

Factors Affecting Farmers' Awareness of the Consequences of Solid Mineral Extraction on Yam and Cassava Production in Southeast Nigeria

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Abstract

This study was carried out in Southeast states of Nigeria to examine the factors affecting farmers' awareness of the consequences of solid mineral extraction on yam and cassava production in Southeast Nigeria. Two specific objectives were set for the study involving four hundred and fifty (450) respondents obtained through a multi-stage sampling technique. Structured question was used for data collection, while frequency distribution, percentage, average and binary logistic model were used for data analysis and interpretation. The result reveals that majority of respondents were males (74.7%) and married (84.4%). It shows that majority of the respondents (92.91%) grow both yam and cassava, while most respondents (90.78%) and (62.41%) were members of social organizations and cooperatives, respectively. The result further reveals that educational levels vary widely among the yam and cassava farmers in the study area. The independent variables included in the model were: education has a coefficient of 1.213886 and significant at 1%, household size has a coefficient of 1.007158 and significant at 1%, the gender coefficient was 1.692373 and also significant at 5%, off-farm income was positive and significant at 5% with a coefficient of 7.01E-06, social organization membership was significant at 10% with a coefficient of 1.42039, while farm size has a positive coefficient of 1.2337 and significant at 1% in the study area. There should be increased sensitization, mobilization and advocacy to create more awareness on the negative impacts of solid mineral mining on the socio-economic livelihoods of the host communities to enable them to become more proactive in tackling this menace.

Keywords: Farmers' Awareness, Yam and Cassava Production, Solid Mineral Extraction, Sustainable Agriculture, Southeast Nigeria.

Introduction

Solid mineral extraction and related activities have become increasingly prevalent in South East Nigeria due to the region's rich deposits of minerals such as limestone, lead, zinc, and coal. While mining contributes to economic development, it also poses serious environmental and socio-economic challenges, particularly for rural communities that rely heavily on agriculture. Farmers, whose livelihoods depend on land and water resources, are especially vulnerable to the negative impacts of mining activities, including land degradation, water pollution, deforestation, and loss of biodiversity. Despite these consequences, the level of awareness among farmers regarding the environmental and health risks associated with solid mineral extraction varies significantly. Factors

such as educational background, access to information, proximity to mining sites, government policies, and involvement of local authorities or NGOs may influence their understanding and perception of these impacts. This study seeks to explore the factors affecting farmers' awareness on the consequences of solid mineral extraction on yam and cassava output in Southeast Nigeria (Wikipedia, 2025).

Solid mineral mining helps advance humankind and will always be important in addressing societal demands. In order to raise living standards, people and rising economies have increased their need for solid minerals due to the urbanization and population growth in China and other developing nations. Other services in modern civilization, including as health, education, and a variety of related consumer goods and services, are also impacted by solid minerals. Solid mineral mining is currently trending toward developing nations, but smelter and refinery output is still concentrated in industrialized nations (Jenkins and Yakovleva, 2006). Solid mineral mining leads to tax exchange, foreign exchange, and foreign direct investment. The presence of responsible solid mineral mining companies in communities improves the health and education of the local population. As the demand for solid minerals rises, human resources are challenged because hiring highly skilled workers is necessary due to the cyclical long-term at all times, even when markets slump and activities decline (Tadesse, 2006).

