptive individuals are able to minimise the effects of stress.

The apparent negative correlation between mining and development is explained by the natural resource curse hypothesis. The framework posits that natural endowments tend to be a curse as the expected impact on the people's livelihoods on whose lands resources are situated are constantly kept in perpetual poverty (Pokorny et al., 2019; Forson et al., 2016). In some instances, countries with natural resources tend to concentrate on the natural resource sector to neglect the other sectors.

Meanwhile, the skills required in that sector is very specialised, which do not appeal to the ordinary people in the communities where these resources are discovered. The ideal situation or what everyone expects should have occurred in these communities is seeing massive socio-economic improvements of the indigenes over a sustained period of time. It is obvious that this can only be made possible through consistent good planning and execution of policies. While government policies are good in regulating the sector, the consequences of implementing those policies need to be appreciated.

3. Theoretical and conceptual frameworks

The theory underpinning this study is the theory of psychological stress and coping propounded by Lazarus and Folkman. According to Lazarus and Folkman (1984), the process of coping is critical to the management of immediate or long-term stressful environments or outcomes. When faced with stress, such a livelihood loss, one need to devise ways of coping with the situation if it cannot be solved permanently. Based on this, Lazarus and Folkman (1984) indicated that problem-focused coping includes confrontative coping, seeking social support, and planning full problem-solving. As noted by Baqutayan (2015), individual performance when subjected to a problem depends on his/her coping ability.

Similarly, a moratorium on ASM or *galamsey* operations in Ghana was a stressful outcome for those who depend on mining for livelihood. The moratorium was not expected and hence can be classified as a shock Ellis (2000) defined it as an unpredictable event that can directly destroy assets or affect the people. Therefore, this shock compels the miners and their labourers to react to the stress threatening their livelihood and wellbeing by adopting coping strategies. Folkman and Lazarus (1980) noted that coping is a cognitive and behavioural effort to minimise and endure the effect of the stress, as in this case, the loss of livelihood due to the ban on mining. As shown in Fig. 1, psychological stress and coping theory explain that stressors lead to worries that intend to result in either

bad or good feelings of stress, thereby making an individual interpret the stressors and look for coping strategies (Baqutayan, 2015).

Similarly, it is expected that legal and illegal small-scale miners who face the ban on their activities will entertain some worries and begin to feel the ban's effects. With this, they will have different interpretations of the ban and adopt different coping strategies to mitigate or tolerate the impacts. Therefore, the psychological stress and coping theory which is inert, is expressed outwardly based on socio-economic factors, thereby transitioning into the conceptual framework as shown in Fig. 1.

Problem-solving coping in this study is an intervention used in reducing or managing the loss of livelihoods by the displaced miners. Livelihood coping strategies to a government moratorium on *galamsey* and ASM activities are the short-term strategies miners or their employees used to save their livelihood from unexpected abnormal situations or calamities (Adjei, 2007). The coping strategies identified in this study as paramount to the moratorium on mining are farming, trading and labour supply. It is important to note that a miner or a mining employee's ability to cope with the livelihood loss varies based on his or her socio-economic factors. The stress reaction of people differs. As shown in Fig. 1, the miners choose different coping strategies to the ban on mining based on certain personal-specific, location-specific and institutional characteristics.

For instance, Adeniyi et al. (2016) found that increasing household size increases the likelihood of becoming poor, making the household members offer labour for any menial job as a coping strategy. It has also been observed by Adeniyi et al. (2016) that education increases diversification and hence can be included as one of the drivers of livelihood coping strategies such as farming, trading and labour supply. One cannot forget about the experience as one of the determinants of disaster (Bozzoli et al., 2011). Loss of livelihood due to government moratorium on small scale mining can be described as a disaster. Therefore, more experienced will have better-coping strategy their counterparts with otherwise experience. As observed by Addisu et al. (2016), distance to the nearest health centre (developed towns like regional and district

