الآثار الصحية لحرق الغاز في مناطق انتاج النفط على المجتمع في أوكابي و بينكوكو، إقليم دلتا – نايجيريا

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الملخص :

يعد قطاع الغاز والنفط الدعامة الرئيسة للاقتصاد النايجيري، ولسوء الحظ تحتل نايجيريا المرتبة الثانية من حيث حرق الغاز في افريقيا مؤثرة بشكل أسوأ على الواقع الصحي خصوصاً على المجتمع في مقاطعتي أوكابي و بينكوكو. تهدف الدراسة الى اختبار اثر شعلات الغاز المحترق على الواقع الصحي في سبيل معرفتها والسيطرة عليها ووضع استراتيجيات باستخدام نموذج المعادلات الهيكلية.

بينت نتائج الدراسة وجود أثر صحي سلبي للغاز المحترق بما يدعم فرضية كوزنتس البيئية. كما اثبتت ان التدفقات الداخله لرأس المال الاجنبي كانت عاملا سلبياً في منطقتي الدراسة. تمثلت استنتاجات الدراسة في امكانية تقليل الاثر السلبي للغاز المحترق على الواقع الصحي من خلال تقليل الغاز المنبعث عن طريق تحسين مستوى المعرفة وتطبيق الاستراتيجيات على المجتمع. أخيرا، أوصت الدراسة بأن تطبق الحكومة سياسات لمكافحة حرق الغاز، فضلا عن قيام الشركات النفطية بانشاء خدمات المراكز الصحية المجانية للمجتمع في منطقتي الدراسة. كما اوصت بان يقوم القادة بوضع ايضاحات للمجتمع حول استراتيجيات التعامل التي من الممكن ان تحسن وضع الصحة المجتمعية من شعلات الغاز المحترق .

الكلمات المفتاحية : الصحية ، حرق الغاز ، أوكابي ، بينكوكو، SEM ، النفط ، إقليم دلتا .

Health Effects of Gas Flaring in Okpai and Benekuku Oil Producing Communities in Delta State, Nigeria

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Abstract :

The oil and gas sector is the mainstay of the Nigerian economy ; unfortunately, Nigeria ranks 2nd in the incidence of gas flaring in Africa with worsened health outcomes especially in Okpai and Benekuku communities where constant gas flaring has not attracted empirical inquiries. The objective of the study is to examine the health effects of gas flaring on health outcome, and controlled for knowledge and coping strategies using Structural Equation Modeling.The result revealssignificant adverse health effect of gas flaring, and evidence of environmental Kuznets hypothesis. The negative mediating role of foreign capital inflows provided evidence that Okpai and Benekuku are pollution havens. Also, knowledge and coping strategies were found to improve health outcomes. The study concludes that the negative health effect of gas flaring is reduced by improved knowledge and coping strategies among the people.The study recommends that the government should implement anti-gas flaring policies;oil companies establish free healthcare services and community leaders get their members informed on the need to device coping strategies, as the strategic actions that would improve human health in gas flaring communities.

Keywords: Health, Gas Flaring, Okpai, Benekuku, SEM, Oil, Delta State

1.Introduction

Environmental pollution has become a global challenge, and its effects are more severe in developing countries. There are a multiplicity of pollution effects which has taken toll on the quality and stock of human health, vegetation, soil, animal, water, and air quality (Atubi, 2013; Babayemi, Ogundiran&Osibanjo, 2016). Undoubtedly, pollution has implications for human health either directly or indirectly through agriculture and foreign capital inflows into the oil and gas sector.

In Nigeria, a preponderance of environmental pollution and degradation is recorded in the Niger Delta Region where oil- one of the mostly highly priced extractive products is domicile. It is the mainstay of the Nigerian economy. Ironically, the processes involved in the exploration, extraction and transportation of oil and its components significantly impinge on the environment through spillage and flaring of gas constituents (Aroh et al. 2010; Oghenetega et al. 2019; Okonkwo, 2017).

Incidences gas flaring has caused monumental damage to communities within the oil rich region and other areas remotely distant from the Niger Delta region. Mba et al. (2019) observed that oil spill could occur via mechanical faults, operational failure, natural disaster, pipelines corrosion or sabotage. Babayemi et al. (2016) posit that the spill-over effects of such spills and gas flaring degrade the quality of fresh water, vegetation, agricultural output, genetic composition and aquatic lives, which are natural consumables for human. Thus, the passthrough effects of such consumption have implications for human health in oil and gas economies including Nigeria.

