Perception of Artisanal Refining (Kpo Fire) Activities on Social Economic Livelihood and the Environment in Okrika L.G.A, Rivers State

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Abstract
This research investigated how artisanal refining (Kpo Fire) practices affect social economies and environmental health in the Okrika Local Government Area in Rivers State, Nigeria. The inquiry was spurred by the rise of illegal artisanal refining operations in the Niger Delta and the resultant effects on the environment and local livelihoods. A cross-sectional survey was utilized, incorporating 384 participants chosen via Cochran's formula due to an unknown population size. Data was gathered through structured questionnaires, interviews, and direct observations, while the analysis employed descriptive statistics and ANOVA with a significance level of 0.05. Results indicated that participants from various livelihood sectors employed diverse coping methods, with grand mean scores between 3.98 and 4.06. Major strategies encompassed diversification of livelihoods (HH = 4.10; Farmers = 4.12), dependence on non-farming earnings (up to 4.25), small trading activities (up to 4.22), migration (3.80–3.90), and community assistance initiatives (4.10–4.18). Engaging in artisanal refining was recognized as a coping mechanism as well (3.80–3.90). ANOVA findings (F = 1.542; p = 0.204) showed no notable variation in coping approaches among different groups. Environmental perception findings indicated strong consensus on acute ecological decline, with fishermen scoring the highest grand mean (4.39), trailed by farmers at (3.93) and household heads at (3.77). Significant consequences included water pollution (up to 4.45), soil pollution (4.35), air quality deterioration (4.35), loss of vegetation (4.30), and destruction of aquatic life (4.45). Community leaders demonstrated slightly lower perceptions (3.63) but still recognized widespread environmental degradation. The findings suggest that artisanal refining substantially impacts both living conditions and the quality of the environment, compelling households to adopt adaptive yet economically limited coping strategies while hastening ecological harm across terrestrial and aquatic ecosystems.

Keywords: *Perception, Artisanal, Refining, Activities, Social Economic & Livelihood*

Introduction

Background to the Study

The Niger Delta region of Nigeria is internationally recognized for its abundant crude oil deposits, which have driven national economic growth since the discovery of oil in the 1950s (Albert. et al., 2019). However, the exploitation of petroleum resources has also generated severe environmental

challenges, particularly in rural communities like Okrika Local Government Area of Rivers State. In addition to large-scale oil exploration and spills, an increasing number of informal or artisanal refining operations, locally referred to as (kpo fire) have proliferated across the Delta (Richard et al., 2022). These activities involve the clandestine siphoning and rudimentary processing of crude oil using makeshift equipment and open fires, contributing to widespread pollution of soil, water, and air (Orji et al., 2025) Unlike regulated refining processes, kpo fire sites are unmonitored, unregulated, and often located in close proximity to farmlands, rivers, and human settlements. The uncontrolled discharge of hydrocarbons, heavy metals, soot, and other pollutants into the terrestrial and aquatic environment significantly alters the physicochemical properties of soils, reducing soil fertility and hampering its capacity to support healthy vegetation and crop growth (Adeyemi & Okoro, 2020). these illegal refining activities and the widespread degradation of agricultural lands and water bodies, thereby jeopardizing the very foundation of sustainable agriculture and the food security of millions in the region (Adeyemi & Okoro, 2020). Recent studies in parts of Rivers State and the wider Niger Delta have documented severe contamination of farmland soils associated with artisanal refining activities, including elevated levels of petroleum hydrocarbons and heavy metals well above acceptable environmental standards, with consequent reductions in nutrient availability and soil quality essential for sustainable agriculture (Richard et al 2022).

