ASSESSING THE FACTORS INFLUENCING ILLEGAL MINING OPERATIONS; EVIDENCE FROM GHANA

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Abstract

Mining activities over the years have formed an integral part of the economic development of Ghana. Many economists believe the mining industry in many ways has greatly contributed to the socio-economic growth and development of such countries with mining activities, especially Ghana. These contributions are seen in the area of employment and social infrastructural development, nonetheless, mining activities have for a long time been considered as environmental polluters and a great cause of water pollution. In this paper, we examined some factors influencing participation in illegal mining in Ghana. We sampled 300 respondents from five areas known for illegal mining in Ghana. The data collected was analysed using regression analysis with the aid of statistical package for social science (SPSS). We found poverty, illiteracy rate, unemployment, high dependency rate, and mining mismanagement significantly and positively related to illegal mining. However,

unemployment and illiteracy have the strongest influence on illegal mining in Ghana. We concluded that, an educational system of good operating practices for gold and technical assistance should be mounted so the adverse effects of mining on the environment and on themselves will be decreased.

Keywords: Poverty, Unemployment, Illiteracy, Ineffective mining laws, Dependency

INTRODUCTION

Mining activities over the years have formed an integral part of the economic development of Ghana. The revenue generated from it has increased household's income, created employment opportunities, increased the country's revenue and income tax, increased foreign exchange reserves, significant contribution to GDP, created avenue for investment, and financial assistance to the agricultural sector and other economic sectors like trading and industrialization, the impacts are visibly clear.

The mining industry of Ghana accounts for about 5% of the country's GDP, Minerals make 37% of the total exports of which gold contributes over 90% of the total mineral exports. A report by Trading Economics shows that the GDP from mining in Ghana increased from 6357.49 GHS Million to 6829.13 GHS Million in the third quarter of the year 2018. According to their survey between 2006 and 2018, the GDP from mining increased from 3664.73 GHS Million to 6829.13 GHS Million.

Ghana, apart from the endowment in precious minerals and metals is also an agrarian economy, where agriculture is the backbone of the country's economic and social development. Ghana is the world's second largest producer of cocoa after Ivory Coast, with a record being the country with the highest quality of cocoa production (COCOBOD release, 2017). Simply put, mining activities are undermining the growth and production of goods, in that; agricultural lands and cocoa farms are being destroyed for further mining activities and exploitation.

To protect agricultural lands, manage the activities of the mining industry and secure the environment against deforestation, destruction, pollution, exploitation, contamination and scarcity of fertile lands, the government and responsible institutions have put in place regulation, Acts and Laws to govern mining activities in the country. In Ghana the mining and minerals law was enacted in 1986 under the PNDC Law 153 to register and regulate the activities of mining companies. Other Acts such as the Minerals and Mining Act, 2006 (Act 703) and the Minerals Commission Act, 1993 (Act 450) are the principal enactments setting out the framework of mining laws. These acts express the basic position of the government's oversight and ownership of the minerals in their natural state.

Mining has contributed significantly to nations' development and also serviced the fuel sector and trade sector. With the several benefits developing countries have with mining activities, mainly manifested in generating revenue and providing employment, it requires sufficient manpower, very labour intensive and seasonal (United Nations, UN, 1992). However, in spite of all these achievements, mining and mineral processing industries and activities contribute massively to environmental pollution. In general, mining has several methods of extraction depending on the mineral being mined and the geography and demography of the land. In Ghana, contaminations of surface and ground water bodies have particularly been experienced in gold mining communities (Adetunde, Sackey, & Denkey, 2014).

Ghana has several river basins and reservoirs that supply the country with water for industrial, domestic and agricultural purpose, however, the predominant and cascading operations of illegal miners is affecting these water sources that supply water for the said sectors. Thus, it is significant to fish out the motivating factors influencing this menace in the Ghanaian community.

According to Dreschler (2001), and Mutemeri & Petersen, (2002), the large scale mining industry employs about 28,000 people whilst over 1 million are directly engaged in the small scale gold mine with an estimated 4,400,000 dependents. These numbers would be increased today giving us over 4 million small scale mining operators and over 6million dependents. What is the motivation factor? What influences the majority of the Ghanaian men to engage in illegal mining activities? And do these factors have a positive correlation with the recent escalation of illegal mining operations?