The problem is that, through Nigeriahas the largest proven gas reserve in Africa and occupied 9th in the world with natural proven natural gas reserve capacity of 5,675 billion cubic metres that accounts for 2.7% of global proven reserve of natural gas (PWC, 2019), unfortunately, the incidence of gas flaring is high and the nation ranks 2nd in Africa, and 7th globally. Gas flaring constitutes the highest pollutants in Delta State, the highest oil producing state in Nigeria. Ndokwaland is the only place where commercial extractive activities are on-going in the Northern senatorial district in Delta State. The oil producing communities in Ndokwa are under pressure from rapidly deteriorating ecological and economic conditions, health challenges and social cost. The World Bank reports that gas flaring costs the global economy US$20 billion in 2018, while in Nigeria the cost stood at ₦233 billion which represents 3.8% of the global cost (IEA, 2019). Although the proportion of gas flared in Nigeria has been on a decline since 2004 (see Figure 1), Nigeria still ranks 2nd in Africa and 7th in the world with a proportion of 6.9% contribution to global gas flaring, a preponderance of these are in the Niger Delta region.

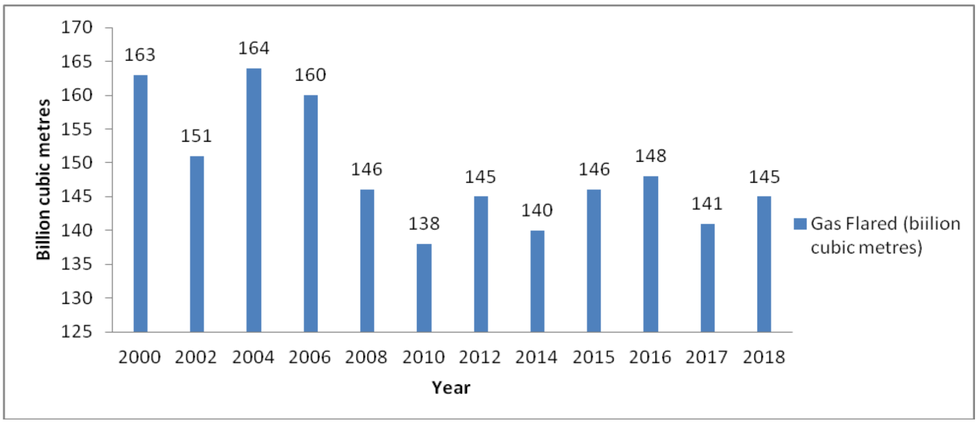

Figure 1: Gas flared (billion cubic metres)
Source: IEA, 2019.

Although the government has through the National Gas Plan and the Nigerian Gas Flaring Commercialization programme seeks to accelerate and deepen the development of the oil and gas sectors, minimize gas flaring, reduce imports and foster domestic consumption of gas through gas-allied products, gas flaring remains a serious pollutant and causes harm to human health and households economies in Okpai and Benekuku communities.

Against this backdrop, the main objective of the study is to analyse the health effects of gas flaring in Okpai and Benekuku communities. Specifically, the study analysed the direct and indirect mechanisms through which gas flaring affect human health, and controlled for knowledge and coping strategies in the structural model.

The study is motivated by the need to address the health issues caused by gas flaring to the people of Okpai and Benekuku communities and to establish coping strategies to ameliorate this challenge. The study is significant to theory; it validates the EKC and PH theories; improved the methods of analysis using the structural equation modeling; and offered practical implications for social change.

The main findings of the study are; gas flaring has a significant negative effect on the health of the people of these communities; agriculture and foreign capital inflows are significantly mediate the health effect of gas flaring; knowledge and coping strategies are important in curbing the adverse health effect of gas flaring.

Following the introduction are the empirical review, methodology, results and conclusion.

2. Empirical Review

The health effects of oil spill have been well documented in the literature, without serious attention on gas flaring. Lyons et al. (2011) report high anxiety and mental health among inhabitants of oil spill vicinity in the south coast areas. Loginova (2018) analyse the achievement of human and societal security in Russia. The study submits that oil extraction and spillage has negative impact on the health, and livelihood of inhabitants. Hayes (2019) posits that oil spills has indirect and direct effects on human health. Specifically, the study reports that headache, dizziness are indirect effects while respiratory syndromes, fertility issues, genetic mutation and back pains direct health effects.