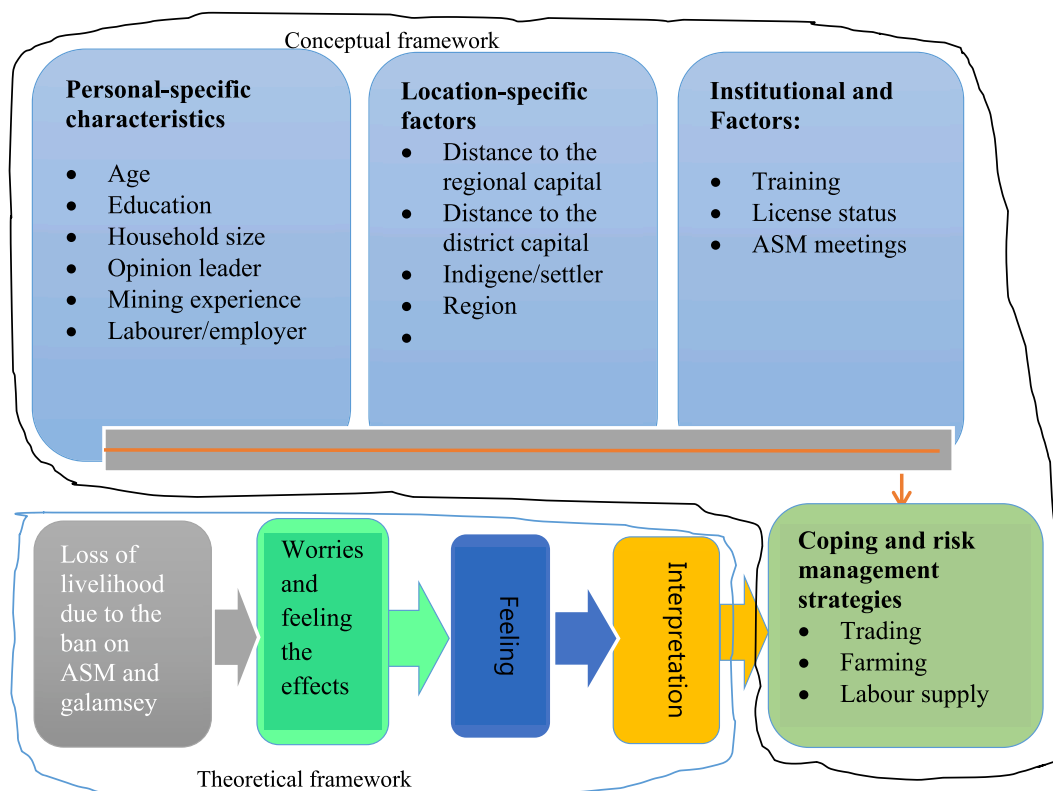


Fig. 1. Theoretical and conceptual frameworks.

capitals have better health centres) increases one’s ability to cope with climate change which can be likened to a stressor such as a loss in livelihood due to a ban on mining. A study by [Oparinde and Hodge \(2011\)](#) observed that household size is critical to adopting labour supply as a coping strategy to household vulnerability.

4. Methodology

4.1. Study area, sampling, and data requirements

The study area is Ghana which falls in West Africa. Ghana is known for its abundance of minerals, especially gold, and hence was called the Gold Coast. The minerals mined in Ghana in commercial quantities are gold, bauxite, diamond, and manganese.

Due to the fact that the ASM and *galamsey* activities are endemic in

some parts of the country and the quest to deal with the heterogeneity, a purposive sampling technique was used to select Upper East, Eastern, Western and North-West Regions in Ghana. A purposive sampling technique was used to select Talensi District in Upper East Region; Amenfi West District in Western Region; Bibiani-Anhwiaso-Bekwai District in Western North Region and Denkyembour, East Akim, and West Akim Districts in Eastern Region of Ghana (see [Fig. 2](#)). The purposive sampling technique was used based on the availability of the population (Licensed small-scale miners and *galamseyers* and their employees). With the help of a semi-structured questionnaire and face-to-face interview, 156 respondents were selected using the snowball sampling technique. The primary cross-sectional data were analysed using SPSS and STATA.

