Socio-Economic and Environmental Effects of Stone Mining in Ohaukwu Local Government Area, Ebonyi State, Nigeria

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Abstract: Stone mining is one of the key economic activities in Ohaukwu L.G.A, Ebonyi State, Nigeria; playing a critical role in rural livelihood improvement? Purposive and random sampling techniques were employed in collecting primary data from 120 respondents by means of questionnaires. Both descriptive and inferential statistical tools were used in data analysis. Result showed that majority (30%) of the respondents engaged in stone mining activities as site workers. The result also showed that majority (48%) of the respondents earn between N30000- N40000 monthly from mining activities. Destruction of agricultural lands (2.88) and increased illiteracy level (2.90) were the negative environmental and socioeconomic effects respectively while provision of water source by abandoned pit and Creation of employment (2.84) were the positive environmental and socioeconomic effects respectively. The result of the multiple regression analysis showed a high value of R^2 of 79.7 (80%) which indicates that about 80% variation in the dependent variable was caused by combined effects of changes in the explanatory variables of the respondents. The null hypothesis was rejected at 5% level of probability. The paper concludes that while quarrying is a major economic activity, its effects in socio-economic and environmental terms are unsatisfactory. It is the view of this paper that effective collaboration involving all the stakeholders would make the industry socio-economically beneficial and environmentally sustainable.

Key words: Stone Mining · Sustainability · Amoffia Ngbo · Ebonyi State · Nigeria

INTRODUCTION

Civilizations have ushered modern man into exploration and exploitation of the natural environment with increasing sophistication in the tools and methods [1]. Mineral resources exploration has assumed prime importance in several developing countries like Nigeria especially Amoffia Ngbo of Ebonyi State. Mining may well have been the second of humankind's earliest endeavors granted that agriculture was the first. The two industries ranked together as the primary or basic industries of early civilization. Little has changed in the importance of these industries since the beginning of civilization. If we consider fishing and lumbering as part of agriculture and oil and gas production as part of mining, then agriculture and mining continue to supply all the basic resources used by modern civilization.

Nigeria as a country is endowed with abundant mineral resources which have contributed immensely to the national wealth with associated socio-economic benefits [2]. From prehistoric times to the present, mining has played an important part in human existence. However, without good management and appropriate mining processes, chemical substances as well as pollution generated have the potential to pose significant risks to human health and the environment, with the

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poorest members of the global community, particularly women and children most vulnerable to the negative effects [3]. Here, the term mining is used in its broadest context as encompassing the extraction of any naturally occurring mineral substances solid, liquid and gas from the earth or other heavenly bodies for utilitarian purposes.

Mineral resources are important source of wealth for a nation and play a critical role in rural livelihood improvement but before they are harnessed, they have to pass through the stages of exploration, mining and processing which affects the environment so negatively [4] as in Mallo [5]. This activity has affected the socioeconomic attributes of the rural dwellers starting from exposure associated with silicosis, lung cancer, pulmonary tuberculosis and other pulmonary and non-pulmonary diseases [6]. In Nigeria, stone quarrying represents an unorganized sector of industry. There is poor awareness of the hazards of the industry and commonly poor usage of dust mask. Factors associated with poor usage include lack of knowledge, discomfort and poor perception of its importance [7]

In Ebonyi State, Agriculture and mineral extraction are seen as playing a critical role in rural livelihood improvement thereby helping to alleviate rural poverty. Even though agriculture remains the key strategy for rural poverty reduction, access to agricultural land remains a major challenge to the majority of the rural poor and the quarry industry has become a major means of livelihood for the people and majority of the quarry workers (as in other parts of Nigeria) are poor with no social welfare. The workers have not received the necessary attention from the relevant authorities as routine inspection for enforcement of extant laws is almost nonexistent [8].

Also even though agriculture remains the key strategy for rural poverty reduction, access to agricultural land remains a major challenge to the majority of the rural poor and mining seems to be one of the cause. This has compelled over 500 million people in developing countries to engage in occupations such as small-scale surface mining and quarrying for survival and Nigeria is not in exception [9]. Mining and its related activities have always resulted in changes in the environment. These changes differ from one area to another. Quarry activities are well known to causes air pollution, loss of land, threatening of underground and surface water which directly impair environmental quality and ecosystems [10].