Contribution of the Study

Our study contributes to the existing literature of illegal mining. To begin with, literature calls the studies of how economic factors such as unemployment influence individuals to engage in illegal mining. Illegal mining in Ghana in current years has increased drastically, which is arguably the agitation of the populace since it affects the water bodies. There are a few empirical evidences on assessing the factors influencing illegal mining in developing countries in Africa, Ghana to be precise**.** Therefore, assessing factors affecting illegal mining in Ghana would be significant, considering the bearing of illegal mining on water withdrawal, in terms of quantity and quality references. We believe the results of this study will be paramount to the Government, Ministry and all affiliates on the incidence of illegal mining.

The rest of the paper adopts the subsequent arrangements. The next section reviews the literature. Section 3 is the research methodology, section 4 addresses the findings, results, and discussions, and the last section concludes and offers several policy implications

RELATED LITERATURE REVIEW

Mining has its benefits and effects especially on the people living in communities where minerals are found. Adu et al, (2016) in their paper emphasized that illegal mining activities do not only harm the natural environment but also jeopardize human economic activities, health, and livelihoods. Undoubtedly, mining activities either illegal or legal tend to give financial support and independence to people involved in it and the communities in which mining operations occur tend to indirectly or directly have a fair share of that benefit through employment, improved sales, etc. but these benefits cannot outweigh the negative implications the mining activities have on the environment, the people and their livelihoods. In their paper they laid emphasis on some factors that influence individuals to engage in these activities and they include Poverty, Lack of education and employment skills, Lack of job opportunities, High rate of unemployment, Huge start-up capital for businesses, Poor business performance, High dependency rate in families, Loss of farm lands, Ineffective social intervention programs, Averting cost of legal processing and attached responsibility in mining, Excessive Bureaucracy in attaining requisite license.

Based on the findings of Osei A. K et al's (2016) study, household size, age, sex, educational attainment, perceived risk and peer influence were the key influencers of individual's decision to participate in illegal mining activities in the Denkyira corridor in Ghana. On this ground, they recommended an intense mass education on the negative effects of illegal mining to be rolled out for especially males, household heads, and the youth.

According to Arah I. K. (2014), there was an upsurge in informal employment in the mining sector which was twice that of the formal sector in the mining industry. These activities created employment for individuals in mining communities, and those around them.

Illegal mining activities are predominant in the western, central, and eastern parts of Ghana, and these places hold the majority of unskilled and unemployed youths (60% of Ghana's population are located in rural areas). The availability of these precious rocks and metals seems to be the only alternative lucrative enterprise to venture in. Currently, the unemployment rate in Ghana stands at 6.70% and the majority of this percentage are involved in illegal mining operations.

Conceptual Framework

We examined the factors affecting illegal mining in Ghana. Therefore, we conceptualized this research with relevant variables developed to answer the research questions. The independent variables are: Poverty, High Dependency rate, Mining Mismanagement, and Unemployment.