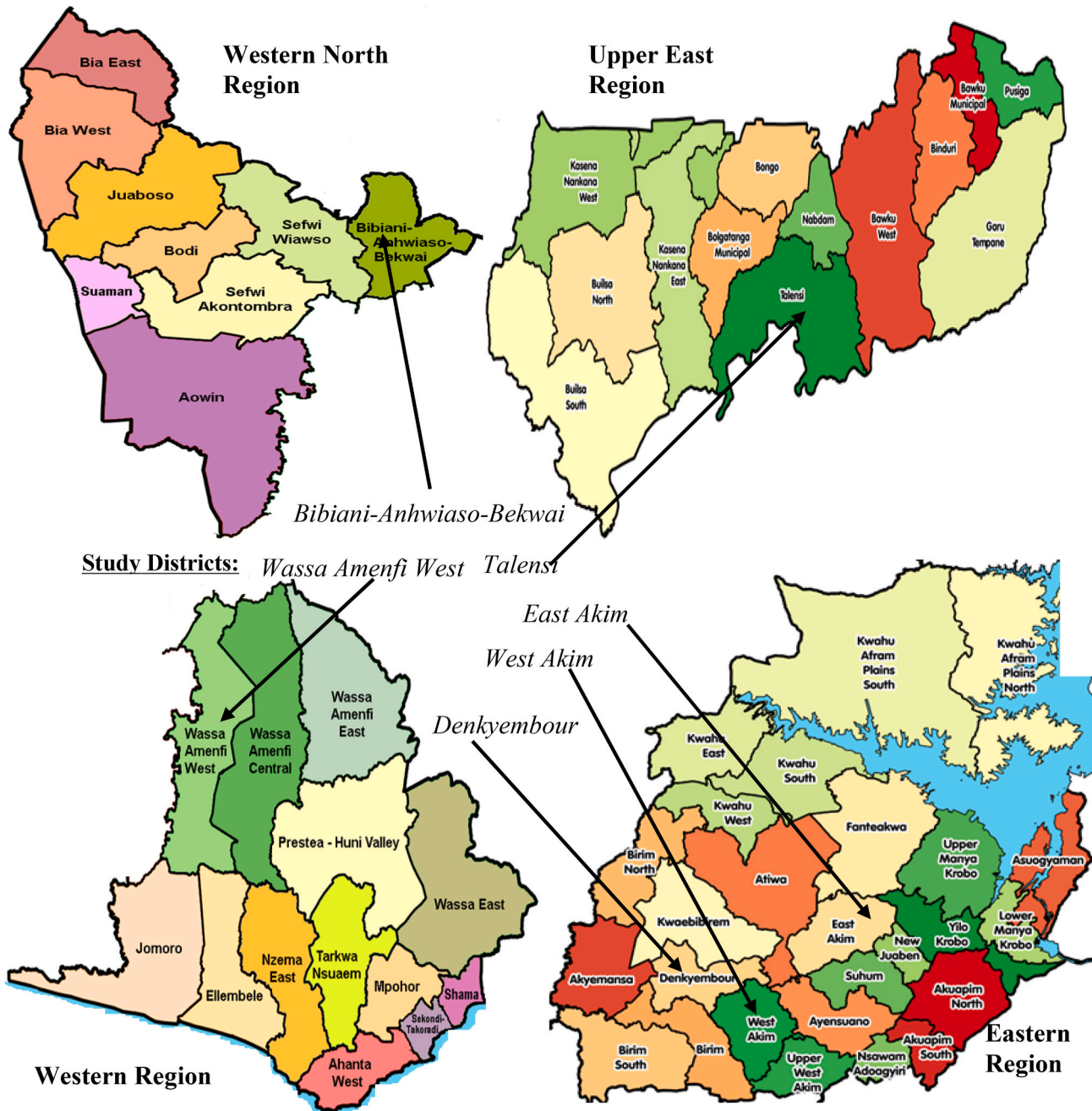


Fig. 2. Map showing the study districts in the selected four regions.

4.2. Drivers of coping strategies to the moratorium on ASM or galamsey

The study identified farming, trading, and labour supply as the three principal coping strategies adopted by miners or their employees. This was done with the help of a semi-structured questionnaire. The identified coping strategies were analysed using descriptive statistics such as frequencies and bar charts. Coping with the government moratorium on ASM and galamsey is a random decision a miner or his employee takes. The theory of utility maximisation underpins the decision to adopt a coping strategy or groups of coping strategies. A miner or the employee will adopt a bundle of coping strategies that maximise their expected utility.

To identify the determinants of the coping strategies, multivariate probit analysis was employed. To account for the interdependent and simultaneous coping decisions when investigating the drivers of adopted coping strategies, Greene (2012) suggested the use of the multivariate probit model (MVP). The multivariate probit model has the ability to estimate several correlated dichotomous outcomes together (herein coping strategies) as it can simultaneously capture the impact of the set of covariates on each of the coping strategy options (Greene, 2012). Whilst it does this, it allows for possible relationships among unobserved disturbances and the relationships between the coping strategy options. Dorfman (1996) noted that miners' adoption of coping strategies in response to a government moratorium on ASM is inherently multivariate. This study could not have disagreed with Dorfman (1996) that if the probit or logit model is used to model the drivers of the coping strategies, important economic information about the interdependent and simultaneous decisions will be biased. Though the multivariate probit model is a discrete choice regression model, it has an additional advantage as it simultaneously identifies the factors that affect the choice of one or more dependent variables as well as allowing the error terms to be correlated freely (Christina et al., 2013).