It is also estimated that environmental pollution emanating from quarrying, sandblasting and emission of dangerous chemicals accounts worldwide for an estimated 9% of deaths due to lung cancer, 17% due to chronic obstructive pulmonary disease, more than 30% due to ischemic heart disease and stroke and 9% due to respiratory infections (WHO, 2014). A report by the World Bank working group on environmental sustainability reveals that occupations such as lumbering, mining, quarrying and sandblasting degrade the environmental and worsen the plight of the poor [4]. In the Northern Region of Ghana and East Gonja District in particular commercial extraction of sand and Stone has led to land degradation and desertification through destruction of economically important trees mostly indigenous in nature [11]. In spite of this, quarrying continues to be a major occupation for most poor people living in rural areas across the globe and especially in some parts of Nigeria, Asia, Latin America and Africa because the immediate benefits of mining in terms of financial returns were more important to the people than the hazard caused to the physical environment. It offers the opportunity for diversification of the economies of rural and peri-urban areas. Aside employment and income that it generates, the Stone mining industry is a major source of raw materials for building and other constructional works.

In Nigeria, stone mining occurs mainly on the lands. These lands are usually either agriculturally cultivated lands or fallow lands. Mining of mineral resources results in extensive soil damage, altering microbial communities and affecting vegetation materials including trees leading to destruction of vast amounts of land [12]. According to Peter , Alozie and Azubuine [13], stone extraction can significantly alter the physical, chemical and biological characteristics of mined sources. Mining of stone and other aggregates usually on upland often result not only in generating land use conflicts in populated areas due to its negative externalities including noise, dust, truck traffic, pollution and visually unpleasant landscapes, but also represents a conflict with competing land uses such as farming, especially in areas where high-value farmland is scarce and where post-mining restoration may be infeasible [14]. Social and environmental activists pointed out that there are potential linkages between mineral resources exploitation and conflict and consequential underdevelopment [15].
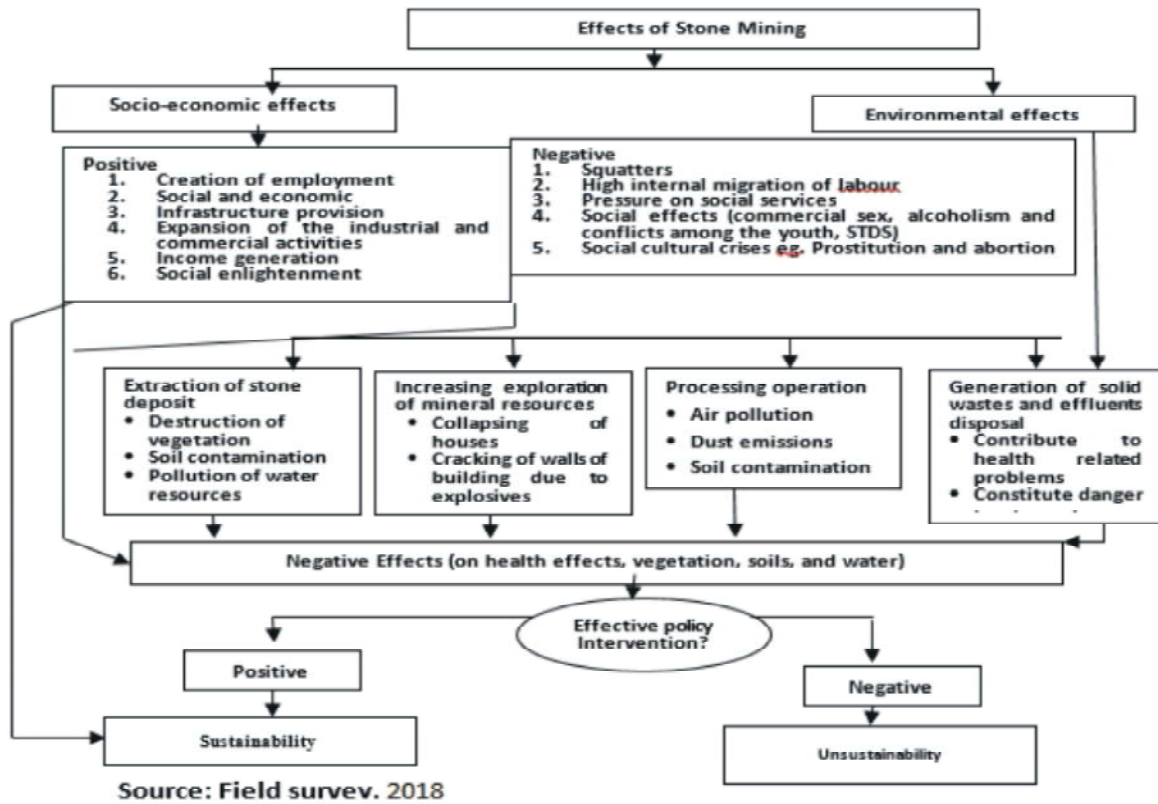
Fig. 1: Conceptual framework of socio-economic and environmental effects of stone mining in Amoffia Ngbo