These influence individuals to engage in illegal mining operations which then results in changes (decrease) in the quantity of water withdrawn. This relationship is captured below.
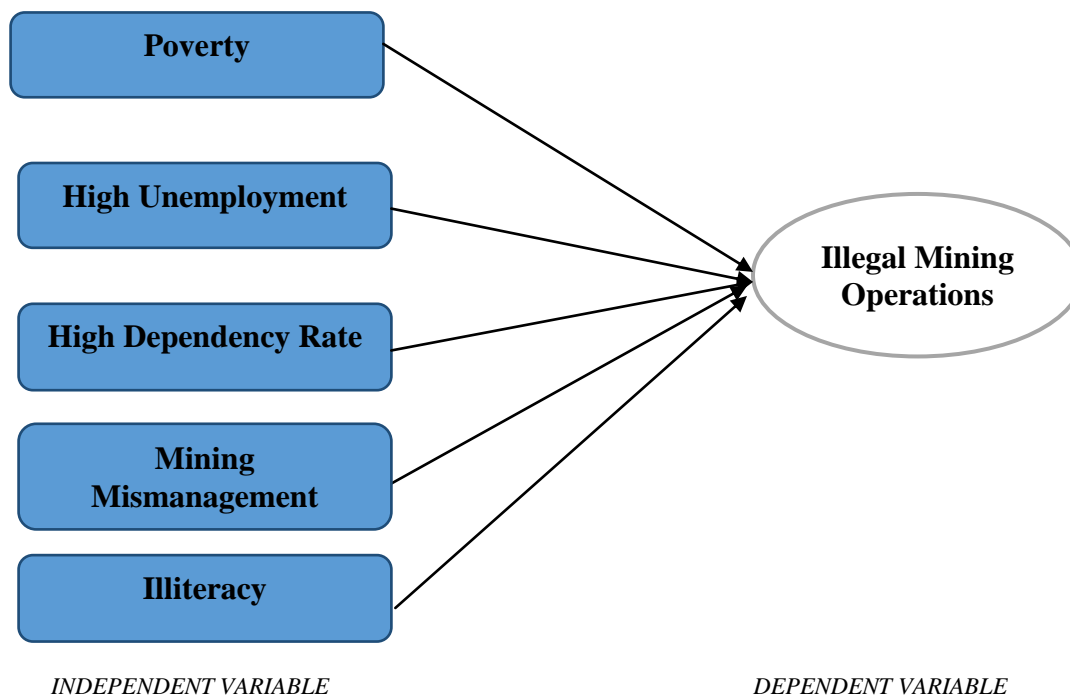

Figure 1. Research Framework

The hypothesis is developed to ascertain whether there is a positive or negative relationship between the study variables. A positive effect or impact indicates there is a relationship between the stated variables and a negative impact indicates there isn't a relationship.

We hypothesized that;

H1: **Unemployment, High Dependency, Mining Mismanagement, Illiteracy, and Poverty have statistically significant positive impact on illegal mining in Ghana.**

METHODOLOGY

The study

We employed a descriptive research to explore the factors affecting illegal mining in Ghana. We then used surveys aiding the collection of data from the targeted respondents. We used a cross sectional questionnaire prepared, pre tested and reviewed with five (5) sections. Nonetheless, we obtained data from individuals involved in illegal mining from 5 different towns, in Ghana.

Data Collection Instrument

We used questionnaires piloted and pre tested by issuing it to experts known by authors in the field of mining management and experts working in the Ministry of Energy and experts in the Minerals Commission. They were engaged to review, amend, and provide recommendation for improvements and adjustments of the original draft work of the questionnaires for its importance, contents, and the wordings as well. As a result, we have deployed a revised, modified, and pre-tested questionnaire to the targeted respondents. The first section of our questionnaire asked the profile of the respondents. The remaining part of the questionnaire asked the respondents about the factors influencing their decisions to engage in illegal mining. We included a cover letter setting out the objectives of the research, defining illegal mining, and ensuring confidentiality of the responses.

Sampling

We used a sample population of some citizens from Kyebi, Awodua, Heman, Ankobra, and Tarkwa Municipality in Ghana. We used a random sampling technique with three hundred (300) respondents considered for the study sample. These participants are Ghanaian citizens who have lived in the community for more than five years and are engaging or had engaged in illegal mining.

Equation Specifications

To examine the causes or the factors influencing the activities of illegal mining in Ghana, We estimate using multiple regressions as follows:

$$IM = \beta_0 + \beta_1 \text{UNEM}_1 + \beta_2 \text{HDPRT}_2 + \beta_3 \text{POVTY}_3 + \beta_4 \text{MLAWS}_4 + \beta_5 \text{ILLTRCY}_5 + \beta_6 \text{AGE}_6 + \varepsilon_t$$

We have IM as illegal mining, which is measured by the total sum of operation without license, use of unauthorized operation site, operation without restoration and use of obsolete machines. Absence of land rights, mining license, and mineral transportation permits, was also considered in the measurement of illegal mining. UNEM is unemployment rate in Ghana, HDPRT is the high dependency rate, POVTY is poverty in Ghana, MLAWS is mining mismanagement (Laws), ILLTRCY is the literacy level of respondents, β_0 indicates the constant parameter of the regression model. $(\alpha\beta_1 - \beta_6)$, represent the coefficients of the independent variables on the dependent variable, AGE represents the control variable for the study and ε_t is the stochastic or error term.