In Nigeria, Bruederle and Hodler (2019) investigate the impact of oil spill on infant mortality in Nigeria but neglected the effects of gas flaring which has become a significant pollutant. Other studies that ignored the impact of gas flaring on health status include (Albert, Amaratunga&Haigh, 2018;Ovuomarie-Kevin, Ononugbo&Avwiri, 2018; Nriagu et al., 2016). This is the primary gap that motivated this study. Secondly, of the studies that investigated gas flaring in Nigeria, none considered its health effects in Ndokwa. For instance, Udo and Akpan (2017) examined the problems and prospects of gas flaring in Nigeria, Giwa et al. (2019) analysed the impact of gas flaring and particulate pollutants in the Niger Delta without considering the Ndokwa region, while Otene, Murray and Enongene (2016) presented a theoretical conversation on gas flaring in the region.

Unfortunately, the study overlooked the severe health implications of gas flaring and oil spills in the Niger Delta.
In addition, Ajugwo (2013) studied the negative effects of gas flaring in Nigeria and concluded that it has negative impact on the environment, economy and health of communities where it is practiced. The study attributed the continued gas flaring exercise in Nigeria to reluctance on the part of the government and policy makers. Examining the impact of gas flaring in Nigeria, Adewale& Mustapha (2015) found that it causes health challenges, results in unsustainable environment, and socio-economic problems. The ecological and human health implications of gas flaring were further discerned by Osuoha and Fakutiju (2017) in the Niger Delta region. In recent times, studies have become community specific, this is obvious in Akuirene et al (2029) that analysed the impact of gas flaring in Ubeji metropolis of Delta State. The survey used survey design to establish that gas flaring affects human health negatively. The position of Akuirene et al (2019) is in congruence to Nwosisi et al (2021), and Uzoekwe et al (2021) for Delta State and Bayelsa State respectively.

Despite the consistent findings that gas flaring is inimical to human health, and the communities cannot be relocated due to structural rigidities, existing studies have not thought of knowledge and coping strategies as the far forward. Also, the Ndokwa region, where gas is constantly flared has been neglected by previous studies for political reasons. The study extends the literature by analysing the health effects of gas flaring in Okpai and Benekuku communities, and controlled for knowledge and coping strategies to minimize its attendant health consequences.

Nevertheless, the study improved on the existing methods of analysis employed by earlier studies in this research space. The studies reviewed in this section employed either descriptive or regression analyses, which could produce spurious results due to sampling error. To correct the limitations of these techniques, this study employed Structural Equation Modeling (SEM) technique.

3. Methodology

The study was carried out in Okpia and Benekuku communities in Ndokwa East LGA of Delta state within the Niger Delta Region.

Ironically, the Ndokwa East local government of Delta state, which is endowed with crude oil and related biodiversity resources, is the least developed. Within this local government, Okpai and Benekuku are the two leading communities where crude oil is exploited, and gas resources are flared without environmental and health considerations. Surprisingly, previous studies on air pollution in the region neglected the incidences of air pollution, health disaster and economic losses in these communities. Due to political reasons, much attention has not been given to the area.