Stone mining activities can be extremely environmentally destructive as top soils and important economic trees are destroyed. Over the course of many years, stone mining can cause irreversible damage to surrounding landscapes since most of the scattered stone mined sites are not closed and therefore left at the mercy of nature. For example, trees on large tracts of land are often removed to gain access to underlying stone and a vast quantity of often productive topsoil, through continuous exposure to weathering agents, erode sand collects in nearby water bodies. However, in the Amoffia Ngbo, in Ohaukwu LGA of Ebonyi State, it is usually perceived that except some few community leaders such as the chief and some of his elders, majority of other community members are usually not consulted in respect of the lands (usually farmlands) that are released for stone mining activities. Such perceptions have been lingering over decades now and there seems that little or no studies have really been conducted to confirm or disprove these assertion hence one of the need for this study.

From the foregoing therefore, there is the need to undertake an in depth study to examine changes in the environment due to mining in Amoffia, Ohaukwu Local Government Area with emphasis on the landscape. No study, to the knowledge of the researcher, has yet addressed this need. This study will therefore try to find out what the detrimental effects and environmental hazards caused by the mining are, with the view to bringing to light more findings on the above scenarios.

Objectives of the Study: The broad objective of the study is to analyze the socio-economic and environmental effects of stone mining in Amoffia Ngbo, Ohaukwu Local Government Area of Ebonyi State, Nigeria. The specific objectives include to:

- Examine the socio-economic characteristics of members of surrounding communities;
- Describe stone mining activities in the study area;
- Identify and analyze the socio-economic and environmental effects of stone mining;
- Relate socio-economic characteristics of respondents with income made from mining; and
- Make policy recommendation based on findings.

Hypothesis:

H_{o1}: There is no significant relationship between income made from mining and socio-economic characteristics of the community people.

Methodology: Ohaukwu Local Government Area was the study area. Ohaukwu L.G.A is one of the 13 LGAs in Ebonyi state and it's located at Ebonyi North agricultural zone of Ebonyi State. It has an estimated land area of 50, 689 km^2 with total population of 196, 337 comprising of 92, 848 males and 103, 489 females [9].The vegetation is evenly distributed with deep well drained sandy-loam soil type and some scattered swampy field's with gentle slope topography. The people of this area are mostly farmers. The study employed purposive and random sampling techniques in selection of 120 respondents for the study. In the first stage, 12 villages were purposively selected from the sixteen 16 sited areas. This is to ensure that only functional mining sites in terms of carrying out day-to-day activities were sampled.

In the second stage, from each of the 12 villages that were purposively selected, 10 household heads were randomly selected. Thus, giving a total of 120 respondents for the study.

Primary data were collected with the use of well-structured questionnaire. Descriptive and inferential statistics were used for data analysis. Descriptive statistics such as means, percentages and frequency tables were used to achieve objective I, ii and iii. While Objective iv was actualize using multiple regression analysis.

Model Specification: Model for multiple regression analysis is hereby specified:

The implicit form of the stochastic multiple regression models is:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7) \tag{1}$$

where,

Y = dependent variable (income of the miners (N)),

X = independent variable, in these case of the socio-economic characteristics of the respondents.