Dependent Variable

To test factors influencing illegal mining in Ghana, the study measured illegal mining as the sum of absence of land rights, mining license, and mineral transportation permits. Several scholars have used this method as a measure of illegal mining. (Owusu Nimo et al, 2018).

Independent Variables

To examine the causes or factors influencing the activities of illegal mining in Ghana, the research used five influential factors which are in line with literature: High Unemployment, high dependency rate, Poverty, Mining Mismanagement (Laws), and High Illiteracy. They were measured as respondent perceptions where they were asked how unemployment, high Dependence, Mining Mismanagement, and high level of Illiteracy influenced their engagement in illegal mining with the help of Likert scale ranges from strongly disagree (1) to strongly agree (5).

Control Variable

The control variable would be applied in the first analysis of the study which would be looking at factors that influence participation in illegal mining activities. The control variable that would be looked at is Age. Control variables in a study are constant and unchanged throughout the course of the investigation. These values are held constant so the researcher can fairly assess and examine the effects of an independent variable on a dependent variable.

Age, was chosen to be the control variable because it determines the maturity of an individual, according to the Mining Acts anyone involved in a licensed mining activity should have attained the age of eighteen years and above.

Table 1 Description of Study Variables

Variable	Models	Item	Measurement	References
Illegal Mining Factors	Questionnaires	Unemployment Poverty Mining Mismanagement High illiteracy Dependency rate	Index ranging from (1) to (5) that measures the effects of Unemployment, high dependence rate, Mining Mismanagement Poverty and Illiteracy rate on Illegal mining (IM). 1 means strongly disagree and 5 means strongly agree.	Xie et a, (2016)
Illegal Mining	Secondary Data	The effects posed by the social factor variables	Sum of absence of land rights, mining license, and mineral transportation permits.	Owusu Nimo et al, (2018).

Data Analysis

We processed and analyzed data obtained through statistical package for social science (SPSS). The data for the study was gathered using a survey questionnaire that was distributed to (300) respondents at Kyebi, Awodua, Heman, Ankobra, and Tarkwa Municipality, and secondary data was from the Minerals Commission of Ghana.

FINDINGS

The descriptive analysis gives and discusses the data from the structured questionnaires and secondary data. Three hundred (300) sampled respondents were involved in the survey from the selected cities in Ghana. We present the profile of respondents of our study. With the usage of (300) respondents, 72.7% were males (n=218) and 27.3% were females (n=82). On the other hand, majority of the respondents were from the ages of 18 and 30 years (n=115) (38.3%), 32% of the respondents were from the ages 31-50 (n=96), and (n=89) representing 29.7% were above the age of 51.

With regards to educational status, the results show that, 169 (56.3%), 65 (21.7%), 40 (13.3%), and 14 (4.7%) and 12 (4%) of participants had basic education (i.e. from kindergarten to Junior High School), Senior High School, Polytechnic, Training College and tertiary education respectively. Regarding the marital status of the respondents, whiles 171(57%) were married, 34 (11.3%) were divorced, and 95 (31.7%) of respondents were single.

We also looked at the dependency frequency of the respondents and we had 267 (89%) of them having family dependents of more than 1 person and 33 (11%) had no dependents, thus they catered for just themselves.

Respondents' Profile

Table 2 Gender

	Frequency	Percent
Female	82	27.3
Male	218	72.7
Total	300	100.0

Table 3 Age

	Frequency	Percent
18-30	115	38.3
31-50	96	32.0
51-above	89	29.7
Total	300	100.0

Table 4 Educational Level

	Frequency	Percentage
basic education	169	56.3
senior high school	65	21.7
polytechnic	40	13.3
training college	14	4.7
university	12	4.0
Total	300	100.0

Table 5 Marital Status

	Frequency	Percent
Married	171	57.0
Divorced	34	11.3
Single	95	31.7
Total	300	100.0