Mining can benefit a community, but it can also have detrimental effects on the environment and society. In addition to destroying farmlands and forest reserves, solid mineral mining operations disrupt water supplies in mining communities. Governments have a significant influence on development through legislation, even while the mining industry unquestionably contributes significantly to a nation's progress. In order to achieve sustainable development, policies must be strengthened and put into effect. Solid mineral extraction is a major threat to biodiversity because it results in massive habitat losses that affect microorganisms, vegetation, and animals. Gerui, Yalin, Jianping & Sanmang (2017) reported that mineral mining activities cause great socio-economic and environmental disturbances that culminate in reduced crop output in mineral mining host communities. Additionally, environmental pollution caused by solid mineral extraction and related damages negatively affects crop production, which is the primary source of income for the rural folk. As they compete for resources and agricultural yield in solid minerals extraction host communities continues to drop, mining and agriculture can coexist and produce economic and social advantages, but there are certain inherent tensions between the two (Esheya, 2018). However, the extraction of subsurface geological resources, which are essential raw materials for development, must be done carefully to reduce the adverse impacts on agriculture and the environment because humanity cannot afford to give them up (Afolayon et al., 2021). Although they are incompatible, both agriculture and mineral mining have the potential to be a means of escaping poverty. Unfortunately, it is at best doubtful whether these two development paths—which typically occur in rural areas—can coexist. Mining uses a lot of land that could be utilized for farming and pollutes the soil and water, which reduces agricultural productivity (Stoops and Cheverry, 2002). However, mining creates revenue that farmers who work as small-scale artisanal miners can use to augment their income. As

a result, they can hire workers and purchase supplies like fertilizer to increase the production of their crops. The connection between mining and agriculture is a significant and contemporary topic. Agricultural research and development, soil deterioration arrest, and reforestation of damaged land are all possible uses for mining earnings. In order to minimize disputes and guarantee that the advantages of mining support long-term sustainable growth in rural economies, it is imperative that these two economic activities be reconciled (Olade, 2019).

An important aspect of the majority of Nigeria's solid mineral extraction industries is that they are situated near fertile agricultural areas; for instance, the south-east states are among the major producers of rice, yam, cassava, maize, oil palm, and vegetables. Due to the fact that a larger portion of the country's population lives in rural areas and depends on agriculture and related activities for survival, the impact of pollution on agriculture becomes extremely relevant. According to Obaje (2009), if pollution has a negative impact on agriculture, then mining can potentially have a direct impact on rural income, livelihood and living standards.

This study adopts the concept of environmental justice to understand the dynamics of solid mineral extraction in host communities, particularly in relation to the fair distribution of environmental benefits and burdens. According to Wikipedia (2025), environmental justice emphasizes three core dimensions: distributive justice, procedural justice, and recognitional justice.

- i. **Distributive Justice** focuses on the equitable allocation of environmental risks and benefits. In host communities, this involves assessing whether the environmental harms of mining: such as pollution, land degradation, and loss of farmland-disproportionately affect certain groups, particularly smallholder farmers and marginalized populations.
- ii. **Procedural Justice** examines the extent to which affected communities are included in decision-making processes related to mineral extraction. It considers whether community members have access to relevant information, are consulted meaningfully, and can influence policies and actions that affect their environment and livelihoods.
- iii. **Recognitional Justice** addresses the need to respect and acknowledge the cultural identities, values, and rights of local communities. It involves recognizing traditional land rights, indigenous knowledge, and the unique relationship between communities and their natural resources.

By integrating these dimensions, the conceptual framework guides the analysis of how environmental justice or the lack thereof shapes the experiences of solid mineral host communities. It highlights the need for inclusive, transparent, and equitable policies that protect both the environment and the well-being of those most affected by extraction activities (Wikipedia, 2025).

Solid mineral extraction in South East Nigeria has intensified in recent years, raising concerns about its impact on agricultural activities, particularly crop production. As mining operations expand, they often encroach on farmlands, degrade soil quality, contaminate water sources, and contribute to environmental pollution. These adverse effects threaten the productivity and sustainability of agriculture, which remains the primary livelihood for a significant portion of the population in the region. Despite the growing presence of mining activities, there is limited empirical data on how solid mineral extraction directly affects crop yields and farming practices in South East Nigeria. The lack of comprehensive understanding hampers the development of effective strategies to mitigate the

negative consequences on food security and rural livelihoods. Unfortunately, most of the rural population are unaware of these implications. This study aims to fill this gap by investigating the extent and nature of the impact of solid mineral extraction on crop production in the region.