The explicit function is;

$$Y = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + a_5X_5 + \ldots a_7X_7 + et \tag{2}$$

where, Y = Income (N); X_1 = Gender (dummy: male = 1; 0 otherwise); X_2 = Age (years); X_3 = Marital status (dummy: married = 1; 0 otherwise); X_4 = level of Education (years); X_5 = household size (number); X_6 = primary occupation (mining = 1; farming = 2; civil servant =3); a_0 = constant; a_1-a_6 = parameters; et = error term.

RESULTS AND DISCUSSION

The results and discussion were based on the specific objectives of the study.

Socio-Economic Characteristics of Respondents: The result on age showed that majority (81.67%) of the farmers are within the age bracket of 25-49 years, with an average age of 43 years old. This implies that younger people are more involved in stone mining in the area.

The result on sex also show that majority (61.67%) of the respondents were male while 38.33% were females. The finding is in line with Teklewold *et al.* [16] who asserts that males(62%) constitute a greater proportion of those involved in mining activities. The implication of male's greater proportion may be that productivity is expected to be higher because males have tendency to be more labour efficient than females [17].

Result of educational level reveals that majority (65.00%) of the stone miners had primary education, 18.33% had secondary education and 10.00% had tertiary education, while 6.67% never attended formal education. This implies that approximately 93.33% of the stone miners attained formal education.

Also the result on marital status showed that majority (76.67%) of the respondents were married, while 16.67% with very few 6.67% widowed. This shows that majority of the respondents were married and are responsible according to the societal standard and therefore are likely to have some experience [18].

The result on household size shows that majority (76.67%) of the stone miners had a household size of 6-10 persons while 23.33% had a household size of 1-5 persons. The average household size was 6 persons. This implies that stone miners in the study area have a large household size. Large household size reduces the cost of hired labor, ensures availability of labor as well as expansion of mining sites. This findings support the result of Willis and Garrod and World health organization [19, 20] who reported that large household size is a proxy to labor availability, ensure ease adaptation to climate change and reduce the cost of hired labor.

Table 1: Distribution of the Respondents According to their Socio-
economic Characteristics in the study area

Variables	Frequency (N=120)	Percentage (%)	Mean score (X)
Age			
Less than 25	16	13.33	
25-49	98	81.67	
50 and above	6	5.00	43.10
Sex			
Male	74	61.67	
Female	46	38.33	
Marital status			
Single	20	16.67	
Married	92	76.67	
Widowed	8	6.67	
Educational level			
No formal education	8	6.67	
Primary education	78	65.00	
Secondary education	22	18.33	
Tertiary education	12	10.00	
Household size			
1-5	28	23.33	
6-10	72	60	6.1
Above 10	20	16.66	
Other Occupation			
Farming/mining activities	108	90	
Civil service	6	5	
Trading	4	3	
Artisan	2	2	

Source: Field Survey, 2018

Table 2: Percentage distribution of respondents according to their
involvement in stone mining activities practiced in the study area

Area of involvement	Frequency (N=120)	Percentage
Leased my land	15	6.12
Sold my land to miners	35	14.29
Own a pit	50	20.41
Site worker	75	30.61
Others	70	28.57

Source: Field survey, 2018. *Multiple Responses recorded.

Finally, the result revealed that almost all the respondent (90%) are full time farmers, who also engage in one form of mining activities or the other, but few (8%) were into trading and civil service as their main occupation and 2% are artisans.

Stone Mining Activities Practiced in the Study Area:
This section examined the stone mining activities practiced in the study area. Here the properties considered were how people engaged in stone mining activities and how much they earned.

Result of the analysis in Table 2 showed that majority(30%) of the respondents engage in stone mining activities as site workers, followed by other activities in the mining environment like provision of tippers, food vendors, petty shop keepers, security guards and transporters which account for 29% of the respondents, 20% own a pit, 14% sold their lands to miners, while only 6% leased their lands for mining activities. This implies that the miming communities of Ohaukwu L.G.A engage in mining activities in many ways.