Table 6 Family Dependents

	Frequency	Percent
Yes	267	89.0
No	33	11.0
Total	300	100.0

Reliability estimation

We first evaluated the conceptual relationships of the model, an assessment of internal consistency and reliability of the measurement scales of variables. We used Cronbach Alpha to test the internal reliability of the measurement of explanatory variables. Based on the findings, we established that, all study variables were above the threshold level (0.70) which is the accepted rate for research (Nunnally, 1978). These results are perceptible in our research. The below provides the reliability test of explanatory study variables:

Table 7 Reliability Test and Variable description

Abbreviation	Variable Name	Reliability Level
UNEM	Unemployment	0.790
HDPRT	High dependency rate	0.825
POVTY	Poverty	0.712
MLAW	Mining management	0.814
ILLTRCY	Illiteracy	0.723

Descriptive Statistics

We presented the empirical results regarding the factors influencing illegal mining based on H1. We present the descriptive summary from the above. From the findings, it is evident that, illegal

mining happens in Ghana of 31% with a minimum of (2.84) and a maximum of (4.73). The positive sign of both maximum and minimum values indicate the higher influence of causative factors on illegal mining. However, unemployment influenced illegal mining happening on average of 26% with a minimum and maximum value of (1.70), and (3.97) respectively. On average, high dependency rate influenced illegal mining by 36%. The mean value of poverty effects on illegal mining was (5.1). It is worth noting that, poverty has a strong influence on people's choice of engaging in illegal mining (51%). However, the average value for the citizens engaging in illegal mining by not adhering to mining laws of Ghana is 31% having a minimum of (2.52) and a maximum of (3.69).

Table 8 Descriptive Summary

Variable	Mean	Std. Dev.	Min.	Max.
IM	3.160	0.573	2.84	4.73
UNEM	2.684	0.760	1.70	3.97
HDPRT	3.615	0.530	2.81	4.61
POVTY	5.113	0.878	3.67	6.58
MLAW	3.194	0.432	2.52	3.69
ILLRCY	2.684	0.760	1.70	3.97

Inferential Statistics

We tested the study variables using correlation matrix. The results show positive relationship between illegal mining and factor variables discussed in our study. From the correlation analysis, it depicts that, unemployment is highly, significantly and positively correlated with confirmation that, unemployment is one of the high influencing factors for which illegal mining happens. This is consistent with our study hypothesis. Empirically, the findings show that all the discussed factors affect illegal mining, implying that, they influence individuals to engage in illegal mining activities.

Table 9 Correlation Matrix

	IM	UNEM	HDPRT	POVTY	MLW	ILLRAT
IM	1	0.4507	0.0864	0.27252	0.3193	0.0605
UNEM	0.4507	1	0.4070	0.2065	0.3691	0.1553
HDPRT	0.0864	0.4070	1	0.1538	0.0894	0.1921
POVTY	0.27252	0.2065	0.1538	1	0.3048	0.2038
MLAW	0.3193	0.3691	0.0894	0.3048	1	0.2886
ILLRAT	0.0605	0.1553	0.1921	0.2038	0.2886	1

Table 10 Regression Model Testing

Influencing Factors	Coef.	Std. Err.	t Statistics	Prob. Sig
UNEM	0.2831	0.030210	8.678	0.0000***
HDPRT	0.1466	0.035251	3.863	0.0000***
POVTY	0.1717	0.057594	9.013	0.0000***
MLAW	0.1352	-0.010688	5.002	0.0000***
ILLRAT	0.2831	0.41963	6.381	0.0000***

Note: *** indicates 1% significance level

From the regression model shown in the above table, factor variables statistically and significantly influence illegal mining in Ghana. In effect, they are positively related to illegal mining. This positive relation of explanatory variables on illegal mining is consistent with literature Osei. A. K (2016). The results of the analysis show that the hypothesis is supported and there are positive relations between variables. The results in the regression show that in general, illegal mining factors positively affect illegal mining as proxy. Therefore, the explanatory variables influence illegal mining in Ghana. In this regard, the effect of unemployment, level of illiteracy, and poverty (0.283, P <0.001; 0.283; P<0.001; 0.171, P<0.001) on illegal mining was sophisticated than the remaining explanatory variables.