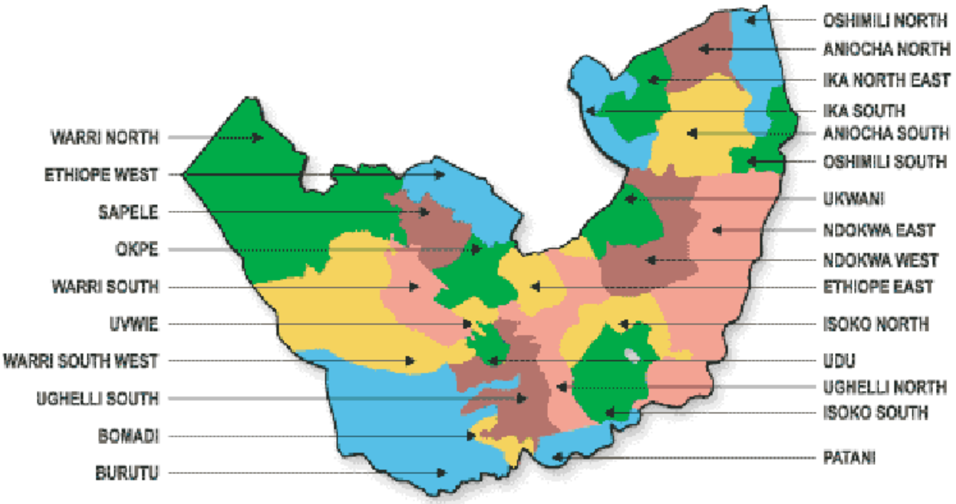

Figure 2: Map of Delta State
Source: Adopted from Salami et al., 2014

The primary research instrument comprises structured questionnaire items covering the key constructs – life expectancy, agricultural output, CO emission, and FDI. The instrument has five sections. The first part sought for demographic data of the respondents, including their gender, age group, educational qualification, marital status, and occupation. The other sections contain Likert structured questions on the primary constructs of the study, based on a 5-point scale (1 = strongly disagree, and 5 = strongly agreed). The instrument has been peer and expert reviewed to ensure that content and face validity are met.

Specific scale measurements on life expectancy (LFEXPT; consisting of 8 items including “I am satisfied with available health facilities to improve life expectancy in Nigeria") were adapted from Snyder *et al.* (1991), EU healthy life expectancy survey (2016), WHO quality of life survey (2012), and OECD better life index (2011).

Other constructs, agricultural output (AGRI; consisting of 5 items including “the growth in agricultural output is satisfactory”), Carbon-dioxide emission (CO; consisting of 7 items including “I feel satisfied with how carbon emissions are controlled”), and foreign direct investment (FDI, consisting of 3 items including “Multinational firms are expanding yearly”) were developed following insight from reviewed literature (Campbell-Lendrum&Prüss-Ustün, 2019; Halkos&Paizanos, 2013; Opoku*et al.*, 2019).

To measure the reliability of the survey instruments, the study employed the Cronbach’s Alpha coefficients, which fell between the 0.714 and 0.921 reliability range.

Structural Equation Model (SEM)

$$LFEXPT = \beta_0 + \beta_1 CO + \beta_2 AGRO + \beta_3 FDI + e \quad 1$$

$$AGRO = \alpha_0 + \alpha_1 CO + e \quad 2$$

$$FDI = \alpha_0 + \alpha_1 CO + e \quad 3$$

Equation 1 shows the mediating roles of agricultural output and foreign capital inflows in the effect of gas flaring on life expectancy (health indicator). It further reveals the direct and indirect effects of gas flaring on life expectancy. However, equations 2 and 3 depict the indirect channels through which life expectancy is affected by gas flaring. The structural model test the hypothetical relationship between the gas flaring and life expectancy using path analysis (Hoyle, 1995, 2011; Kline, 2010), while the measurement model measured the latent variables using either CFA (Hoyle, 1995, 2011; Kline, 2010; Yi *et al.*, 2016).

4. Results

The study explored the health effect of gas flaring in oil producing communities by collecting quantitative data from 333 respondents fromOkpai and Benekuku communities in Ndokwa East LGA of Delta State, Nigeria

- ***Descriptive Statistics***

The summary of descriptive statistics further reveals that the average age of the respondents falls within the range of 31 and 50 years. The result implies that respondents to the questionnaire are of age and have the requisite experiences required for relevant information for the study. Also, the standard deviation value of 1.36499 shows a low level of variability in the age distribution of the respondents. The skewness and kurtosis coefficient for the age demographic reveals that the respondents' ages are not normally distributed. The result does not have implications for data analysis, and the result does not incorporate age as a control variable in the structural equation model.