Methodology

This study was carried out in South East zone of Nigeria. Southeast Nigeria is one of the six geopolitical zones of Nigeria and is primarily made up of states inhabited by the Igbo ethnic group. The region comprises of Abia, Anambra, Ebonyi, Enugu, and Imo states. It is located at latitude 5.5° N and longitude 7.5° E. Niger River, Anambra River, Imo River, and Cross River tributaries flow through parts of the zone. These rivers support fishing, farming (irrigation), and transportation in some areas (Wikipedia, 2025). Annual rainfall is high, ranging from 1,500 mm to over 2,500 mm, depending on location. Fertile loamy soil suitable for agriculture: Yams, cassava, palm oil, rice, and maize are widely cultivated. Rainforest vegetation in the south and derived savannah in the north. Solid minerals such as limestone, lead, zinc, coal and salt are extensively extracted in the area (Esheya, Okoye & Nweze (2022). Three states (Abia, Ebonyi, and Enugu) from the zone were purposively selected for this study because of high concentration of solid mineral extraction and processing activities among the majority of the people in the areas. These three states have three (3) agricultural zones each. These divisions are mainly for administrative and extension services and not for any agro-ecological variations in the area (Esheya, 2019).

A multi-stage sampling technique was used for this study. In the first stage, five Local Government Areas each were purposefully selected from the three chosen states based on the intensity of solid mineral extraction and related activities. Then, six (6) communities were purposefully selected from each Local Government Area. These were randomly and proportionally selected after receiving a list of names of affected communities from the local government area headquarters. In the second stage, 5 respondents were selected from each community. The selection was based on purposive sampling technique. A sample size of four hundred and fifty (450) respondents was used for this study. Structured questionnaire was used for data collection. The questionnaire was designed as a structured instrument to collect quantitative and qualitative data from farmers. It targets key domains influencing awareness, such as:

- Demographic information (age, education, farming experience)
- Exposure to mining activities (proximity, frequency)
- Knowledge and awareness levels (understanding of mining impacts)
- Information sources (media, extension services, community forums)
- Perceived consequences (soil quality, yield reduction, water pollution)
- Adaptive behavior (changes in farming practices, advocacy)

Question formats include:

- Closed-ended questions (Likert scales, multiple choice)
- Dichotomous responses (Yes/No)
- Open-ended responses (optional for elaboration)

Development was guided by a literature review and expert consultations to ensure relevance to the local context and research objectives. For content validity, subject matter experts: agricultural scientists, environmental specialists and rural sociologist reviewed the questionnaire for clarity, relevance, and comprehensiveness. Adjustments were made based on their feedback to eliminate ambiguity and ensure coverage of all necessary dimensions. The structured approach to questionnaire development, coupled with rigorous validation and reliability testing, ensures that the instrument effectively captures farmers' awareness and perceptions. This enhances the credibility of findings and supports data-driven policy and intervention planning.

Descriptive and inferential statistics were used for data analysis. Frequency distribution, percentage and mean scores were used to analyse objective (i) while binary logistic model was used for objective (ii). This binary logistic model for the factors that could influence the level of awareness is presented below:

$$Y_i = \beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + \beta_3\chi_3 + \beta_4\chi_4 + \beta_5\chi_5 + \beta_6\chi_6 + \beta_7\chi_7 + \beta_8\chi_8 + \beta_9\chi_9 + \varepsilon \quad \text{.....(1)}$$

Where Y_i = Awareness of the negative effects of mineral mining (1 or 0)

β_0 = intercept

β_i = the coefficients

ε = error term

X_1 (EDUHH) = Level of Educational attainment (Years)

X_2 (AGEHH) = Age of the household head (Years)

X_3 (MSTHH) = Marital Status (Dummy, takes the value 1 if couple and 0 otherwise)

X_4 (OFFINCOME) = Off-farm income of the household head (measured in Naira)

X_5 (HHSIZE) = Household size (number of persons living in the household)

X_6 (FAMSIZE) = Total area of farm land owned by the household (measured in hectares)

X_7 (GENHH) = Gender of the household head (Dummy, takes the value 1 if male and otherwise 0),

X_8 (ORG MEMBERSHIP) = Membership of social organization (Dummy, takes the value 1 if household head is a member of social organization and 0 otherwise)

X_9 (SCONPRACT) = Soil conservation practices (1 or 0).