From the research carried out in the study area, the first step taken by the stone miners during mining processes was site identification or acquisition followed by a lease from ministry of mines. This involves obtaining certificate from the state government to mine in a particular place and supervised by environmental protection agency (EPA).

The third step was having an agreement with land owners (Landlords) and the host community concerning their need in exchange of the resources in their land and the duration of mining operation. The next step was site clearing which involves removal of grasses and economic trees from the site including the top soil and unwanted materials so as to get actual deposited minerals.

The fifth step was installation of stone crushers which are strategically located within the mining sites for breaking of stones into different aggregates after crusher installation, holes are drilled using wagon driller or drilling rigs and compressor depending on the depth required by the pit engineer/pit manager.

The next step was stone blasting with the use of blasting materials or explosives (NH_4NO_3 and fuel). After stone blasting, the lumps of stone are being loaded to the crusher via tippers or dumpers using excavators for breaking down into marketable aggregates (sizes). There are three segments in crusher through which stone hauling takes place, thus: Jaw Crusher: Primary producer; Impact/cone crusher: Secondary producer; The Screen: The tertiary producer section.

The Jaw crusher breaks the rocks into sizes up to 100-150 mm using a conveying belt which carries it to the impact/cone crusher. At the impact section the crusher breaks them into different sizes (aggregates). The same conveying belt conveys them to the screen section where materials are sieved and the dust is separated from the stone aggregates. At this point, different sizes such as 3/4, 3/8, ½-inch, 1 inch, dust, etc. are obtained which are ready for marketing.

List of existing stone mining industries in the study area: RCC quarry industry; Setracco; Aerial company; Paul B Nig Ltd; Mark-Daniel Quarry; Harpal mining industry; C.C.C quarry industry; Star timber stone industry; Niger Cem.
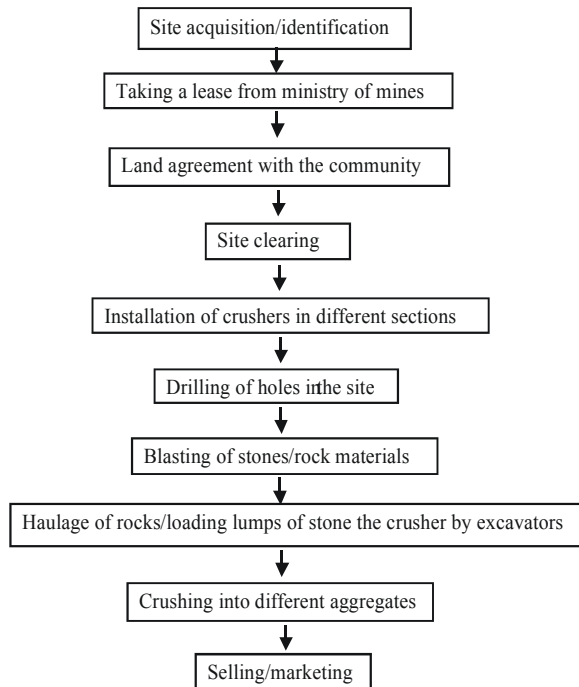
Fig. 1: Flow chart description of the steps of mining processes in the study area

Source: Field Survey, 2018.

Sections or Departments Found in Stone Mining Industry in the Study Area:

Section 1: The pit/quarry phase which is made up of mining engineer, drillers, compressors, blast man;
Section 2: The crusher engineer, operator, mechanics, attendant;
Section 3: Weigh bridge/selling section;
Section 4: The mechanic/workshop section;
Section 5: Admin. Section;
Section 6: The welder/Vulcanizers;
Section 7: Panel/control room: Control the crushers;
Section 8: Store section.

Machineries involved in the study area: Compressor/wagon drill, drilling rig, the excavator, dump trunk and tippers, pay loader/wheel loader, generator, panel room, the crusher, weigh bridge, filling stations, stores, staff bus.

Contributions of Quarry Industry to the Income of the Households:
In this section, the daily income of the respondents from quarry industry were ascertained, presented and discussed including their weekly and monthly equivalent.

