Mining Effects on Rural Livelihoods, Adopted Strategies and the Role of Stakeholder and Regulatory Institutions in Ghana. Evidence of the Amansie West District of Ghana

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Abstract   The study determines the effects of mining on rural livelihoods, adopted strategies and the role of stakeholder and regulatory institutions. The study achieves this by investigating the status of key rural livelihood indicators, what influence the choice of livelihood strategies in mining communities and the assessment of institutional performance. The role of institutions even though a key instrument in ensuring sustainable livelihoods is mostly not considered in livelihood studies of developing countries. The study employed both quantitative and qualitative methods of data analysis. The significant difference in the means of income, yield value and labour cost between non-mining and mining communities is an evidence of the threat posed on communities in the study area by mining and its activities. The multinomial logit result showed that farmers' choice of livelihood in mining communities was influenced by gender, age, family size, leadership status of household head, labour cost, annual household income, number of years of education and extension training. Farmers diversified into non-farm and off-farm livelihood strategies in order to increase or sustain income in mining communities. The study determined the performance of stakeholder and regulatory institutions through their relations and how effective functions are performed. Four (4) institutions namely EPA, MoFA, COCOBOD and Amansie West District Assembly were found significant in their relations to other institutions whilst three (3) institutions were found significant in the performance of their functions. The study concluded that poor relations and ineffective performance of stakeholder and regulatory institutions resulted in unregulated exposure and depletion of livelihood resources such as land, forest and water bodies in mining communities. The study therefore recommended that there should be inter-institutional policy that would link stakeholder and regulatory institutions together for effective performance of functions and sustainable livelihoods.

Keywords: mining, livelihood, household, effects, rural, non-mining, farmers, regulatory institutions, strategy

1. Introduction

1.1. Background

According to [1], the Economic Recovery Programme (1983) and the Structural Adjustment Programme (1986) reforms to a greater extent laid emphasis on the export sector, particularly, cocoa and the mining sectors, which were the largest contributors of foreign exchange earnings and had the potential to develop and expand under sound policy reforms and improvements in management.

As in [2], throughout the 1980s and 1990s, the reform of regulatory and legal frameworks supporting greater harmonization and stability in the mining sector in Africa has contributed to creating a more favourable environment for foreign investment. In the process, the reform measures have entailed redefining the role of the state so profoundly that there are few historical precedents. In large part because of this, the reforms have had the effect of reducing institutional capacity, as well as driving down norms and standards in areas of critical importance for social and economic development, and the protection of the environment in many countries in Africa in which mining activities take place. Strong evidence leaves little doubt that the latter tendency continues to be the case in an increasing number of situations [3,4].

Some evidence shows that livelihood diversification is the prominent strategy for rural people to survive and improve their standard of living [5].

Mostly role of regulatory institutions are not considered in most livelihood studies and this undermines the recognition of institutional importance in ensuring that

livelihood outcomes are achieved in spite of threats caused by mining and its activities.

The role of stakeholder and regulatory institutions is important in ensuring assets are not depleted and livelihoods of farmers are sustained when shocks are imposed by mining activities in communities. Gold mining has also contributed to the economy through foreign exchange earnings and employment. However, agriculture has contributed remarkably to the economy of Ghana.

Exploratory studies indicate that farmers are being convinced by miners to give out their farms for monetary offers. This shows that lands used for farming are being used for mining now, hence the need to assess how the reduction in land for farming coupled with high cost of labour and other influential factors affect farming in the District and hence the livelihoods of farmers. The study provides information for policy recommendation and also adds to knowledge.

There are couples of studies that used descriptive statistics to compare the socio-economic characteristics of people in mining and non-mining communities without much emphasis on the outcome that would be observed without the inception of mining and the involvement of regulatory and stakeholder institutions. For instance, [6] drew on both sustainable livelihood framework and concept of land tenure to examine the impact of mining paying close attention to power and how livelihoods have altered as a result of mining activities. He considered only the mining company (Newmont) as the stakeholder in the mining sector whilst this study is not limited to mining companies alone but considers all the stakeholder and regulatory institutions in the District.

Mining operations have increased in the Amansie West District affecting farming activities in the District. Exploratory studies indicated that farms were being given out daily to miners. Rural livelihoods in the study area are almost exclusively dependent on the production of cocoa and other food crops. There is the need to investigate the impact of the mining operations in the Amansie West District with respect to farming, its effect on the livelihood of farmers and the livelihood strategies adopted by farmers.

1.2. Objectives

The major objective of this study is to assess the effect of mining operations on the livelihood of farmers and the role of stakeholder and regulatory institutions in the Amansie West District. The specific objectives are:

1. To investigate the effect of mining on rural livelihood
2. To identify the livelihood strategies adopted by rural households and what influence their choices
3. To identify the support which regulatory and stakeholder institutions provide to rural households and determine how effective the institutions perform their functions
4. To identify constraints that limit institutional performance