Results and Discussion

Socio-economic Characteristics

Table 1: Socio-economic characteristics of the yam and cassava farming households

Items		Frequency	Percent
Gender			
	Female	107	25.3
	Male	316	74.7
Marital Status			
	Single	26	6.15
	Married	357	84.4
	Widow	4	0.95
	Divorced	36	8.51

Table 1: Contd.

Items		Frequency	Percent
Crop(s)			
	Yam only	6	1.42
	Cassava only	24	5.67
	Yam and Cassava	393	92.91
Social Organisation			
	Non- Members	39	9.22
	Members	384	90.78
Cooperative membership			
	Non- Members	159	37.59
	Members	264	62.41
Education in Years			
	No formal education	8	1.89
	Primary 3	4	0.95
	Primary 6	18	4.26
	Junior Sec. 1	5	1.18
	Junior Sec. 2	4	0.95
	Junior Sec. 3	18	4.26
	Senior Sec. 3	133	31.44
	OND/NCE	109	25.77
	HND/BSc	102	24.11
	MSc	22	5.2
Land ownership			
	Owned no land	30	7.09
	Owned land	393	92.91
Mode of Access to land			
	inheritance	423	100
	Leased	220	52.01
	Contract	102	24.11
	purchase	134	31.68
	cooperative farm	49	11.58
	community farm	137	32.39
Other Source of Income			
	Civil servant	140	33.1
	Pensioner	23	5.44
	Mining activities	272	64.3
	Okada/bus driver/keke driver	87	20.57
	Trading on large scale	13	3.07

	pettytrading	139	32.86
	Fishing	3	0.71
	Others	6	1.42

Field Survey 2024.

The result in Table 1 shows a frequency distribution of gender, marital status, crops produced, membership of social organisation, membership of cooperatives, years spent in the educational system among the respondents in Abia, Ebonyi and Enugu State. The result reveals that majority of respondents are male (74.7%), while females make up about 25.3% of the sample. This indicates a gender imbalance in the study. The result further reveals that the vast majority of respondents are married (84.4%), which is typical in many Nigerian agricultural settings (Omogo, Ume and Esheya, 2023). Also, a small proportion of the respondents are single (6.15%), widowed (0.95%), and divorced (8.51%). This suggests that the study population is predominantly composed of married individuals, which may influence household dynamics and decision-making in farming activities. This result agrees with the findings of Ali & Murtala (2020).

The result shows that majority of the respondents (92.91%) grow both yam and cassava, indicating that these crops are commonly cultivated together in the study area. A small proportion grow only yam (1.42%) or only cassava (5.67%). This suggests that mixed cropping of yam and cassava is a prevalent practice, possibly due to complementary growing conditions and or economic benefits. Additionally, most respondents (90.78%) are members of social organizations, while a small proportion (9.22%) are not. This indicates a high level of social organization participation, which could be beneficial for collective action, resource sharing, and community development. A majority of respondents (62.41%) are members of cooperatives, while 37.59% are not. This suggests that cooperative membership is relatively common in the study area, which could have implications for access to resources, training, and market opportunities. This agrees with Fasusi, Ji-Min & Sungtaeg, 2022) in a similar study. The result further reveals that educational levels of respondents attained vary widely among the yam and cassava farmers in the study area. A small proportion (1.89%) have no formal education, about 10.34% have basic or incomplete secondary education. Meanwhile the majority (31.44%) have completed senior secondary education. Moreover, a significant proportion (25.77%) have diplomas or NCE qualifications, about 24.11% have higher education degrees (HND/BSc), and 5.2% have postgraduate degrees (MSc). This indicates that the study population is relatively educated, with a significant proportion having secondary or higher education. This could positively influence agricultural productivity, adoption of modern farming practices, and participation in cooperatives or social organizations (Esheya and Awolumate, 2025).