Furthermore, the mean value of 2.2583 for the highest educational qualification shows that, on average, the participants had between NCE/ND and HND/BSc as the highest level of education obtained. This further implies that most of the respondents had at most HND/BSc or NCE/ND. Thus, the respondents are of a high level of knowledge to give information on air pollution and its attendant consequences on their health status. Also, the skewness and kurtosis coefficient of the highest educational attainment demographic shows that it is not normally distributed. The study further explored the gender distribution of the respondents. The mean value of 1.4384 shows that both genders were adequately represented in the study; however, most respondents are male. From the standard deviation estimate of 0.49694, it is evident that the variability in gender is very low. The skewness and kurtosis coefficient provides further information on the normality of the gender distribution of the respondents. In the study sample, as presented in Table 4.17a to 4.17f, the majority, 187 (56.2%), were males, while 146 (43.8%) were females. There were more people in the age bracket 51-60 with a total of 99 (29.7%), followed by those aged 31-40 with 85 (25.5%) and less than the 30s with 84 (25.2%). Those around 41-50 and above 60 years had the most negligible numbers with 34 (10.2%) and 31 (9.3%).

Also, the majority of the participants have higher degrees, with HND/BSc holders having the highest number at 123 (36.9%), NCE/ND with 48 (14.4%), and postgraduates with 7 (2.1%). A reasonable number, 129 (38.7%), have only primary/secondary education, while 26 (7.8%) had no formal education. This set of respondents was aided by research native ad hoc assistants who translated the questions in the native language and guided them through the process. There were more farmers, 90 (27%), followed by traders, 69 (20.7%), oil and gas workers, 63 (19.5%), and civil servants 38 (11.4%). Others are students 12 (3.6%), teachers 6 (1.8%), and unclassified 53 (15.9%). 286 (85.9 %) were married, 24 (7.2%) widowed, and 23 (6.9%) not married. The majority was of the Ukwani tribe with 206 (61.9%), while the rest were of the Igbo tribe with 137 (38.1%).

Table 1: Descriptive Statistics

Item		Age	Highest educational attainment	Gender	Marital Status	Occupation	Tribe
N	Valid	333	333	333	333	333	333
	Missing	0	0	0	0	0	0
Mean		2.7237	2.2583	1.4384	1.2853	3.7958	1.3814
Std. Deviation		1.36499	1.21708	.49694	.79890	2.23345	.48646
Skewness		.131	.614	.249	2.864	.103	.491
Std. Error of Skewness		.134	.134	.134	.134	.134	.134
Kurtosis		-1.384	-.379	-1.950	6.846	-1.451	-1.770
Std. Error of Kurtosis		.266	.266	.266	.266	.266	.266

Source: Author’s computation

- ***Assessing reflective measurement models with Knowledge and coping strategies***

First, the indicator loadings are verified. As shown in Table 4.18B, only 18 items loaded significantly. According to Hair et al. (2019), Loadings above 0.708 are recommended, as they indicate that the construct explains more than 50 per cent of the indicator's variance, thus providing acceptable item reliability. However, for scales that test original constructs, as is the case here, loadings of 5.0 and above could be acceptable if the removal of such items can affect the theoretical construct (see Gefen& Straub, 2005). Next, the internal consistency reliability is assessed. Cronbach's alpha values ranged from 0.714 to 0.921. These values fall within the 0.60 to 0.94 acceptance zone for construct reliability (Hair et al., 2017). The Average Variance Extracted (AVE) values which ranged from 0.516 to 0.812, fall within the acceptance zone since they are higher than 0.50as presented in Table 2 below.

Table 2: Validating the measurement models with KCS

Latent Variable	Factor Loading	VIF	Cronbach's Alpha	AVE
LFEXPT	-	-	0.837	0.730
LE1	0.849	2.839		
LE2	0.790	3.911		
LE3	0.647	4.246		
LE8	0.534	3.980		
AGRI	-	-	0.836	0.596
AQI	0.769	4.945		
AQ3	0.837	3.604		
AQ4	0.786	3.055		
AQ5	0.946	1.750		
FDI	-	-	0.921	0.812
FD11	0.957	2.225		
FDI2	0.988	2.671		
FDI3	0.733	2.437		
CO	-	-	0.885	0.516
CE2	0.720	1.932		
CE5	0.838	1.430		
CE6	0.838	3.942		
CE7	0.901	3.211		
KCS	-	-	0.714	0.693
KCS1	0.741	4.384		
KCS4	0.845	2.803		
KCS6	0.827	1.829		

Source: Author's computation

Finally, discriminant validity was checked following Fornell and Larcker (1981) method. Accordingly, each construct's AVE was compared to the squared inter-construct correlation (as a measure of shared variance) of that same construct and all other reflectively measured constructs in the structural model (Hair et al., 2019). To be accepted, the shared variance for all model constructs should not be more significant than their AVEs. As indicated in Table 4.19, discriminant validity is obtained as the results are consistent with expectations. All correlation coefficients were significant at $p < 0.05$; figures in bold in the diagonal are the square root of the AVEs.