U_0 The utility a miner will derive from not using any of the coping strategies and U_k represent the utility derives from using k^{th} coping strategy. A miner will use k th coping strategy if the utility derived from it is greater than otherwise, thus, $Y_{ik}^* = U_k - U_0 > 0$.

The net benefit (Y_{ik}^*) that the miner derives from the k^{th} coping strategy is a latent variable determined by a vector of covariates and unobserved characteristics u_i . This can be expressed as;

$$Y_{ik}^* = X_i' \beta_k + u_i \tag{1}$$

Where, $k =$ coping strategies 1, 2, 3

The econometric approach suggests the use of indicator function to translate the unobserved preferences into the observed binary outcome equation for each choice as:

$$Y_{ik} = \begin{cases} 1 & \text{if } Y_{ik}^* > 0 \\ 0 & \text{if } Y_{ik}^* \leq 0 \end{cases} \tag{2}$$

Given that $Y_{ik} = (Y_1, Y_2, \dots, Y_K)$.

Since using any coping strategies is possible, the error terms jointly follow a multivariate normal distribution (MVN) with zero conditional mean and normalised unity variance, where $(U_1, U_2, \dots, U_k) \approx MVN(0, \Omega)$ with the symmetric covariance matrix Ω given by;

$$\Omega = \begin{bmatrix} 1 & \rho Y_1 Y_2 & \rho Y_1 Y_3 \\ \rho Y_2 Y_1 & 1 & \rho Y_2 Y_3 \\ \rho Y_3 Y_1 & \rho Y_3 Y_2 & 1 \end{bmatrix} \tag{3}$$

Where ρ denotes the pairwise correlation coefficient of the error terms for any two of the estimated coping strategy equations in the model. The correlation between the stochastic components of different coping strategies is represented by the off-diagonal terms in the variance-covariance matrix (Teklewold et al., 2013). The complementarity or substitutability of the coping strategies is shown by the sign of the correlation coefficient value (Khanna, 2001).

5. Results and discussions

5.1. Summary statistics of variables

Table 1 shows the summary statistics of the socio-economic factors. As evinced in the table, the respondents' average age is 42years suggesting that youths are more engaged in ASM or galamsey activities. The average years of education of 9.7years is a clear indication that lowly educated people are engaged in mining activities. With low education, such miners do not have the requisite technical skills to be employed in the formal sector. This follows a global trend where 70–80% of ASM workforce are informal (Intergovernmental Forum on Mining, Minerals, Metals, and Sustainable Development [IGF], 2017). The respondents have an average 9.7 years of experience in mining. This implies that the majority of the miners have been in the mining business for over closed to a decade. Typical of a rural household, 7.8 members in a household is above the national average of 3.8. and rural savannah average of 5.7 (GSS, 2019). It is not surprising that out of 156 respondents, 72% are from the community or are indigenes in the community. The opinion leaders and the well-endowed people in the communities are engaged in mining and accounted for 44% of the total respondents considered in this research. As much as 71% of the miners or their workers indicated they had ASM licenses to operate. Lastly, 50% of them indicated that they had been trained in small-scale mining by the Mineral Commission before.

5.2. Distribution of livelihood coping strategies before and after the ban

Farmers were asked to indicate any other livelihood activities they were engaged in aside from mining before the ban. As shown in Fig. 3, the three dominant livelihood activities mentioned were farming, trading, and supplying labour services. At the same time, they indicated the livelihood coping strategies they adopted after the ban on mining, and it emerged that farming, trading, and labour supply were dominant as well. Livelihood coping strategies are shown in Fig. 1. Out of 156 respondents, 51 were engaged in farming before the ban and increased to 76 after the ban. This is in line with Hilson and Banchirigah (2009) that some government and donor agencies have implemented alternative livelihood projects over the years to help miners diversify over the dependence of rural mining communities on illegal ASM. Not only that but also, some of the large scale mining companies, especially Anglo-Gold Ashanti, trained miners on vegetable farming, snail, and grass-cutter rearing in the bid to diversify miners' livelihood to reduce encroachment on their mining concessions (Banchirigah, 2008). It also confirmed the assertion by Obiri et al. (2012) that rural livelihoods are natural resource-dependent. Those who were engaged in both farming and mining still indicated that they had expanded their farms to make enough money to support their households. Whilst 46 respondents were

Table 1
Summary statistics of variables.