Determinants of Farmers' Awareness of the Consequences of Solid Mineral Mining

Table 2: Probit regression for the factors influencing awareness of the negative impact of mining activities in the study areas

Abia					Ebonyi				Enugu		
Awareness of negative impact of mining activities	Coefficient	Std. err.	z		Coefficient	Std. err.	z		Coefficient	Std. err.	Z
education	1.213886	0.353953	3.43***		-0.53929	0.475256	-1.13		2.56831	0.810516	-3.17***
age	0.011648	0.043976	0.26		1.621488	1.125597	1.44		0.032919	0.034918	0.94
maritalstatus	-0.01017	0.40548	-0.03		-23.3176	14.21432	-1.64		-0.43502	0.58877	-0.74
hhsiz	1.007158	0.286229	3.52***		-1.31316	0.917548	-1.43		0.36398	0.126683	-2.87***
farmsize	0.790409	0.580288	1.36		0.84297	1.1616	0.73		1.233756	0.362226	3.41***
gender	1.692373	0.728776	2.32**		18.50704	12.00482	1.54		2.875951	0.815085	3.53***
secincome	7.01E-06	3.46E-06	2.02*		1.28E-05	8.73E-06	1.47		1.71E-05	1.22E-05	1.4
socorg	-0.01045	0.444815	-0.02		1.42039	0.850772	1.67*		0.451161	0.491145	0.92
_cons	-25.3741	6.300345	-4.03***		-27.5527	29.20061	-0.94		30.50808	10.74933	2.84
LR chi2(8) = 46.13 Pseudo R ² = 0.3988					LR chi ² (8) = 21.82 Pseudo R ² = 0.5923				LR chi ² (8) = 66.59 Pseudo R ² = 0.5957		

Field survey 2024.

The results in table 2 reveals the socio-economic factors influencing farmers' awareness of the negative impacts of solid mineral extraction in three states: Abia, Ebonyi, and Enugu State. The χ^2 values (46.13 for Abia, 21.82 for Ebonyi, and 66.59 for Enugu) indicate that the models are statistically significant at ($p < 0.05$) respectively. This means that the predictors, as a group, significantly explain the variation in awareness of the negative impacts of mining. The Pseudo R^2 values (0.3988 for Abia, 0.5923 for Ebonyi, and 0.5957 for Enugu) suggest that the models explain a moderate to substantial proportion of the variance in awareness. Enugu and Ebonyi have better model fit compared to Abia. The independent variables included in the model are; education, age, marital status, household size, farm size, gender, off-farm income, and membership of social organizations. In Abia State the result in table 2 shows that educational level of the farming households has a Coefficient: 1.213886, significant at 1%. This shows that the higher educational attainment increases the likelihood of being aware of the negative impacts of mining. For each additional year of education, the probability of awareness increases significantly. This concurs with the findings of Muhammad, Esheya, and Ibrahim (2023) in a similar survey. The Household Size has a coefficient of 1.007158, and significant at 1%. This means that the larger household sizes are associated with higher awareness of mining impacts. This could be due to greater exposure to information or shared knowledge within larger families as reported by Abah, Esheya and Ochoche (2021).

Furthermore, the gender coefficient: 1.692373 which is also significant at 5% shows that the male-headed households are more likely to be aware of the negative impacts of mining compared to female-headed households. The Off-Farm Income is also positive and significant at 5% with a coefficient of 7.01E-06, shows that the higher off-farm income is associated with increased awareness. This may reflect greater access to information or resources among households with diversified income sources (Ubokudom, Esheya, and Udioko, 2021).). Additionally, the farm size, age, marital status and social organization membership do not significantly influence awareness in Abia State. The result further reveals that of Ebonyi State. The result reveals that only Social Organization Membership is significant at 10% with a coefficient of 1.42039. This shows that Membership in social organizations increases awareness of mining impacts. This suggests that social networks play a role in disseminating information. Meanwhile all other variables do not significantly influence awareness in Ebonyi state. This could be due to unique regional characteristics or data limitations. According to Adamu & Esheya, (2020), unique regional characteristics and data limitations can bring about variation in the result of empirical studies.