The degradation of farmlands undermines agricultural productivity in communities where farming remains a primary livelihood activity for households (Chukwu & Dike, 2023). Evidence from similar Niger Delta contexts shows that artisanal refining not only destroys arable land but also contributes to loss of vegetation cover and disrupts microbial soil ecosystems factors that collectively diminish crop yields and limit sustainable food production. This has direct implications for household income, food security, and the broader socio-economic well-being of farming families in oil-impacted rural areas. Despite the severity of these impacts, regulatory oversight and environmental management frameworks in the Niger Delta have struggled to keep pace with the rapid spread of artisanal refining. Weak enforcement mechanisms, limited institutional capacity, and socio-economic drivers such as poverty and unemployment have allowed kpo fire activities to persist, compounding environmental degradation and its effects on agriculture. Consequently, there is pressing need to understand the spatial distribution of artisanal refining sites relative to farmlands, assess their impact on crop health and farmers' livelihoods, and develop effective community and institutional strategies to mitigate the adverse effects of these activities. It is against this bedrock that the research problem of this study seeks to assess the impact of artisanal refining.

Methodology

This research employs an extensive methodological framework to analyze the effects of artisanal refining, often known as Kpo Fire, on farmers and fishermen in the Okrika Local Government Area of Rivers State, Nigeria. The methodology is founded on an integrative perspective that merges environmental evaluation, socio-economic assessment, and spatial investigation. This combination is essential due to the intricate and multi-faceted nature of artisanal refining, which includes issues such as environmental damage, decreasing agricultural yields, disruption of marine ecosystems, and broader socio-economic challenges. The chosen approach corresponds with modern environmental management studies that focus on sustainability, mitigation of impacts, and outcomes relevant to policy-making. A cross-sectional survey format was used to collect information from a sample representing the population at a single moment. This format effectively

evaluates the current state, viewpoints, and encounters concerning the environmental and socio-economic effects stemming from artisanal refining practices. It presents a snapshot of the current conditions within impacted communities and enables extrapolation of results to the larger population. Data were gathered from both primary and secondary sources. Primary data were collected using structured questionnaires, semi-structured interviews, and direct observations in the field. The questionnaire included both closed and open-ended questions to capture not only quantifiable data but also the personal experiences and viewpoints of participants. Field observations were made across central, intermediate, and outer regions of the study area, focusing on environmental quality, land use trends, drainage features, and susceptibility to environmental threats. Interviews were conducted with participants' consent, with audio recordings made and later transcribed for analysis. Secondary data were gathered from relevant literature, environmental documents, and institutional reports related to artisanal refining and environmental oversight in the Niger Delta. The main research tool featured a structured questionnaire aimed at gathering insights regarding the impacts of artisanal refining on crop yields, plant health, agricultural output, income levels, food security, and the sustainability of livelihoods. It also included assessments of views on environmental decline, regulatory shortcomings, and possible strategies for mitigation. Moreover, the study's spatial elements involved mapping the locations of artisanal refining in relation to agricultural lands and fishing areas within the study region. The population targeted by the study consisted of adult residents from communities within Okrika LGA where artisanal refining is widespread. Participants included heads of households, fishermen, farmers, vendors, skilled workers, small business proprietors, community representatives, youth advocates, and environmental activists. These groups were chosen due to their direct or indirect experiences with the environmental and socio-economic effects of artisanal refining. Socio-economic factors such as age, gender, educational background, occupation, income, household size, and length of residence were considered because these elements shape perceptions and vulnerability to environmental influences. Due to the lack of a detailed sampling framework, the overall population size could not be determined. The calculation of the sample size of 384 participants was performed utilizing Cochran’s formula intended for a limitless population, with a confidence level set at 95%, a margin of error of 5%, and a proportion estimated at 0.50. This number is deemed statistically sufficient to guarantee the representativeness and dependability of the results obtained. The distribution of the sample was proportional among significant stakeholder groups, which included heads of households, fishermen, farmers, traders, and community members, to achieve a variety of viewpoints and thorough coverage of the study aims. A multi-phase sampling method was employed. The initial phase involved the intentional selection of Okrika LGA, recognized for its role as a major site of artisanal refining operations. The subsequent phase consisted of the deliberate selection of impacted communities based on data gathered through field investigations, previous research, and discussions with local participants. The last phase involved randomly selecting participants within these communities to reduce sampling bias and improve representativity. Adults who had lived in the region for no less than two years and were willing to take part in the study were deemed eligible. To validate the research tool, it underwent evaluation for both face validity and content validity. Environmental management specialists reviewed the survey to determine its appropriateness, clarity, and thoroughness in meeting the study goals. Suggestions from these experts were integrated to enhance the tool. Reliability was measured through internal consistency and the test-retest approach. A preliminary investigation produced Cronbach’s alpha value of 0.76, indicating satisfactory reliability. The test-retest method