Variable	Mean	Std. Dev.	Min	Max
Age (years)	42.01	7.95	25	61
Education (years)	9.65	5.88	0	18
Mining experience (years)	9.72	5.77	2	32
Household size	7.75	3.06	2	16
Indigene or settler (1 = indigene, 0 = settler)	0.72	0.45	0	1
Opinion leader (yes, 0 = no)	0.44	0.50	0	1
Number of ASM meetings	4.66	3.12	0	14
Have mining license (yes, 0 = no)	0.71	0.45	0	1
Trained by MIMP (1 = yes, 0 = otherwise)	0.27	0.44	0	1
Distance to Regional Capital (Km)	76.87	27.12	12	105
Distance to District Capital (Km)	13.65	9.33	0	26
Trained on mining (1 = yes, 0 = otherwise)	0.50	0.50	0	1
Number of workers	20.78	9.84	6	62
Live in a mining community	0.44	0.50	0	1
Western North (1 = yes, 0 = otherwise)	0.69	0.46	0	1

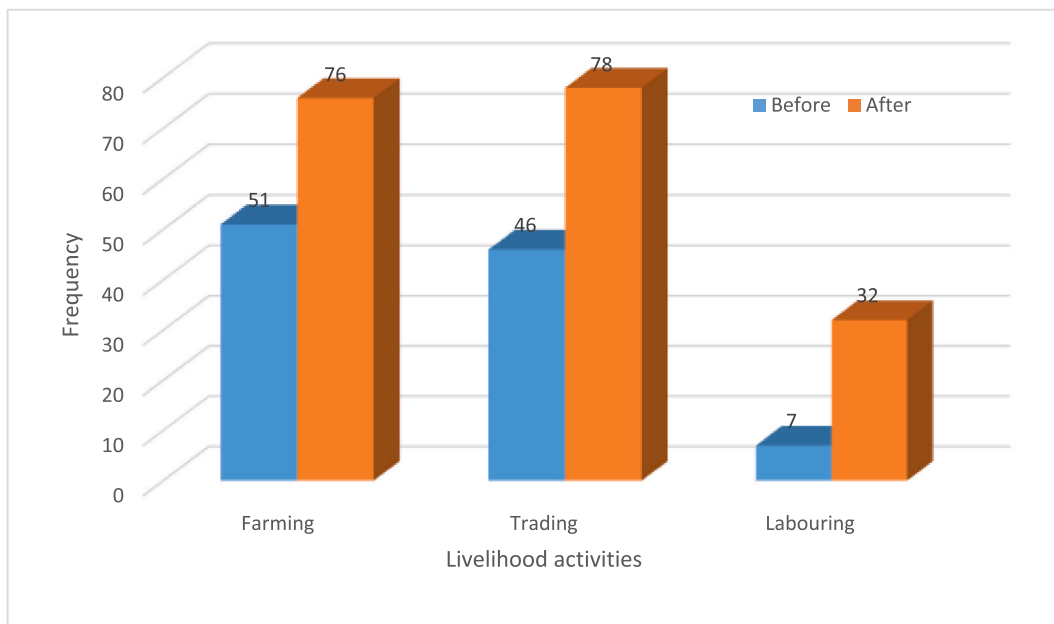


Fig. 3. Distribution of livelihood coping strategies before and after the ban.

engaged in mining before the ban, and this has increased to 78 during the ban. The livelihood activity with the least number of respondents is labour supply. Relatively, only 32 respondents supply labour to cope with the hardship of the ban.

The Venn diagram showing how the respondents are distributed and interconnected regarding the coping strategies they adopted to mitigate the livelihood lost due to the government ban on a small scale and illegal mining is evinced in Fig. 4. From the figure, out of 156 respondents, 8 were engaged in all the three livelihood coping strategy activities, namely farming, trading, and supply of labour services. Out of 35 respondents who were involved in farming and trading as coping strategies to the ban, 27 were engaged in only farming and trading. The total number of respondents engaged in only two of the coping strategies is

45, whilst 72 were engaged in only one coping strategy. In all, trading was the most dominant livelihood coping strategy. Out of 146 respondents, 78, representing 53%, have coped with the ban on illegal or small-scale mining by entering into trading. This is closely followed by 52% of the respondent who has entered into farming as full-time livelihood coping strategy to the ban. Relatively, few thus 32 respondents offer their services to farmers or other organisations and firms as labourers. Ansah et al. (2021) noted that labour deployment is one of the coping strategies to minimise the effects of shocks on household livelihood security.