2. Methodology

2.1. Theoretical Framework

2.1.1. Conceptualizing Livelihood

Vulnerability context is defined as the external environment of risk in which households or individuals exists and this context includes seasonality (price, production and employment opportunity); trends (national/international, economic trend and technology trend), and shocks (natural disaster, ill health, economic shock, livestock health shock). Figure 1 depicts DFIDs livelihood framework adopted for this study. Information obtained from a pre-survey in the study area indicated that mining has influence on livelihood assets of farmers such as financial (loss income), human (high labour cost), social (cultural values), physical and natural assets (loss of land) [7]. The study would concentrate on the most affected assets of farmers to ascertain the main impact of mining on farmers. The threat and influence of mining as well as the coping strategies of farmers in the study area are analysed. The risk coping is a short-term response to adversity [8].
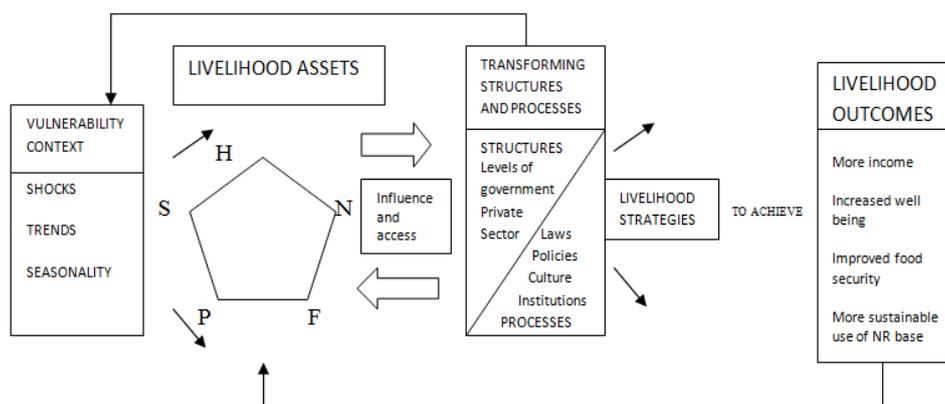
H represents **human capital**: the skills, knowledge, ability to labour and good health important to the ability to pursue different livelihood strategies; **P** represents **physical capital**: the basic infrastructure (transport, shelter, water, energy and communications) and the production equipment and means that enable people to pursue livelihoods; **S** represents **social capital**: the social resources (networks, membership of groups, relationships of trust, access to wider institutions of society) upon which people draw in pursuit of livelihoods; **F** represents **financial capital**: the financial resources which are available to people (whether savings, supplies of credit or regular remittances or pensions) and which provide them with different livelihood options; and **N** represents natural capital: the natural resource stocks from which resource flows useful for livelihoods are derived (e.g. land, water, wildlife, biodiversity, environmental resources).

Figure 1. DFID'S SUSTAINABLE LIVELIHOOD FRAMEWORK (Source: [9])

2.2. Method of Data Analysis

2.2.1. Investigating the Effect of Mining on Rural Livelihood

This study identifies and understands the effects of mining on the livelihoods of farmers. The livelihoods framework of [7] is found to be suitable for this study in order to analyse both impact on the livelihoods and responses in the institutional context. The framework is used as a guide to identify the livelihood indicators in the study area.

Cross-sectional data on farmers after the inception of mining in mining communities were obtained and perception of farmers on the influence and threat of mining was sought through questionnaires, focus group discussion and participatory rural appraisal. The data obtained was analysed using descriptive statistics where differences in livelihood indicators between farmers in mining and non-mining communities were verified.

2.2.2. Identifying Livelihood Strategies Adopted by farmers

The study identifies the existing livelihood strategies adopted by rural households in the study area through multinomial logit and assesses factors that determine households' decision to choose alternative livelihood strategies with the inception of mining.

Dependent variable: The dependent variable in this study is the selection of different livelihood strategies by farm households as a result of mining threats i.e. it was be identified by categorizing the sample households into livelihood strategy groups based on their choice. Therefore, the polychotomous dependent variable for multinomial logit was hypothesized to have the following values:

Y= 1, if the choice lies in farm alone (Agricultural markets);

Y= 2, if the choice lies in farm + non- farm (Rural non-farm economy);

Y= 3, if the choice lies in farm+ off- farm (Agricultural consumption and wage work);

Y= 4, if the choice lies in farm + nonfarm+ off-farm (Diversified household).

Household classified to belong to a particular household strategy have at least 70% of their income from that particular household as stated by [10].

However, we use the share of income from each activity because we lack other variables that help identify the intensity of engagement in livelihoods. After identifying the percentage share from agricultural production, agricultural wage work, and off farm activities, the main livelihood strategies are identified. Some households derive most of their income from actively engaging in agricultural markets. These farm-oriented households might receive more than 70% of their income from agricultural production to belong to this livelihood. Others could primarily depend on agricultural wage work and use their farming production mainly for home consumption. These households must receive more than 70% of their income from agricultural wage work and agricultural production and less than 30% from rural nonfarm activities in order to be categorized within this livelihood. Others derive the larger part of their income from rural non-farm activities such as own business, off farm wage work, and remittances from migration and government plus wage work in agriculture.

Households must receive more than 70% of their income from rural non-farm activities and agricultural wage work and less than 30% from agricultural production to belong to this livelihood. Finally diversified households combine income from farming, off-farm activities, and agricultural wage work. For these households neither farming, off-farm or agricultural wage income source contributes more than 70% of total income. These are the parameters used to classify the households into the four, mutually exclusive, livelihood strategies.

From literature, [11] defined non-farm activity as any income generating activity that is not related to agriculture whilst off-farm is any income generating agricultural activity carried out away from the family farm. Definitions and measurement of the independent variables and their working hypothesis are described in Table 1.

Table 1. Measurement of independent variables

Variables	Description and measurement	Expected Sign
SEX	is a dummy variable taking value 1 if the household head is male,0 otherwise	-
AGE	Age of household head (year)	+
EDUCTN	Formal education of household head (grades or number of years in school)	+
DEPRAT	Dependent household members measured in number	+
FARMSZ	Total farm size of household (hectare)	-
TRLU	Total livestock owned by the farm household	-
FERTLZR	It is a dummy variable that takes value 1 if a household use fertilizer and 0 otherwise	-
IMSEED	It is a dummy variable takes 1 if a household use improved seed, 0 otherwise	-
EXTCNT	Number of time extension agent visited/advised farmer (number)	-
TRAIN	Farmer attended formal agricultural training, dummy variable (= 1, if yes; =0, otherwise)	+
CREDIT	Farmers access to credit, dummy variable (=1, if yes; =0, otherwise)	+
LEADER	Households participation in local social leadership, dummy variable takes value of 1 if a household participated, 0 otherwise	+
COOP	Households membership in cooperative organization, dummy variable (=1, if yes; =0, otherwise	+
INCOM	Total annual cash income of households	+
LBRCOST	Cost Labour per ha in Ghana cedis	-

Author's computation from survey data, 2016.

2.3. To Identify the Depth and Breadth of the Support which Institutions and Stakeholders Provide to Farmers and Determine How Effective the Stakeholder Institutions Perform Their Functions

2.3.1. Assessing the Strength of the Institutional Linkage

Strength of the linkage among the institutions was determined by how respondents perceived relation and nature of relation with others on the basis of their collaboration. A strong relation is achieved when two institutions collaborate during the performance of functions. For example, when one organisation facilitates or gives credit to another it is perceived as a strong relation.