The result for Enugu State further reveals that Education is significant at 1% with a positive coefficient of 2.56831. This is in line with the aprior expectation, and it shows that the higher education is associated with higher awareness of mining impacts in Enugu state. This could indicate that educated individuals are more exposed to mining-related issues or prioritize other concerns. The Household Size significant at 1% and positive coefficient of 0.36398. This shows that larger households are associated with higher awareness. This might reflect greater individual engagement with mining issues in larger families. Farm Size has a

positive coefficient of 1.2337 and significant at 1%. This shows that larger farm sizes are associated with higher awareness. Farmers with more land may be more directly affected by mining activities and thus more aware of their impacts. Gender also has a positive coefficient of 2.87595 and significant at 1%. This also shows that Male-headed households are significantly more aware of mining impacts than female-headed households. This finding concurs with Esheya (2012). Finally, age, marital status, off-farm income, and social organization membership do not significantly influence awareness in Enugu state. To compare the results, it was discovered that education increases awareness in Abia and Enugu states. This suggests regional indifferences in how education influences exposure to or prioritization of mining issues. In Abia, larger households are more aware, while in Enugu, they are less aware. This could reflect differences in family dynamics or information-sharing practices. Male-headed households are consistently more aware across Abia and Enugu, highlighting potential gender disparities in access to information or engagement with mining issues. Membership in social organizations increases awareness in Ebonyi, emphasizing the role of community networks in disseminating information. While, larger farm sizes are associated with higher awareness in Abia and Enugu, likely because farmers with more land are more directly impacted by mining activities.

Conclusion and Recommendations

Sadly, the majority of locals are ignorant of the substantial impact solid mineral mining has, either directly or indirectly, on the ecology and way of life of the host communities. The factors affecting farmers' knowledge of the effects of solid mineral extraction on the production of yam and cassava in Southeast Nigeria were investigated. This study is subject to several limitations. First, data availability and quality may vary across regions, potentially affecting the accuracy of correlations drawn between mineral extraction activities and crop yields. Second, the study may not fully account for confounding variables such as weather variability, pest outbreaks, and differences in agricultural practices, which also influence crop production. Third, spatial and temporal limitations in sampling could constrain the generalizability of the findings. Lastly, the study primarily relies on observational data, which limits the ability to establish direct causality between mineral extraction and agricultural outcomes in the study area.

According to the results in Table 1, the average farmer is 51 years old, has about 21 years of farming experience, has been a cooperative member for about 7 years, has an average family size of about 8, and has an average farm size of about 2.41 hectares. The most common secondary source of income in the study area is participation in solid mineral mining-related activities. The socioeconomic parameters that influence farmers' understanding of the detrimental effects of solid mineral extraction in the three states that were chosen are shown in table 2. The models appear to account for a moderate to significant amount of the variation in awareness, according to the Pseudo R² values (0.3988 for Abia, 0.5923 for Ebonyi, and 0.5957 for Enugu).

Mining firms contend that agriculture and mining are not always mutually exclusive. However, there aren't many instances when this has happened, especially in underdeveloped nations where mining industry control is frequently lacking. Increased lobbying, mobilization, and sensitization are needed to raise awareness of the detrimental effects that solid mineral mining has on the socioeconomic well-being of host communities so that they can take more proactive measures to combat this threat. Furthermore, the government and interested parties should make sure that reliable mineral mining firms strictly follow all applicable national and international laws, rules, and regulations. In order to minimize disputes and guarantee that the advantages of mining support long-term sustainable development in rural economies, including the production of yam and cassava in Southeast Nigeria, it is imperative that these two economic activities be reconciled.

Conflicts of Interest

The authors hereby declare that there are no relevant interests that could be perceived as conflicting in this study.

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