Farming is identified as the major alternative livelihood coping strategy for miners in the face of the ban. This confirms Hilson and Banchirigah (2009) that alternative livelihood programs for miners in

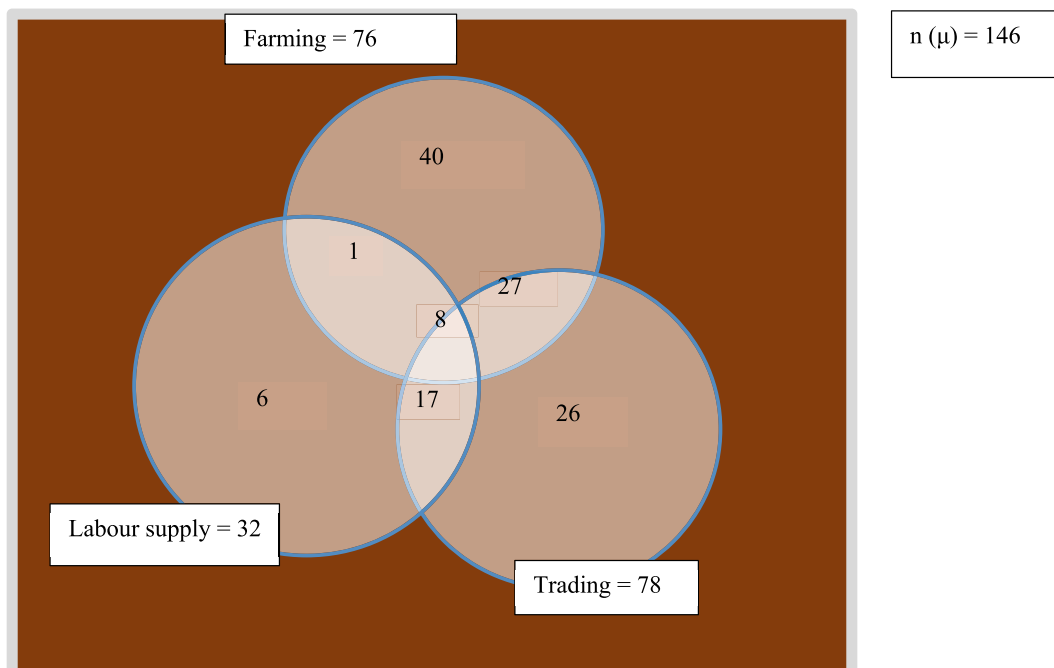


Fig. 4. Venn diagram showing the distribution of livelihood coping strategies.

sub-Saharan Africa have long been agrarian. Though this has been the case, *Sippl and Selin (2012)* questioned the viability of agro-based alternative livelihood programs since ASM is a livelihood strategy for agricultural poverty. Another hindrance to farming as a livelihood strategy for mining is difficulty in accessing land in Ghana.

5.3. Factors influencing livelihood coping strategies to the ban on mining

Table 2 presents the multivariate probit model results of the factors that influence the livelihood coping strategies that ASM or illegal miners have adopted to minimise the effects of the government moratorium on mining. As typical of multivariate probit, a maximum likelihood estimator determines the factors influencing multiple dependent variables with binary outcomes. As shown by the significance of the Wald Chi-square test, the null hypothesis that the coefficient of farming, trading, and labour supply coping strategies' equations are jointly equal to zero is rejected in favour of the alternate hypothesis. Also, the significance of the likelihood ratio test suggests that the error terms in all the equations are correlated and hence are interdependent of each other. These diagnostic tests show that the MVP model is appropriate for the data.

The pairwise correction matrix, which is used to determine the substitutability or complementarity of the coping strategies, suggests that only trading and labour supply are statistically significant. The significant and positive correlation coefficient of the trading and labour supply implies that the two complement. Those who do trading also supply labour to other firms or organisations as a coping strategy to livelihood loss resulting from the moratorium on mining. Since at least one of the correlation coefficients is statistically significant, the MVP model's use is justified implying the three coping strategies are interdependent. This means the probability of miners or former mining employees using one coping strategy depends on whether another strategy is being adopted.

Adjei (2007) noted, besides from farming, the engagement in non-natural resource-based activities such as supplying labor services (manual work) on other people's farmlands and petty trading are important livelihoods coping strategies in the mining areas. Hence, these three livelihood coping strategies have been used in this study. From

Table 2, years of education, mining experience, and distance to district capital are 5% statistically significant each and have positive effects on farming. This means that if each of them increases, the probability that miners will engage in farming to minimise or mitigate the dire consequences of the livelihood lost due to the ban on illegal or ASM activities is very high. The direction of the effects of distance to district capital on farming is plausible and meets the a priori expectation. It is expected that miners who live far away from the district capital are indeed in remote areas where access to farmlands is relatively easy. Such miners have a high propensity to engage in farming as a mitigating strategy to the ban.