The indicators for the strength of linkage were measured as 'strongly relate', 'relate', and 'do not relate'.

The chi-square test was done. A score of '1' was allocated for 'strongly relate or relate' and '0' for 'do not relate'.

Statement of Hypothesis:

Null hypothesis:

Ho: x=0 /Local Institutions are not strongly related with each other

Alternate hypothesis:

H_A: x=1 /Local Institutions are strongly related with each other

The decision rule is that: If the computed value of the chi-square is greater than the value observed from the chi-square table then the null hypothesis will be rejected and vice versa.

2.3.2. Determining How Stakeholder Institutions Perform Their Functions

Information on local institutions that support farmers is sought from the farmers through interviews and focus group discussions after which those institutions are contacted to review their statutory and non-statutory functions with regard to the welfare of farmers and issues affecting their livelihoods. As stated by [12], the effectiveness of financial institutions could be judged by the performance of key functions such as channeling of loans into productive investment. This study takes effectiveness as the quality of work, consistency and responsiveness as defined by [13].

1. Identification of the different categories of the institutions

2. Assessment of the effectiveness of their functions based on the relevant programs rolled out by the identified institutions

Identifying the functions of the local institutions:

The functions (statutory and non-statutory) of the identified local institutions in relation to the farming were obtained from representatives of the following institutions:

1. Local Administration
2. Membership Associations (farmers cooperatives)
3. Local Government (District Assembly)
4. Service Organizations (Agro-based NGOs)
5. Private Businesses (Input dealers, Financial institutions)

Assessing the degree of effectiveness of the identified functions of the local institutions:

Identification of the different categories of the institutions was done and the assessment of the effectiveness of their functions based on the relevant programs rolled out by the identified institutions was analyzed as done by [14]. The Local Institutions were identified and selected based on purposive sampling and grouped into five (5) categories as Local Administrations, Local Government, Service Organizations, Membership Organizations and Private Businesses.

There was a study of how well the Local Institutions perform their statutory and non-statutory functions based on best practice from literature (theory and empirical). As to whether the selected institutions are performing their functions well or not was determined using the chi- square goodness-of-fit test to test the performance of their functions based on the activities carried out in the past five years.

The Chi-square test was used to analyze the performance of the identified functions of the selected institutions.

The indicators used for assessing the performance are 'very well done', 'well done,' fairly well done' and 'not well done'. The expected (very well done or well done) was scored as '1' whilst the observed was scored as '1' if 'very well done or well done' and '0' if 'fairly well done or not well done'.

The expected data takes a score of '1' whilst the observed takes a score of '1' if it meets expectation and '0' otherwise.

Hypothesis:

The null hypothesis

Ho: local institutions are not effective in the performance of their functions.

The alternate hypothesis,

H_A: local institutions are effective in the performance of their functions

The chi – square was computed as:

$$X^2 = \frac{\sum(\text{Observed} - \text{Expected})^2}{\text{Expected}}. \qquad (1)$$

The decision rule;

If the computed value of the chi-square is greater than the value observed from the chi-square table then the null hypothesis will be rejected and vice versa.

Table 2. Types of institutions in the study area

	Type of Institution	Institution identified in the study area
1	Local Administration	Environmental Protection Agency, Minerals Commission, Ghana Cocoa Board, Ministry of Food and Agriculture, Forestry Commission
2	Local Government	Amansie West District Assembly
3	Service Organisations	Millenium Development Authority, CARE international
4	Membership Organisation	Farmers cooperatives, Atobrakrom Cadbury Cocoa Partnership cooperative cocoa farmers and marketing society, Takorase Cadbury cocoa partnership cooperative cocoa farmers and marketing society
5	Private Businesses	Farmers, Adansi Mines Ltd.,Amansie Resolute, Keagan Mines.

Table 3. The Identified Constraints

1. Inadequate funding	6. Poor governmental support
2. Competition with other institutions	7. Inadequate research information
3. Unable to relate to other institutions	8. Poor marketing facilities
4. Inability to disseminate information to target groups	9. Transportation problem
5. Poor logistics	10. Lack of technical information and support

Source: survey data, 2016.

2.3.3. Identifying the Constraints that Limit Institutions

Constraints may be internal (that is related to institutions themselves) or external (that is related to factors outside the control of the Local Institutions). They are the human and non-human factors that hinder the performance of institutions. Hence the perception of selected institutions were sought with respect to internal problems such as low knowledge and funds capacity, poor logistics and external problems such as unfavorable government policies, social and economic problems.

Ten identified constraints (Table 3) were provided for the Local Institutions to rank from one (1) being the highest to the lowest.

2.4. Method of Data Collection

Simple random sampling was employed to obtain data from household heads in selected mining and non-mining communities. Cross sectional data of farmers in mining and non-mining communities as well as other socio-economic characteristics were collected using semi-structured questionnaire. The sample size was two hundred household selected from ten mining communities and ten non-mining communities. Firstly cluster sampling was used to select mining and non-mining communities after which simple random sampling was used to select households from the farmers data obtained from COCOBOD and MoFA in the study area.

3. Results and Discussion

3.1. Results and Discussion

3.1.1. Investigating the Effect of Mining on Rural Livelihood

Comparing means of livelihood indicators such as income, farm size, yield value, labour cost of mining and non-mining communities brings to light a thorough understanding of the threat posed by mining and its effects in the study area. There was a significant difference between the means of income in mining and non-mining communities as shown in Table 4 below. This is a clear indication that the livelihood of farmers in mining communities is threatened by the activities of mining. Even though there was no significant difference between the means of the farm size of farmers in mining and non-mining communities there was a significant difference in that of the income, yield value and labour cost. The average farm size of farms sampled in non-mining communities was a little higher than that of

mining communities even though their difference was not found to be significant. There was a significant difference between the mean yield value of mining and that of non-mining communities. This can be better explained by the fact that 22% of farmers in mining areas complained of a decline in yield due to the closeness of their farms to mining concessions (less than 100 meters) as shown in Table 5. This can be attributed to the pollution of water bodies and soil as well as flooding of polluted water in cocoa farms and food farms as a result of mining activities. Footpaths leading to farms were mostly inaccessible due to the excavating activities of miners and this prohibits many farmers from easily accessing their farms leading to a decline in yield due to irregular farm visits.