Table 3: Percentage distribution of the respondents according to the contributions of quarry industry to their income

Contributions	Frequency	Percentages
Monthly		
10000-20000	25	20.83
20000-30000	32	26.67
30000-40000	57	47.50
Above 40000	6	5.00

Source: Field Survey, 2017.

The result on the contributions of quarry industry to the respondents income showed that majority (48%) of the respondents earn between N30000- N40000 monthly while few (5%) earn above N40000 from mining industry in the study area. This implies that stone mining business is lucrative business that can give employment to many unemployed individuals in the study area though unhealthy to the environment.

Socio-Economic and Environmental Effects of Stone Mining in the Study Area:
Socio-economic and environmental effects of stone mining in the study area was considered and discussed thus:

Result of the analysis onsocio-economic effects of stone mining in the area indicates that the major Positive socio-economic effects of mining were provision of employment ($\bar{x} = 2.84$), additional source of income ($\bar{x} = 2.80$), creation of other business and marketing opportunities ($\bar{x} = 2.72$), attraction of socio-economic amenities e.g. roads, electricity, pipe-borne water, markets, schools etc ($\bar{x} = 2.66$). Also, some other benefits like provision of social responsibilities for the communities by the companies ($\bar{x} = 2.58$), social enlightenment ($\bar{x} = 2.55$) and recognition to community ($\bar{x} = 2.50$) were also recorded. Negative socio-economic effect includes; increased number of illiterates as youths drop out of schools or refuse to go to school but join the mining business ($\bar{x} = 2.90$), increase in criminal activities and gangsterism ($\bar{x} = 2.86$) and Socio-cultural crises such as child labour, displacement and unemployment, accident, theft, prostitution and abortion and competition by local resident for natural resources ($\bar{x} = 2.53$). This implies that stone mining activities influenced people both positively and negatively in the study area.

On the basis of the environment, stone mining has affected the environment positively in the following areas; Abandoned pits provide all year round sources of water ($\bar{x} = 2.84$), Non-agricultural land are made useful ($\bar{x} = 2.54$), Home for fisheries and other aquatic life ($\bar{x} = 2.52$) and Cordial relationship ($\bar{x} = 2.50$). While the negative environmental effect of mining includes:

Socioeconomic Effects

- Creation of employment
- Income generation
- Infrastructure provision
- Social enlightenment
- Expansion of industrial and commercial activities

Stone mining

Site clearing

Blasting

Loud sound

Shock waves

Dust emissions

Environmental Effects

Removal of economic trees

Loss of biodiversity

Exposes top soil to erosion

Panic and Psychological problem

Accident

Hearing problem

Damage to building

Earthquake

Air Pollution

Contaminate water bodies

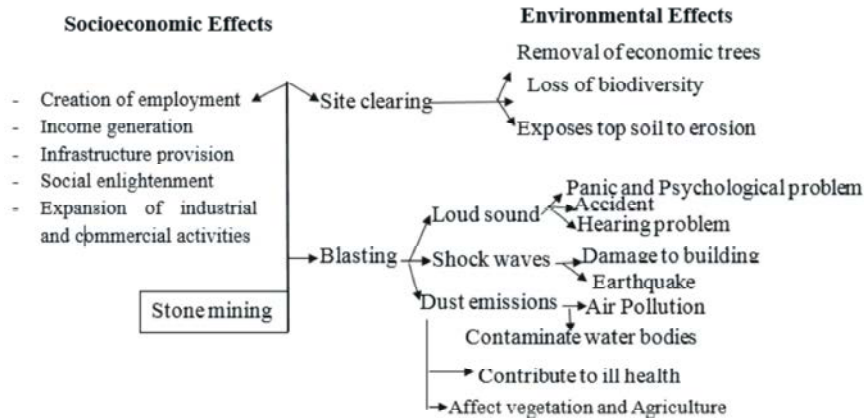Contribute to ill health

Affect vegetation and Agriculture

Fig. 2: Network diagram on socioeconomic and environmental effects of some steps involved in stone mining operations

Table 4: Mean score Distribution of Socio-economic Effects of Stone Mining in the area