Also, the 1% and positive significant of the household size suggests that miners with large household sizes have a higher probability of engaging in farming as a coping strategy to the negative consequences of the ban on mining. Farming is labour-intensive, and it is highly expected that miners who have large households might have more helping hands to assist in the farming activities. Opinion leaders are people who might have land for farming activities and hence its positive significant effects on farming. The probability of an opinion leader who was into mining before the ban engaging in farming during the ban is 62.6% higher than a non-opinion leader in the community. Having a valid mining license is statistically significant at 1%. Its negative sign implies that miners who have valid mining licenses or worked in mining firms with valid licenses have a lower propensity to engage in farming compared to their counterparts. Similarly, those who have been trained in mining have a lower probability of engaging in farming. This is an indication of hope that the government will soon lift the moratorium to return to mining. Such miners are usually members of ASM who have had many engagements with the government during the ban. According to them, the government officials have in several engagements assured them that since they have a license and have been trained, they will be given priority when the ban is lifted.

Those who were engaged in mining by supplying their labour services were more likely to engage in farming than those who owned the concession. As labourers, they do not have enough money to engage in capital-intensive business other than farming. Also, those who supply labour to miners do not have much formal education and hence have no

Table 2
Determinants of adopting farming, trading, and labour supply as coping strategies to the ban on ASM or *galamsey*.

Variables	Farming		Trading		Labour supply	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Age	-0.0065	0.0183	-0.0092	0.0170	-0.0475**	0.0241
Edu_yrs	0.0643**	0.0248	-0.0135	0.0226	-0.0858**	0.0432
Mine_yrs	0.0543**	0.0271	-0.0006	0.0242	-0.0613*	0.0359
HHS	0.0837*	0.0446	-0.0005	0.0422	0.1073*	0.0583
Indigen_settler	-0.1734	0.2838	0.0506	0.2766	-0.4625	0.5062
Opinion_leader	0.6255**	0.3155	0.7039**	0.3174	0.3204	0.4690
No_ASM_meeting	-0.0650	0.0520	-0.0433	0.0493	-0.0129	0.0785
Have_license	-0.6174*	0.3525	-1.2264***	0.3334	-0.5511	0.4422
Train_by_MIMP	-0.4900	0.3684	-0.1421	0.3244	1.3635***	0.4193
KM_Reg_Cap	0.0075	0.0094	-0.0181**	0.0088	0.0021	0.0117
Mining_training_b4	-0.6735**	0.2947	1.0513***	0.2889	-1.2254**	0.5114
Mining_labourer	0.0329**	0.0154	0.0130	0.0134	0.0185	0.0182
W_North	-0.5987	0.7179	-0.5234	0.6856	0.0765	0.9685
Leave_mine_com	-0.5619	0.2620	-0.4051	0.2568	-0.1134	0.3612
Km_Dist_Cap	0.0014**	0.0330	-0.0313	0.0320	-0.0398	0.0490
_cons	0.7292	0.8059	0.0680	0.7862	0.8586	1.0867
		Coef.		Std. Err.		
/atrho21		-0.0584		0.1485		
/atrho31		-0.3310		0.2173		
/atrho32		0.4157*		0.2319		
rho21: Farming*Trading		-0.0583		0.1480		
rho31: Farming*Labour supply		-0.3194		0.1952		
rho32: Trading*Labour supply		0.3933**		0.1961		
Log likelihood = -208.08***						
Likelihood ratio test of rho21 = rho31 = rho32 = 0: chi2 (6) = 11.835*						
Wald chi2 (45) = 114.99***						
Multiivariate probit (MSL, # draws = 5)						

other entrepreneurial skills and hence have a higher probability of engaging in farming as a livelihood restoration strategy.

The factors that significantly influence the miners and their workers' decision to adopt trading as a coping strategy to lessen the effects of non-involvement in mining during the moratorium are whether or not one is an opinion leader, whether or not one has a mining license or was employed in a legal ASM, whether or not one has ever been trained in mining and distance to the regional capital. Opinion leaders are usually people who are well-endowed with resources. Some are educated and have entrepreneurial skills. As such, opinion leaders have a higher probability of entering into trading as livelihood coping strategies. For trading, miners who have a license or those who worked in mining firms with a license have a lower likelihood of engaging in trading. Also, miners or mining labour suppliers who live closer to regional capitals have a higher probability of adopting trading as a coping strategy to the ban on mining as compared to their counterparts. This is typical of Ghana as regional capitals are usually more developed and business-centred than places that are far away from the regional capitals. Miners or their labour suppliers who have been trained in mining are more likely to engage in trading. This is because some of the training in mining comes as a package which usually includes training on alternative livelihood activities such as trading.