The cost of hiring labour was seen as a setback in mining communities since farm labour was scarce. The higher cost of labour as a result of scarce labour in the mining communities resulted in farmers not able to hire the required labourers to effectively work on their farms therefore leading to lower yield as shown in Table 4. The inability of farmers to hire enough labourers for certain number of times for instance at least twice a year for clearing weeds and application of insecticides and thrice for application of fungicides as recommended from CRIG in cocoa farms is a key reason for the decline in yield value and income. Farmers interviewed in mining communities spelt out the effects of mining influx in their communities with 22% of them having lost their land to miners. Even though 22% of farmers interviewed in mining communities claimed they lost their properties including farms and farm lands to mining there wasn't any significant difference between the means of farm size in mining and non-mining communities. This result agrees with that of [15] who pointed out that where mining is practiced, there is the effect of reduction in food production in general that leads to increases in prices of all kinds of foodstuffs, hence the rising cost of living in general.

The reason for lower yield value in mining communities although there wasn't any significant difference in the average farm size between farms in mining and that of non-mining communities was partly due to the lost of farms sizes and also higher labour cost associated with cocoa farming in mining communities. The farmers stressed on the increased cost of living in their communities and how their livelihoods are threatened not withstanding a change in the microclimate which has affected their farm activities due to the destruction of vegetation and deforestation by miners. This buttresses the study by [16,17] which states that economic shocks can have significant negative consequences for households. Also according to [18] when the resulting destruction of assets and changes in economic activity are sufficient to prevent recovery, these shocks lead to poverty traps with lasting effects on household welfare.

Table 4. Significance level of means

Variables	N	Means		Mean difference	t	Sig.(2-table)
		Mining	Non-mining			
Income	100	9084.270	7451.72	1632.550	4.803*	0.000
Farm size	100	5.09	5.36	0.271	0.999	0.320
Yield value	100	4116.26	6134.01	2017.75	6.683*	0.000
Labour cost	100	1284.85	993.97	290.880	2.735*	0.007

Source: Author's computation from survey data 2016.

Table 5. Farm distance to mining site

		Frequency	Percent	Valid Percent	Cumulative Percent
	closer to a mining site	22	22.0	22.0	22.0
Valid	far from mining site	78	78.0	78.0	100.0
	Total	100	100.0	100.0	

Source: Author's computation from survey data 2016.

Focus group discussions proved that there was a remarkable threat and effect of mining in their living conditions and the destruction of their natural assets such as water bodies. They also registered their displeasure on the minimal interference of stakeholder institutions like Minerals Commission, Lands Commission and Forestry Commission.

3.1.2. Factors Influencing the Choice of Livelihood Strategy Adopted by Farmers

.mlogit livstrategy gender age fmlysz eductn fmsz fertlzr imseed extcnt train credit leader coop Lbrcost

hhincome, baseoutcome (1)

Iteration 0: log likelihood = -85.994749
Iteration 1: log likelihood = -61.336932
Iteration 2: log likelihood = -51.748372
Iteration 3: log likelihood = -50.031617
Iteration 4: log likelihood = -49.829033
Iteration 5: log likelihood = -49.807424
Iteration 6: log likelihood = -49.80457
Iteration 7: log likelihood = -49.804196
Iteration 8: log likelihood = -49.804124
Iteration 9: log likelihood = -49.804108
Iteration 10: log likelihood = -49.804104

Table 6. Results of multinomial logit

Multinomial logistic regression		Number of obs = 100						
		LR chi2(42) = 72.38						
		Prob > chi2 = 0.0025						
Log likelihood = -49.804104		Pseudo R2 = 0.4208						
livstrategy	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]		RRR	Marg. effect
1 Farm alone				(base outcome)				
2Farm+Non-farm								
Gender	2.886685	1.653701	1.75	0.081*	-.3545086	6.127878	17.933	.19618
Age	-.2075053	.0709325	-2.93	0.003***	-.3465305	-.0684801	0.8126	-.0135
Fmlysz	.4581353	.1475954	3.10	0.002***	.1688536	.7474169	1.5811	.02307
Eductn	0411884	.1317306	0.31	0.755	-.2169988	.2993755	1.0420	.00310
Fmsz	85785	.28103	3.05	0.002***	.3070413	1.408659	2.3580	.04645
Fertlzr	037186	1.479644	0.03	0.980	-2.862863	2.937235	1.0378	.01327
imseed	-.6392894	.9799083	-0.65	0.514	-2.559874	1.281295	0.5276	-.02554
extcnt	-.6757488	.7495318	-0.90	0.367	-2.144804	.7933066	0.5087	-.03537
train	1.677798	1.94636	0.86	0.389	-2.136997	5.492592	5.3537	-.19114
credit	-1.036642	1.166165	-0.89	0.374	-3.322284	1.249	0.3546	-.01571
leader	1.681572	.9278773	1.81	0.070*	-.1370338	3.500178	5.3739	.12985
coop	.6005833	.9616789	0.62	0.532	-1.284273	2.485439	1.8231	.04797
Lbrcost	.0012017	.000529	2.27	0.023**	.000165	.0022385	1.0012	.00008
hhincome	-.0003221	.0001544	-2.09	0.037**	-.0006247	-.0000195	0.9996	-.00001
_cons	-2.345994	3.791346	-0.62	0.536	-9.776896	5.084908		
3Farm+Off-farm								
Gender	-1.513982	1.720734	-0.88	0.379	-4.886558	1.858595	0.2200	-.09665
Age	.0144787	.054589	0.27	0.791	-.0925138	.1214713	1.0145	.0022801
Fmlysz	.2595578	.1574532	1.65	0.099*	-.0490448	.5681603	1.2963	.007885
Eductn	.2753666	.152162	1.81	0.070*	-.0228654	.5735987	1.3170	.0139063
Fmsz	.3092037	.3228372	0.96	0.338	-.3235455	.9419529	1.3632	.0066653
Fertlzr	-1.844909	1.616087	-1.14	0.254	-5.01238	1.322563	0.1580	-.091519
imseed	.4492349	1.372635	0.33	0.743	-2.241081	3.13955	1.5671	.0324609
extcnt	-2.162988	1.298287	-1.67	0.096*	-4.707584	.381608	0.1149	-.103116
train	17.30936	1735.657	0.01	0.992	-3384.516	3419.135	3.29	.7855513
credit	-1.755771	1.692293	-1.04	0.299	-5.072604	1.561061	0.1727	-.066986
leader	.597312	1.316982	0.45	0.650	-1.983926	3.17855	1.8172	.0239387
coop	-1.185102	1.345562	-0.88	0.378	-3.822355	1.452152	0.3057	-.06254
Lbrcost	-.0011197	.0012752	-0.88	0.380	-.003619	.0013796	0.9988	-.00006
hhincome	-.000383	.0002768	-1.38	0.166	-.0009255	.0001594	0.9996	-.000016
_cons	-15.84192	1735.661	-0.01	0.993	-3417.675	3385.991		