Effect	Mean ($\bar{x}$)	Remark
Positive socio-economic effect		
Employment	2.84	Accepted
Income	2.80	Accepted
Attracts socio-economic amenities e.g. roads, electricity, pipe-borne water, markets, schools etc.	2.66	Accepted
Creates other business and marketing opportunities.	2.72	Accepted
Recognition to community	2.50	Accepted
Social enlightenment	2.55	Accepted
Companies carry out social responsibilities for communities	2.58	Accepted
Negative socio-economic effect		
Contributes to illiteracy as youths drop out of schools or refuse to go to school but join the mining business	2.90	Accepted
Encourage criminality and gangsterism.	2.86	Accepted
Socio-cultural crises such as child labor, displacement and unemployment, accident, theft, prostitution and abortion and competition by local resident for natural resources	2.53	Accepted

Source: Field survey, 2017.

Table 5: Mean score Distribution of Environmental Effect of Stone Mining in the area.

Effect	Mean ($\bar{x}$)	Remark
Positive environmental effect		
Abandoned pits provide all year round sources of water	2.84	Accepted
Non-agricultural land are made useful	2.54	Accepted
Cordial relationship	2.50	Accepted
Home for fisheries and other aquatic life	2.52	Accepted
Negative environmental effect		
Health related problem	2.62	Accepted
Pollution of water bodies	2.52	Accepted
Air pollution	2.50	Accepted
Cracking of walls of buildings due to explosives	2.66	Accepted
Collapsing of house	2.54	Accepted
Possible accidents due to stone blasting	2.58	Accepted
Abandoned pits constitute dangers (deaths)	2.55	Accepted
Destroy agric lands	2.88	Accepted
Scarcity of lands	2.70	Accepted

Source: Field survey, 2017.

Destruction of agricultural lands ($\bar{x} = 2.88$), increase in scarcity of lands ($\bar{x} = 2.70$), Cracking of walls of buildings due to explosion ($\bar{x} = 2.66$) and Health related problems ($\bar{x} = 2.58$). Others were possible accidents due to stone blasting ($\bar{x} = 2.54$), danger due to abandoned pits (deaths) ($\bar{x} = 2.52$), Collapsing of house ($\bar{x} = 2.54$), Pollution of water bodies ($\bar{x} = 2.52$) and Air pollution ($\bar{x} = 2.50$). This implies that stone mining also has serious negative effects on the environment and people thereof.

Table 6: Multiple Regression Analysis on the Effects of Socio-economic Characteristics of the respondents on their income

Variables	Estimated coefficients	Standard error	T-value	Level of significance
a_0 Constant	3.733	1.693	2.204	*
X_1 Gender	0.849	0.468	1.814	*
X_2 Age	0.365	0.807	0.452	***
X_3 Marital status	0.119	0.982	0.121	*
X_4 Level of education	0.117	0.308	0.380	**
X_5 Household size	0.329	0.232	1.418	**
X_6 occupation	0.487	0.262	1.859	*

Source: Field survey, 2017.

R^2 = 0.797; Adjusted R^2 = 0.776; F-ratio = 38.120; SE = 0.30592; *= Significant at 1%

= Significant at 5%;*= Significant at 10%; NS = Not significant

Effects of Socio-Economic Characteristics of the Respondents on Their Income: Ordinary Least Square Multiple Regression Analysis was carried out to determine the effects of socio-economic characteristics of the stone miners on their income in the study area.

Result of analysis on effects of socio-economic characteristics of the respondents on their income showed that the coefficient of multiple determination (R^2) of the regression was 0.797 (80%) indicating that about 80% variation in the dependent variable (income of the quarry workers) was caused by combined effects of changes in the explanatory variables (socio-economic characteristics) of the respondents. The remaining 20% of the variation in the dependent variable was caused by other relevant factors that affects the income of the miners, but were not included in the model since they are not the subject of the research study.

The high value of R^2 (80%) signifies that the socio-economic characteristics of the respondents have significantly affected the income of the stone miners in the study area.

It is believed that the explanatory power of the chosen models was not exaggerated, since the R^2 (80%) was in numerical value closely related to the adjusted R^2 (78%). This was further confirmed by the values of the overall standard error of estimated (SE = 0.30592) which constituted 10% of the total variation that was not explained.