The last two columns in Table 2 show the coefficients and standard errors of the variables that influence labour supply as a coping strategy for the ban. It is clear from these results that younger, less educated, and less experienced miners are likely to offer their labour services to other organisations or firms as a coping strategy to the moratorium on ASM or *galamsey* activities. This is obvious since lowly educated people have no technical skills to do business but rather prefer becoming labourers of others. Training on mining is 5% statistically significant. It has a negative direction of effects on labour supply, suggesting that miners or labourers who have been trained in mining have a lower probability of supplying labour. This is in line with the theory of change for the five-year Multilateral Mining Integrated Project, which was implemented just before the ban. The project expected miners to be trained in alternative livelihood activities such as tree planting activities to reclaim the degraded land.

As noted by Mandishekwa and Mutenheri (2020) and confirmed in this study, socio-economic factors are important determinants of the choice of coping strategies. Household size increases the likelihood of choosing farming and labour supply as coping strategies. This is contrary to Mulinya (2017) that large family sizes may strain family resources, reducing coping or adaptation to change. The findings of this current study confirmed the work of Adeniyi et al. (2016) that an increase in household size increases the probability of being poor, and hence the tendency to offer labour for any menial job is high. Also, larger household sizes have more labour that can be supplied for some income to support the family. Education increases diversification and hence is a significant driver of livelihood coping strategy, as Adeniyi et al. (2016) asserted. Experience, as noted by Bozzoli et al. (2011), is key to coping with a disaster and its significance on the choice of livelihood coping strategy in this study.

6. Conclusions and policy implications

This paper sought to explore the livelihood Coping Strategies adopted by Displaced Small-Scale Miners in Ghana. Over the years, the government has been trying to sanitise the small scale mining activities in Ghana. With the latest one, the media form a coalition IGF, 2017 to report the ills of small-scale mining operations, which caught the government's attention. IGF, 2017, as the government of Ghana realised the wanton degradation of land, pollution of water bodies, and the destruction of forest and farmlands by both legal and illegal small-scale miners, a moratorium was put on small-scale mining. As a result, many of them lost their livelihoods. To minimise these effects, the miners and the employees adopted farming, petty trading, and the provision of

labour services as livelihood coping strategies. Therefore, enabling environment through government policies should be created to encourage the youth to enter into farming or business. Also, tailor-made training programs on alternative livelihoods such as farming, petty trading, and labour supply should be designed and implemented for the displaced miners and their employees. The government should provide safety nets and alternatives before executing programmes. While the intention may be laudable, the unintended consequences must be well thought through, and provisions to mitigate the negative externalities be put in place.

6.1. Theoretical and practical implications

This work further buttresses the theory by Lazarus and Folkman (1984) in a developing country context. It affirms that the process of coping is critical to the management of immediate or long-term stressful environments or outcomes. The results show that the moratorium on ASM or *galamsey* operations in Ghana was stressful for those who depend on mining for livelihood. Also, the findings in the current research support the sustainable livelihood framework as it was able to establish that a moratorium on small scale mining resulted in a change in households' resource base (physical, natural, financial and human) thereby compelling them to adopt coping and risk management strategies such as petty trading, farming and labour supply. Therefore, there is the need for duty bearers to design tailor-made training programs for the displaced miners and their employees to capacitate them in coping with the ban. Alternative livelihood strategies such as farming and petty trading need to be instituted and farmers trained to help them maximise the gains from these strategies.

Meanwhile, further studies should explore if the ASM finds farming and the alternate career options equally profitable, like mining and if they will return when the ban is lifted fully or combine the two. Future studies can also explore if the coping strategies of the ASM are similar to any other occupation that has suffered similar disruptions to their activities in Ghana and the Sub-Saharan African Context.

CRedit authorship contribution statement

Franklin N. Mabe: The conceptualization, Methodology, Data curation, and formal analysis of the study were done. **Ebenezer Owusu-Sekyere:** wrote the literature review. Editing, Visualization, and supervision were done by. **Oluyemi Theophilus Adeosun:** The conceptualization, Methodology, Data curation, formal analysis of the study were done by, The authors did not receive any funding for the study.

Declaration of competing interest

No conflict of interest.

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