4Farm+Non-farm+Off-farm							
Gender	1.181838	1.732731	0.68	0.495	-2.214253	4.577929	3.2603	.0186053
Age	-.0825477	.0751479	-1.10	0.272	-.2298348	.0647394	0.9207	-.000908
Fmlysz	.602546	.2094878	2.88	0.004***	.1919574	1.013135	1.8267	.0180592
Eductn	-.1600964	.1756151	-0.91	0.362	-.5042957	.1841029	0.8520	-.00796
Fmsz	.9484579	.3721678	2.55	0.011***	.2190223	1.677893	2.5817	.0271309
Fertlzr	.0544393	2.210683	0.02	0.980	-4.27842	4.387299	1.0559	.0082429
imseed	-1.80813	1.515598	-1.19	0.233	-4.778649	1.162388	0.1639	-.067354
extcnt	.1321493	1.091603	0.12	0.904	-2.007353	2.271652	1.1412	.0210952
train	16.75981	1772.796	0.01	0.992	-3457.856	3491.375	1.9	.6000218
credit	-3.798993	2.620845	-1.45	0.147	-8.935754	1.337767	0.2239	-.135724
leader	-1.361001	1.915636	-0.71	0.477	-5.11558	2.393577	0.2564	-.07763
coop	.0954951	1.393267	0.07	0.945	-2.635258	2.826248	1.1002	.0008156
Lbrcost	.0008195	.000596	1.38	0.169	-.0003486	.0019876	1.0008	.0000228
hhincome	-.00003	.0002069	-0.14	0.885	-.0004355	.0003756	0.9999	4.00e-06
_cons	-24.73551	1772.801	-0.01	0.989	-3499.362	3449.891		

Author's computation from data ***, **, and * stand for significant at 1%, 5% and 10% respectively. 2016.

Livelihood strategy 1 represents farm alone, strategy 2 represents farm+non-farm, strategy 3 represents farm+off-farm, strategy 4 represents farm+non-farm+off-farm.

The multinomial logit result indicates that among the 14 explanatory variables 7, 3 and 2 variables were found to significantly influence choice of farm + non-farm, farm + off-farm, and farm + non-farm + off-farm respectively. From the result family size, education, gender, age, farm size, leadership status, labour cost, household income, extension education, were determining farmers' choice of livelihood strategies. Gender had positively and significantly affected the probability of diversifying livelihood into farm+non-farm activities at less than 10% probability level. The relative probability of an individual belonging to farm+non-farm instead of farm alone for males is 17 times higher than that of females. The marginal effect indicates that being male increases the average probability of engaging in farm+non-farm strategy by 0.19. This does not conform to the a priori expectation which states that males are less likely to diversify into farm+nonfarm activities. On the contrary females are more likely to diversify into farm+non-farm activities or livelihoods. This is due to the fact that in the study area females were found to support their families by adding to the income of their families by engaging in non-farm activities especially if they are family heads. Most female household heads engage in other non-agricultural activities such as petty trading in order to take advantage of the business atmosphere created by the influx of miners in the community.

Age had negatively and significantly influenced the choice of farm and non-farm activities at less than 1% probability level. Results of the marginal effect indicate that an increase in age by 1 decreases the average probability of engaging in farm+non-farm by 0.0135. As age increases there is a low tendency that household heads will diversify into farm+non-farm livelihoods as against the a prior expectation since household heads are likely to have more children to assist in farming as their age increases and also continue to engage in farm alone due to experience.

From Table 6 above, a unit increase in the family size is associated with an increase in the relative log odds of being in strategy 2(farm+non-farm) vrs strategy 1(farm alone) by 1.58 or 58%. Results of the marginal effect show that a unit increase in family size increases the average probability of engaging in strategy 2 (farm+non-farm) by 0.023. Family size was found to positively and significantly influence the choice of livelihood into farm+non-farm, farm+off-farm, farm+non-farm+off-farm at 1%, 10% and 1% respectively. This conforms to the a priori expectation.

Farm size also positively and significantly influenced household heads to diversify into farm+non-farm livelihood strategy and farm+non-farm+off-farm at 1% significant level. From the computation of the marginal effect, increase in farm size by 1increases the average probability of engaging in strategy 2 (farm+non-farm) by 0.027. This does not conform to the a priori expectation that the smaller the farm size the more likely household heads are willing to diversify. Larger farms were able to provide enough capital for investment unlike smaller farms where the proceeds are small and only sustain the family.

Household heads participation in local social leadership encourages them and spur them on to explore by diversifying into farm+non-farm but not off-farm since such household heads are not ready to work in other farmer's farms for extra income due to their leadership role. The computed marginal effect indicates that an increase in leadership will increase the average probability of household heads in farm+non-farm strategy by 0.129.

The computed marginal effect indicates that an increase in labour cost by one increases the average probability of engaging in farm+non-farm strategy by 0.0008. As the cost of labour increases household heads are forced to diversify in order to sustain their daily needs. Household income was found to negatively and significantly influence diversification of livelihood into farm+non-farm. The computed marginal effect shows that an increase in the annual household income of households by one decreases the average probability of engaging in farm+non-farm strategy by 0.00001, thus a slight change.