The statistical reliability of the estimates of the regression co-efficient was established using standard errors from the estimates of X_1, X_2, X_3, X_4, X_5 and X_6 and (constant) of the miners were less than half of the estimates showing their statistical reliability. Most of the explanatory variables were significant at 1%, 5% and 10% levels of significance as shown in Table 6.

However, the overall significance of the regression was also confirmed by the f * value calculated (F-statistics = 38.120). Since F-cal is greater than F-tab at 5% level of significance, the regression is statistically reliable. Also it is statistically reliable since the value of the standard error estimated (0.330592) was low.

The co-efficient of gender (x_1) was positively signed and statistically significant at 1% level of significance, implying that there is positive relationship existing between gender of the miners and their income.

The coefficient of age (x_2) bore positive sign and statistically significant at 10% level of significance. This means that there is positive relationship between age and the income of the miners, meaning that older miners get more income than the younger once as a result of experience over a period of time. Hence, the a priori expectation was met.

The coefficient of marital status (x_3) was positively signed and statistically significant at 1% level of significance. This indicates that there is positive relationship between income of the miners and their marital status. This is because men who engage in mining activities do that alongside with their wives and possibly their children which therefore increase their income from mining industries.

The coefficient of level of education attained (x_4) had positive sign and statistically significant at 5% level of significance. This implies that educational level and income of the miners were positively related. Hence; the apriori expectation was met. This is because the higher the educational level of the miners, the greater their propensity to comprehend relevant mining information in the area and use it to increase their income.

The coefficient of the household size (x_5) was positively signed and statistically significant at 5% level of significance. This indicates that there was positive relationship between household size and income of the miners. This result agrees with the a priori expectation that the larger the household size, the higher the labor force provided to mining site in the area, the a prior expectation was also met.

Finally, the coefficient of occupation (X_6) had positive sign and statistically significant at 10% level of significance indicating that there was positive relationship between income of the miners and their occupation. Meaning that households who concentrated in mining gained more income than that with divided attention like mining and civil service.

Hypothesis Testing:

Ho_1: which states that there is no significant relationship between income made from mining activities and socio-economic characteristic of the respondents was tested using F-test at 5% level of significance and the result showed that F-cal = 38.120, F-tab = 2.02. And Since F-cal (38.120) > F-tab (2.02), the null hypothesis was rejected and the alternative accepted. This implies that the socio-economic characteristics of the quarry workers had significant influence on the income from their mining activities at the study area.

CONCLUSION

The study therefore concludes that mining activities in the study area had influences on the socio-economic and environmental well being of the community people. It also had influence on income of the people in the study area.

Recommendations: Based on the findings of this studies, the following recommendations were made: Residents of communities should be made to benefit directly from stone pits opened in their areas through participation in the mining activities and selection of sites for the mining. This could improve their economic livelihoods and also enhance their commitments towards reclamation of abandoned stone pits which can as well reduce the unhealthy relationship that exist between them and stone miners. Opening of pits should be done at distances from communities and closure ensured on timely basis as this can help reduce the prevalence rate of stone mining related diseases in the communities.

All relevant stakeholders in the stone mining sector including Environmental Protection Agency (EPA), Minerals Commission, District Assemblies, chiefs and land owners among others should strengthen collaboration among themselves for effective enforcement and compliance of the stone mining regulation. The law recommends that opening and closure of stone pits should be inspected by EPA and if the land size exceeds normal, it has to go through a minor assessment before clearance is offered and if larger than 10 hectares, a full scale EIA is required. Scale of extraction with specifications in terms of depth of mining is all included in the mining guidelines outlined in permit schedules.

EPA should be given signatory status in the award of and the disbursement of contract funds at the district levels. This will ensure that stone miners adhere to reclamation bonds and guidelines. Failure to adhere to these guidelines will therefore deny the mining contractors the rights to access the funds. It can also help EPA to regulate opening and closure of stone mines.

Agroforestry practices and tree planting in degraded stone mining sites should be encouraged as this has proven to dramatically increase the otherwise slow rate of natural forest succession by ameliorating unfavorable soil condition and providing a build-up of soil organic matter and higher above ground biomass.

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