- ***Assessing formative measurement models***

Here, the indicators' collinearity and statistical significance were examined. Results indicate that Variance Inflation Factor (VIF) ranged from 1.430 to 4.246, indicating that multicollinearity is very unlikely (**Table 2**). Besides, the latent constructs are unidimensional since the AVEs of the latent constructs are reasonably greater than 0.50, and the reflective indicators loaded with significant t-values on their theoretical constructs (Bagozzi& Yi, 1988).

- ***Assessment of the basic structural models***

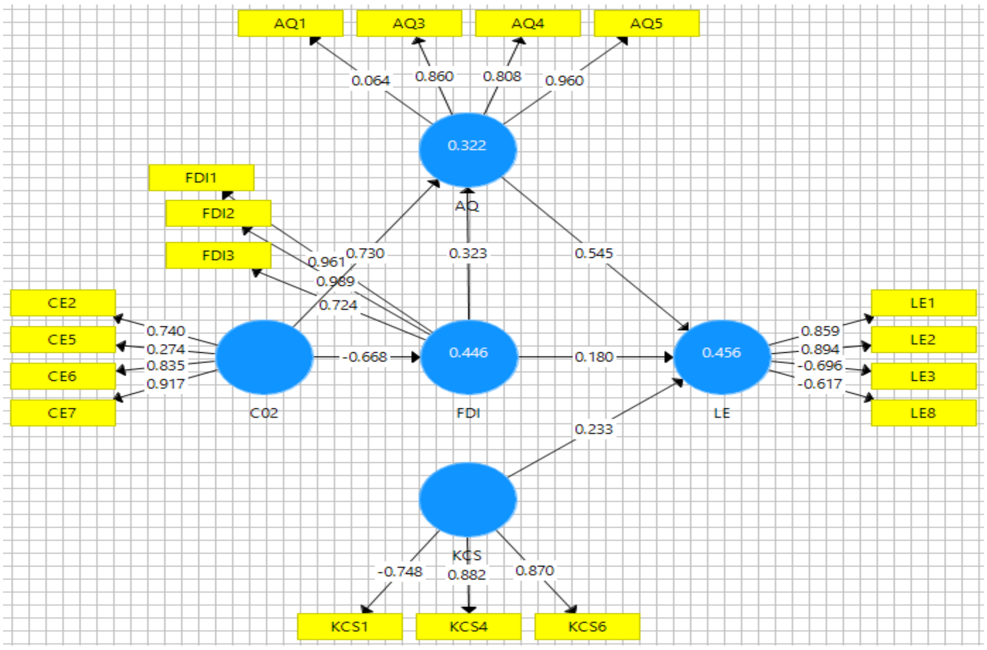

Figure 3: Estimated structural equations model with KCS
Source: Author's computation

Results of estimated structural equation model in figure 3indicate that agricultural output (β = .430, t = 14.607, p < .05), and knowledge of coping strategy (β = .376, t = 6.150, p < .05) are significantly and positively related to life expectancy, while FDI (β = .062, t = 1.325, p> 0.05) is non-significant. Besides, the result show that C0 (β = .360, t = 4.775, p < .05) is significant and positively related to agricultural output, while C0 (β = -.686, t = 21.784, p < .05) is negative and significant. Thus, agricultural output, FDI, and knowledge of coping strategy influence life expectancy positively. However, FDI has non-significant influence unlike agricultural output and knowledge of coping strategy.

Again, the indirect effect results were examined. First, results indicate that agricultural output (β = .155, t = 4.423, p < .05) is a positive and significant mediator of the relationship between C0 and life expectancy, this validating the claim that gas flaring interaction with agricultural output affects human health outcome of life expectancy. On the other hand, FDI (β = -.435, t = 3.862, p < .05) is a negative and significant mediator of the relationship between CO and life expectancy, thus validating the claim that gas flaring interaction with FDI has a significant impact on life expectancy.