The computed marginal effect is explained as a unit increase in family size by one increases the average probability of engaging in strategy 3(farm+off-farm) by 0.007.

The marginal effect is interpreted as a unit increase in education increases the relative probability of engaging in farm+off-farm strategy by 0.0139.

Number of years of education was also found to positively and significantly influence choice of livelihood into farm+off-farm activities. As the years of education increases farmers are more likely to invest in other sectors apart from farming. This result agrees with that of [19] as well as [20]. This is explained by the fact that educated people have more skills and knowledge and are more likely to diversify into other livelihoods aside farming. In

the study area educated people are known to engage in non-agricultural activities and most of them take farming serious only after they have retired from their jobs.

From the results an increase in extension visits will decrease the average probability of engaging in farm+off-farm strategy by 0.103. This indicates that when farmers are educated on farming activities they show more interest in farming and are discouraged from investing in other off-farm activities.

Results of the marginal effect show that a unit increase in the family size increases the average probability of engaging in strategy 4 by 0.018. Thus the higher the family size the more households engage in diversification. The computed marginal effect shows that a unit increase in farm size increases the average probability of engaging

in strategy 4(farm+non-farm+off-farm) by 0.027.

3.1.3. Extent of Adopted Strategies by Respondents

Respondents interviewed showed their ability to maintain their livelihood status by adopting a particular strategy. In Table 7 below 77% of respondents showed they were well off by adopting other livelihood strategies that combine non-farming and off-farming to farming. They showed that by engaging in other livelihoods such as non-farming and off-farming they are able to mitigate the effect of the shock posed by mining in their lives. When interviewed the 77% of respondents spelt out clearly that they moved into other livelihoods after they realized the cost of living in their communities increased as a result of the inception of mining and its activities in the communities.

Table 7. Selected strategies by respondents in mining communities

Livelihood strategy	Freq.	Percent	Cum.
Farm alone	23	23	23
Farm+Non-farm	24	24	47
Farm+Off-farm	27	27	74
Farm+Non-farm+Off-farm	26	26	100
Total	100	100	

Source: Author's computation from survey data 2016.

Table 8. Results of chi-square test on how the institutions relate

Local institutions	Relate	Do not relate	Chi-square value	Asymp. Sig.	Score	%age relation
1.MINERALS COMMISSION	4	8	4.667	0.031	0	33.33
2.EPA	7	5	8.167***	0.004	1	58.33
3.LANDS COMMISSION	5	7	5.833	0.016	0	41.66
4.MOFA	6	6	7.000***	0.008	1	50.00
5.COCOBOD	7	5	8.167***	0.004	1	58.33
6.AMANSIE WEST DISTRICT	8	4	9.333***	0.002	1	66.66
7.CARE INT.	5	7	5.833	0.016	0	41.66
8.MILLENIUM DEV. AUTHORITY	4	8	4.667	0.031	0	33.33
9.CADBURY COOPERATIVE	4	8	4.667	0.031	0	33.33
10.ADANSI GOLD	3	9	3.500	0.061	0	25.00
11.KEAGAN	3	9	3.500	0.061	0	25.00
12.AMANSIE RESOLUTE	3	9	3.500	0.061	0	25.00
13.FORESTRY COMMISSION	4	8	4.667	0.031	0	33.33

*=sig. at10%,**=sig.at 5%,***=sig. at1%

Test statistics
Chi-square (a) 4.667
df   1
Asymp. Sig.   0.031

Source: Author's computation from survey data 2016.

3.1.4. Identifying the Depth and Breadth of the Support which Institutions and Stakeholders Provide to Farmers and Determine How Effective the Stakeholder Institutions Perform Their Functions

Four institutions were found to be significant in terms of relations to other institutions. They were found to relate to more than 50% of the stakeholder institutions (Table 8). The institutions found to be significant were EPA, MoFA, COCOBOD and Amansie West District Assembly with 58.33%, 50%,58.33% and 66.66% respectively. Amansie West District Assembly which is a Local Government institution emerged as the institution with a

strong relation with 66.66% of the other stakeholder institutions. This did not come as a surprise since the Assembly coordinate and also facilitates most of the activities and programmes rolled out by the other stakeholder institutions in the District. For instance the Millenium Development Authority and CARE Int. have incooporated most of their programmes in to that of the District Assembly. Also the Amansie West District Assembly being a Local Government Institution serves as a link between the District and the developmental prospects associated with its settlers. Cocoa Health and Extension(CHED) of COCOBOD was also found to be significant at 1% by relating to 58.33% of the stakeholder

institutions on issues related to cocoa. They ensure to liaise with most of the stakeholder institutions especially those that are accessible.

MoFA and EPA were also found to be significant at 1% significance level. Overall results show institutions are not strongly related to each other since only 33% of the institutions were found to be related. This indicates that there is a huge vacuum to be filled with respect to institutional relations as well as performance. This stems from the fact that strong institutional linkages and relations transform in to effective performance. Institutions found significant were Local Administration and Local Government and those found to be weak in terms of relations were from the private businesses with 25% relations. This can be attributed to the inaccessibility of other stakeholder institutions by them. The weak relationship gap is also due to lack of regular stakeholder workshops in the District.

3.1.5. Institutional Performance

Out of the 13 institutions 3 institutions were found to be effective in the performance of their functions as perceived by the respondents in the mining communities (Table 9). COCOBOD was found to be significant at 1% with 71% of respondents of the view that COCOBOD performs its functions well and effectively. Some of these functions performed by COCOBOD are the provision of advice to farmers, demonstration of new technology on production to farmers and provision of planting materials and inputs to support farmers in cocoa production. Farmers acknowledged receipts of inputs from COCOBOD and also spelt out the regular visits by COCOBOD Extension Agents.