Table 11 Regression Coefficient Estimation

Multiple R	R Square	Adjusted R-Squared	Std. Error of Estimate	Prob > F
0.791	0.626	0.6196	0.4905	0.01

In testing the relationship between illegal mining (IM) and factor variables, statistically from the table above, the explanatory variables contribute a good fit at a significance F value (0.436), since the (F value is less than 0.5). The results further revealed that the processed data, that is the population parameters, obtained a significance level value of (0.003) since the *prob>F* is less than 0.05. This implies that the data is perfect for creating a judgment on the population parameters. Thus, the model is statistically significant. Nonetheless, the explanatory variables show 79 percent of variations in illegal mining. This further shows that illegal mining factors considered in our study positively influence illegal mining, whiles other socio economic factors that could influence illegal mining not discussed in our research contributes the remaining 21%.

DISCUSSION AND CONCLUSIONS

We examined the factors that affect illegal mining in Ghana. Our study aims to contribute to developing countries in Africa where illegal mining is escalating. Illegal mining activities have for a long time been considered as environmental polluters. Although it creates employment for the majority of unemployed populates and somehow attracts development, the negative impact on the environment is deemed greater. We established earlier that, there is an increase in illegal mining operations in Ghana, with the numerous results highlighted from the findings of the data analysis as proof. We also found that, unemployment highly affects illegal mining implying that, it's influence on individuals to engage in illegal mining activities is greater. Most of the unemployed youth in these mining areas and in other regions find mining as a lucrative and best alternative to stealing and engaging in other violent criminal activities to make money. Capital for starting a business was not considered for factors influencing illegal miming activities but most people go into these activities to make money to start their own businesses, cater for their families, and increase their social status. Some also use the excuse of not having capital to start their dream, as a basis to engage in the activity where they just work for others and make "quick" money. However these individuals do not realize the harmful effect their activities is having on the environment and on themselves, in terms of health, livelihood, and environmental sustainability.

We found other significant results supporting the factors affecting illegal mining in Ghana. The findings show that, all factor variables are positively related to illegal mining. The results are consistent with studies such as Osei. A. K (2016) who found positive effects of factors influencing individuals to engage in illegal mining in Ghana. We established that, most miners or individuals in the sampled area are predominantly illiterate and do not have knowledge about the effects of illegal mining on the land. Mining activities contributes the largest source of air, soil and water pollution, thus, the risk of drinking polluted water in Ghana is high, especially in rural areas which have rivers as their source of drinking water. Even for those who use filtered water from treatment plants, there are high concentrations of chemicals in the treated water due to the high concentration of un-dissolved metals and chemicals in the water sources as a result of mining activities. This reflects the fact that no one is spared from the canker of illegal mining impacts.

In terms of practical contribution, this research gives insight to the government, mining officials, and all stakeholders to institute good economic policies for the welfare of citizens especially the youth for better working opportunities and environments to grow and develop their own businesses.

In doing this research, we faced a few limitations which caused the research time to be extended beyond the expected time frame. We struggled with getting all the respondents at our scheduled time, this was because they run shifts, which we did not know about, so we had to extend the days to attend to our targeted respondents. This issue resulted in extra financial cost and double work. We also faced a language barrier limitation, some of the respondents where immigrants from other regions who couldn't speak the country-wide accepted local mother tongue (Twi), this was a hinderance we struggled to overcome. Further, we examined only five (5) areas in Ghana which generalizations of findings may not be applicable to the other areas and regions of Ghana. Future studies could explore same in other communities known for illegal mining in Ghana.

POLICY RECOMMENDATIONS

In order to bring down the incidence of vigorous illegal mining activities in Ghanaian communities, rigorous education programs should be mounted to the Ghanaian populace specifically the dominant areas known for illegal mining (galamsay).

Moreover, the Ministry of Energy, minerals commission, and other affiliates should institute an educational system of good operation practices for gold and the technical assistance to artisanal miners, semi mechanized miners and those of small-scale mining, so the adverse effects of mining on the environment and on themselves will be decreased; Violations of the Environment Code, Mining Code and its implementing texts committed by mining companies must be punished and full adherence to mining laws be enforced.

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