Table 3: Summary of hypotheses and control variables results

Hypothesized Relationship	Path Coefficients	SE	t-Values	Results
AGRI ⟶ LFEXPT	0.430	0.029	14.607**	Supported
CO ⟶ AGRI	0.360	0.075	4.775**	Supported
CO ⟶ FDI	-0.686	-0.031	21.784**	Supported
FDI ⟶ LFEXPT	0.062	0.047	1.325ns	Not Supported
KCS ⟶ LFEXPT	0.376	0.061	6.150**	Supported
CO ⟶ ⟶ AGRI LFEXPT	0.155	0.156	4.425**	Supported
CO ⟶ FDI ⟶ LFEXPT	-0.425	0.110	3.862**	Supported

Source: Author’s Computation

- ***Structural Model Summary (post estimation tests)***

The study further examined the model's fitness using several indices in line with the structural equation modeling techniques, with outcomes reported in Table 4 below.

Table 4: Model Fitness Test Criteria

Model	Chi-square	Normed Chi-Square	RMSEA	NFI Delta1	TLI rho2	CFI
Default model	884.96	4.807	0.063	0.945	.921	.964
Criteria		<5	<0.08	>0.90	>0.90	>0.90

Source: Author’s computation, Avwokeni (2019); Hair et al. 2010; Markus (2012); Shashi*et al.* (2019)

According to Barrett (2007), a sample size of about 200 and above is required for effective estimation in SEM analysis. Barrett (2007), Hair *et al.* (2010), and Avwokeni (2019) recommend a normed Chi-square less than 5 as criteria for absolute model fit. The absolute fit indices of the final measurement model are: Chi-square = 884.96 and normed Chi-square (Chi-square/df) = 4.807 (close to 5). Markus (2012) and Shashi*et al.* (2019) also suggest some criteria for incremental model fit (Normed Fit Index (NFI), Tucker Lewis Index (TLI), Comparative Fit Index (CFI) > 0.90 and Root Mean Square Error of Approximation (RMSEA) < 0.08). The incremental fit test showed; Normed Fit Index (NFI) = 0.945, Tucker-Lewis index (TLI) = 0.921, Comparative Fit Index (CFI) = 0.964 and RMSEA = 0.063 (**Table 4**). The above indices within the threshold, thus, give sufficient grounds to accept the fitness of the model.

5. Conclusion and Implications

The structural equation estimates of the effect of gas flaring (CO) on health outcome (LFEXPT)revealed that gas flaring has a negative and significant effect on life expectancy. This finding aligns with theoretical expectations of the extended Grossman's Health Stock Theory. The negative and significant carbon emission effect on life expectancy further corroborates earlier studies that observed that air pollution had a significant adverse effect on health outcomes.

The significant relationship estimated between gas flaring and foreign capital inflows confirms the main argument of the Pollution Haven Theory for Okpai and Benekuku communities, a result that agrees with the conclusions of earlier studies that foreign direct investment promotes air pollution in the host communities, an evidence of pollution haven relation. The study ascertained that gas flaring's effect on life expectancy is mediated by agriculture and foreign direct investment. It further concludes that knowledge and coping strategies as a measure of awareness and responses to pollution promote quality health among the Okpai and Benekuku inhabitants.

On the basis of the findings, the study recommends the following policy options:

Having observed that gas flaring hurts life expectancy, it is, therefore, pertinent for policymakers to strengthen and strictly implement anti-gas flaring and carbon emission activities in oil producing communities by ensuring that economic activities that contribute to gas flaring, which reduces the quality of atmospheric air, are legally mandated to employ pollution abatement technologies.

Since gas flaring and agriculture were effectively related, efforts towards agricultural output expansion should simultaneously incorporate carbon emission reduction strategies through green agricultural practices that promote environmental quality.

Also, given that carbon emission and foreign capital inflows are significantly linked, the study strongly suggests that foreign capital inflows should be attracted and invested in economic sectors contributing minimally to carbon emission (gas flaring).

Since agriculture and foreign capital inflows mediate significantly in the relationship between gas flaring and health outcomes, policymakers are charged to drive health outcomes through improved investment in the agricultural sector to boost output. Also, foreign capital inflows should be channeled to businesses and economic sectors which would not continue to make the host communities pollution haven.

Finally, environmental regulatory agencies in Nigeria should constantly collaborate with firms that emit carbon to create awareness on hazard communications, reporting and coping strategies in air pollution incidents. Knowledge and coping strategies seminars should be a crucial part of firms' corporate social responsibilities.