Table 9. Results of chi-square test on the performance of the institution

Local institutions	Not well done	Well done	Chi-square value	Asymp. Sig.	Score
1.Lands Commission	42	58	2.560	0.110	0
2.Minerals Commission	42	58	2.560	0.110	0
3.MoFA	46	54	0.640	0.424	0
4.COCOBOD	29	71	17.640***	0.000	1
5.EPA	44	56	1.440	0.230	0
6.AWDA	45	55	1.000	0.317	0
7.CARE INT.	40	60	17.640***	0.000	1
8.MDA	43	57	14.440***	0.000	1
9.CADBCOOP	44	56	1.440	0.230	0
10.ADANSI GOLD	42	58	2.560	0.110	0
11.KEAGAN	42	58	2.560	0.110	0
12.AMANSIE RES.	47	53	0.360	0.549	0
13.FORESTRY COM.	44	56	1.440	0.230	0

Source: Author's computation from survey data, June, 2016. *=sig. at 10%, **=sig. at 5%, ***=sig. at 1%.

CARE INTERNATIONAL a service organization was also found to be significant at 1% significance level in the performance of their functions. CARE INT. also provided support to farmers and also trains farmers in additional livelihoods amidst the provision of inputs to facilitate production and boost yield. Millenium Development Authority a Service Organisation was found to be significant at 1% significance level in the performance of their functions. The three institutions found to be significant thus COCOBOD, MDA and CARE INT. were known to sensitize farmers to refrain from giving their farms to illegal miners for lump sum and also advised farmers not to abandon their farms at the expense of mining.

Nine of the institutions were not found to be effective in the performance of their functions. Lands Commission is one of the institutions not found to perform its functions well. Out of the 22% of respondents that lost their farm lands 19% had their farm lands purchased by miners whilst 3% had their lands invaded by miners without their consent but by the will of chiefs and other community dwellers who claim to be the owner of the lands in question. Minerals Commission was not significant in the performance of its functions. The weakness in the performance of the functions of the Minerals Commission as a regulatory body affects the livelihood resources such as the physical assets, human assets, financial assets and natural assets of the indigenes hence making life difficult in their communities. Cocoa is a foreign exchange earner for the country and also a renewable natural resource and its destruction at the expense of mining could lead to a decline in the country's foreign exchange earned from exports hence the sustainability of the cocoa industry and farm families. When contacted COCOBOD could not deny the fact that cocoa farms are destroyed daily but attributed the cause to the weakness in the regulatory institutions such as Minerals Commission and Environmental Protection Agency but in their bid to mitigate the situation resorted to intensifying their sensitization on the effects of mining on cocoa in order to avoid farmers from giving their farms out to miners for lump sum. The EPA was not significant in the performance of their duties. Majority of the water bodies in the Amansie West District such as River Offin, River Oda and other important rivers are polluted and not drinkable thus access to natural assets like water is gradually declining. Access to portable water is a problem since farmers have to carry water to farms for drinking and other farming activities such as watering and spraying of insecticides and fungicides. Forest reserves have also been entered by miners and community dwellers indicated no action has been taken by EPA and Forestry Commission. Lack of relations and effective communication between institutions have also triggered and worsened the situation in the District.

The results of weak performance of institutions agree with that of [21] which states that Ghana's mining sector faces weak institutional capacity at the political and

regulatory levels and a lack of incentives to meaningfully reform the sector.

3.1.6. Constraints in Achieving High Institutional Performance

The problems that confront each of the Local Institutions during the performance of their functions were identified and ranked. The Kendall W of 0.496 suggests that there is 49.6 percent agreement among the ranking and this is significant at 1 percent. The four most important constraints in descending order are: inadequate funding, poor relation to institutions, inability to disseminate information to target groups and poor governmental support of the stakeholder and regulatory institutions (Table 10).

Table 10. Results of Kendall's test on constraints in achieving high performance

CONSTRAINTS	RANK
1. Inadequate funding	1.82
2. Unable to relate to other institutions	3.00
3. Inability to disseminate information to target groups	3.82
4. Poor logistic	5.00
5. Inadequate government support	5.27
6. Transportation problems	6.18
7. Inadequate research information	6.91
8. Poor marketing facility	7.09
9. Lack of technical information	7.27
10. Competition	8.64

Test statistics	
N	13
Kendall's W[a]	0.496
Chi-square	49.076
df	9
Asymp. Sig.	0.000

Source: Author's computation from survey data, 2016.

Inadequate funding was identified as the most pressing constraint. Most of the institutions explained this constraint as the lack of funds or capital to expand their business or to finance their initiatives. The Private Businesses such as the individual farmers explained this constraint as lack of capital to expand their businesses. Interestingly, poor relation with stakeholder institutions was the second constraint found to limit performance. This agrees with the earlier result of poor relations among the stakeholder and regulatory institutions.

4. Summary, Conclusion and Recommendation

4.1. Summary and Conclusion

The shocks or threats imposed by mining in communities are not entirely the problem but the role of regulatory institutions in managing and regulating the activities of miners such that it doesn't affect farmers' assets and livelihood is of concern. Natural assets such as farm lands and water bodies are destroyed by miners to the extent that farmers unlike previously had to carry water to their farms for drinking and other farming activities such as spraying. There is the need for the regulatory institutions like EPA, Minerals Commission, Forestry Commission and Lands Commission to prioritise

the protection of our natural assets from unregulated depletion. The regulatory institutions play important role in ensuring that mining and its activities do not become a nuisance to the society by destroying its endowed assets and making farmers' livelihood unbearable. For institutions to regulate the effect of mining in the affected communities there should first of all be a strong relationship among stakeholder or regulatory institutions. For instance, the destruction of cocoa farms as witnessed in the study area threatens the economy since cocoa is a major foreign exchange earner. This stems from the fact that COCOBOD and Minerals Commission do not relate with each other in terms of decision making hence the negative effect of the actions of Minerals Commission on COCOBOD continues to deteriorate. Also the poor relation between Minerals Commission, EPA and MoFA leads to the destruction of food farms and this threatens the food security in the study area. Only four institutions out of twelve institutions interviewed were found to be significant in terms of relations to other institutions. Thus there was a poor institutional relations and this does not augur well for proper regulation of mining activities in mining communities leading to the destruction of farm lands, forest reserves, water bodies, infrastructure and social conflicts. The poor performance of institutions in general is attributed to the ineffective communication among regulatory institutions due to poor relations.

4.2. Policy Recommendations

The study found that assets and livelihood of farmers were affected negatively by mining and its activities. This happened as a result of the inability of stakeholder institutions to relate leading to ineffective performance of their duties.

The study recommends that in order to achieve a common goal of sustainable livelihoods and environment in mining communities there should be inter-institutional policy that would enable stakeholder institutions take collective decision. Also for effective protection of endowed resources from massive depletion, governments in developing countries should ensure adequate funding to strengthen regulatory institutions in mining communities.

List of Abbreviations

AER	Annual Environmental Report
ASM	Artisanal Small Scale Mining
CHRAJ	Commission on Human Rights and Administrative Justice
COCOBOD	Ghana Cocoa Board
CSOs	Civil Society Organisations
CRIG	Cocoa Research Institute, Ghana
DAs	District Assemblies
DFID	Department for International Development
EAR	Environmental Audit Report
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
ERP	Economic Recovery Programme
FAO	Food and Agricultural Organisation
GDP	Gross Domestic Product
GNA	Ghana News Agency

GOG	Government of Ghana
GSD	Geological Survey Department
GSS	Ghana Statistical Services
GTZ	Gesellschaft Technische Zusannebarbeit
IDMC	Inspectorate Division of Minerals Commssion
IMF	International Monetary Fund
IRS	Internal Revenue Service
LSM	Large Scale Mining
MC	Minerals Commission
MDAs	Ministries, Department and Assemblies
MIDA	Millenium Development Authority
MoFA	Ministry Of Food and Agriculture
MoTI	Ministry of Trade and Industry
MPs	Member of Parliaments
NCOM	National Commerce Corporation
NGO's	Non-governmental Organisations
PMMC	Precious Mineral Marketing Company
PNDC	Provisional National Defense Council
SAP	Structural Adjustment Programme
SHD	Sustainable Human Development
SL	Sustainable Livelihood
UNDP	United Nations Development Programme
WB	World Bank
EPA	Environmental Protection Agency

References

[1] Twerefou K. Daniel, Ernest Aryeetey, Osei Baffour, (2007), "Impact of Mining Sector Reforms on Output, Employment and Incomes in Ghana 1980-2002", Technical Publication No. 75 ISSER 2007.

[2] Campbell B. (2004). Regulating mining in Africa: For whose benefit? Discussion paper 26. Nordic Africa Institute. ISSN 1104-8417.

[3] Campbell B. (2006). Good Governance, Security and Mining in Africa. Minerals and Raw Materials Report, 2006. Taylor and Francis.

[4] UNCTAD (United Nations Conference on Trade and Development). 2007. *World Investment Report 2007*. Geneva: UNCTAD.

[5] Ellis, F., (1998). Household strategies and rural livelihood diversification. *The Journal of Development Studies*. 35 (1), pp.1-38.

[6] Yaro I.J .2010. "The Impact of Mining on Livelihoods of Local Communities:A Case Study of Newmont Ahafo South Mining Project of Brong Ahafo Region of Ghana. International Institute of Social Studies.The Hague, The Netherlands December, 2010.

[7] DFID (1999). Sustainable livelihoods guidance sheets. *training.itcilo.it/.../SLA%20Guidance%20notes%20Section%202. pdf accessed 23/9/2009*

[8] Roland-Holst, D., Epprecht, M. & Otte, J. (2007a). External Shocks, Producer Risk, and Adjustment in Smallholder Livestock Production: The Case of HPAI in Viet Nam. *FAO–PPLPI Research Report*

[9] Carney Diana, Michael Drinkwater, Tamara Rusinow, Koos Neefjes, Samir Wanmali, Naresh Singh (1999). "Livelihoods Approaches Compared. A brief comparison of the livelihoods approaches of the UK Department for International Development (DFID), CARE, Oxfam and the United Nations Development Programme (UNDP)". DFID, November 1999.

[10] Lopez R. S. Andrade (2008). "Livelihood strategies of farmers in Bolivar, Ecuador: asset distribution, activity selection and income generation decisions in rural households" Virginia Polytechnic Institute and State University.

[11] J.P. Leones and S. Feldman. 1998. Nonfarm Activity and Rural Household Income: Evidence from Phillipine Microdata. *Economic Development and Cultural Change*. Vol. 46, No.4 (July 1998), pp789-806, The University of Chicago press.

[12] Adelman I, and Morris, C.T. (1972), "The measurement of institutional characteristics of nation: methodological considerations in measuring". Ed. Nancy Baster. Frank Cass and Co. Ltd, London.

[13] FAO, 2006, "FAO Briefs On Import Surges" No. 5 Ghana: rice, poultry and tomato paste. November, 2006.

[14] Danquah I.B, Egyir I.S (2014). "Factors that Influence Household Demand for Locally Produced Brown Rice in Ghana". Journal of Economic and Sustainable Development. IISTE. ISSN 2222-1700(paper), Vol.5, No.7, 2014.

[15] Nyamekye, E. (1996). Socio-Economic Impact of MineClosures, Accra: Green Earth.

[16] Skoufias, E. 2003. "Economic Crises and Natural Disasters: Coping Strategies and Policy Impli- cations." World Development 31: 1087-102.

[17] Block, S.A., L. Keiss, P. Webb, S. Kosen, R. Moench-Pfanner, M.W. Bloem, and C.P. Timmer. 2004. "Macro Shocks and Micro Outcomes: Child Nutrition during Indonesia's Crisis." Economics and Human Biology 2:21-44.

[18] Barrett, C.B., and D.G. Maxwell. 2005. Food aid after Fifty Years: Recasting Its Role. London: Routledge.

[19] Dilruba Khatun and B.C. Roy, 2012. Rural livelihood diversification in West Bengal: Determinants and Constraints. Agricultural Economics Research Review Vol. 25(No.1) January-June 2012 pp 115-124.

[20] Babatunde, R.O.; Olagunju, F.I.; Fakayode, S.B. and Adejobi, A.O. 2010. Determinants of participation in off- farm employment among small-holder farming households in Kwara State, Nigeria.

[21] Ayee Joseph, Tina Søreide, G. P. Shukla, and Tuan Minh Le (2011). Political Economy of the Mining Sector in Ghana. Policy Research Paper 5730. The World Bank. African Region. July 2011.