Acknowledgement

We wish to express our profound gratitude to the Chairman of Health Ethics Research Committee of Nigeria, Delta State Branch, Federal Medical Centre, Asaba for the Ethical Approval granted for this study. The study received no funding.

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LAGOS STATE UNIVERSITY
FOR TRUTH AND SERVICE

SURVEY QUESTIONNAIRE

PhD Research, Postgraduate School, Department of

Dear Respondent,
The research aims to ascertain the effects of gas flaring on health in Nigeria, and to examine whether agriculture and foreign direct investment mediate the relationship between gas flaring and health proxied by life expectancy.
Please, read each question carefully before responding, and then, tick the appropriate answer in the designated space(s).
Kindly choose an answer that best reflects your view.
All information provided will be treated with the utmost confidentiality in line with ethical principles and international best practices in research.
Thank you for your help.

Signed
Investigators
D.K Salami & S.E Nwani

Tick ☑ the preferred option and be free to give other necessary information where possible.

Part A: Socio-Demographic Characteristics

1. What is your gender?
   - i. Male ☐
   - ii. Female ☐
2. What is your current age bracket (years)
   - i. Less than 30 ☐
   - ii. 31 – 40 ☐
   - iii. 41 – 50 ☐
   - iv. 51 – 60 ☐
   - v. 61 and above ☐
3. Highest educational achievement.
   - i. Primary/Secondary ☐
   - ii. NCE/ND ☐
   - iii. HND/BSc ☐
   - iv. Postgraduate. ☐
4. Marital status? ☐
   - i. Married ☐
   - ii. Single
   - iii. Divorced ☐
   - iv. Widowed ☐
5. What is your main source of livelihood (occupation)?
   - i. Farming ☐
   - ii. Student ☐
   - iii. Trading ☐
   - iv. Civil service ☐
   - v. Teaching ☐
   - vi. Oil & Gas

Part B: Effects of Air Pollution

Using SA = Strongly Agree (5), A = Agree (4), U = Undecided (3), D = Disagree (2) and SD = Strongly Disagree (1)

Life Expectancy	**SA**	**A**	**U**	**D**	**SD**
1. Our environment is free of toxins that can harm lives					
2. Available health facilities to improve life expectancy in my community is satisfactory					
3. Economic condition in my community enhances the life expectancy					
4. The present system of governance encourages longer life expectancy in my community					
5. I feel safe in my present environment					
6. My job guarantees a healthy lifestyle					
7. I am satisfied with my current place of living					
8. Overall, I am satisfied with my quality of life					
Agricultural Output	**SA**	**A**	**U**	**D**	**SD**
1. Our farms still yield satisfactory produce					
2. The quality of the farm yield is commendable					
3. The agricultural output is adequate					
4. Real farmers are being supported					

for greater performance					
5. Government policies have encourages agriculture					
Foreign Direct Investment	**SA**	**A**	**U**	**D**	**SD**
1. Multinational firms are expanding yearly in this communities					
2. My community depends mostly on multinational firms for our daily living					
3. I still expect multinational firms to keep growing in our community					
Carbon emissions	**SA**	**A**	**U**	**D**	**SD**
1. I do not witness regular industrial emissions in my community					
2. Gas flaring does not constitutes a danger to my environment					
3. I am satisfied with gas flaring activities in my environment					
4. I feel satisfied with how emissions are controlled in my environment					
5. Combustible solid wastes are appropriately handled in my community					
6. Combustion is adequately managed					
7. Indoor cooking activities that emit dangerous smokes are adequately regulated					
Knowledge and Coping	**SA**	**A**	**U**	**D**	**SD**

Strategies					
1. I am aware of the high quality of air in my community					
2. I know how to ensure I am not exposed excessively to breathing polluted air					
3. To cope with the existing level of air pollution, we relocate from one location to another					
4. I know how to communicate the government when there is air pollution					
5. The oil companies inform us about harmful effects of pollution regularly					
6. Health and medical facilities are provided free of charge when affected pollution related illness					
7. I have been educated on how to communicate environmental hazards and what to do when there is pollution					
8. The level of air pollution does not affect my health, because my body is used to it.					
9. To gain the attention of the oil firms, the use of violence is more efficient than peaceful protest or round table discussions.					