confirmed the instrument's consistency over time, with correlation values aligning with acceptable standards. Data evaluation incorporated both descriptive and inferential statistical methods. Descriptive statistics, including frequencies, percentages, tables, and visual displays, were employed to summarize the characteristics and responses of the participants. Inferential analysis was performed using Analysis of Variance (ANOVA) to evaluate hypotheses and investigate relationships among different variables. The level of statistical significance was set at 0.05. All data analyses were conducted using the Statistical Package for the Social Sciences (SPSS), version 25. In summary, the methodological framework provides a thorough, trustworthy, and policy-relevant evaluation of the environmental and social-economic effects of artisanal refining activities within Okrika LGA, establishing a foundation for evidence-based environmental management and sustainable development initiatives.

Results

Research Question One: What strategies for coping have been implemented by farmers, fishermen and fish merchants, household heads and adult inhabitants, traders and artisans, in addition to community and youth leaders and environmental contributors, as a reaction to the effects stemming from artisanal refining within the Okrika Local Government Area?

Table 4.1: Results of the Descriptive statistics of Respondent's perceived Coping Strategies across Livelihood Groups

Items	Household Heads (154) Mean	SD	Decision	Farmers (61) Mean	SD	Decision	Fishermen (77) Mean	SD	Decision	Traders (61) Mean	SD	Decision
Shifted income sources	4.10	0.82	Agree	4.12	0.80	Agree	4.05	0.84	Agree	4.08	0.83	Agree
Engagement in refining	3.90	0.98	Agree	3.85	1.02	Agree	3.80	1.05	Agree	3.88	0.99	Agree
Changes in fishing/fish-trading activities	4.15	0.79	Agree	4.20	0.76	Agree	4.05	0.82	Agree	4.10	0.80	Agree
Non-farm income reliance	4.20	0.77	Agree	4.25	0.74	Agree	4.12	0.81	Agree	4.18	0.78	Agree
Migration	3.85	1.02	Agree	3.90	0.98	Agree	3.80	1.05	Agree	3.88	1.00	Agree
Seeking Alternative Fish Markets/Sources	3.95	0.96	Agree	4.00	0.93	Agree	3.92	0.97	Agree	3.98	0.95	Agree
Community support	4.12	0.80	Agree	4.18	0.77	Agree	4.10	0.81	Agree	4.15	0.79	Agree
Small-scale trading	4.18	0.78	Agree	4.22	0.76	Agree	4.15	0.80	Agree	4.20	0.77	Agree
External support	3.88	1.00	Agree	3.95	0.96	Agree	3.85	1.01	Agree	3.90	0.98	Agree
Local adaptation	4.10	0.82	Agree	4.15	0.79	Agree	4.05	0.83	Agree	4.12	0.80	Agree
Grand mean	4.043	0.874	**Agree**	4.082	0.851	**Agree**	3.989	0.899	**Agree**	4.047	0.869	**Agree**

Respondents' Perceived Coping Strategies across Livelihood Groups

Table 1presents the findings of descriptive statistics regarding the perceived coping mechanisms utilized by respondents across various livelihood categories. The data shows that household heads, farmers, fishermen, and traders extensively apply diverse adaptive strategies to deal with the effects of artisanal refining. The average scores for all the surveyed aspects surpass 3.80, with overall means ranging from 3.98 to 4.06, indicating a general level of consensus. Furthermore, the standard deviations, between 0.74 and 1.05, imply moderate variability within the responses while still showing agreement on the findings. The approach of diversifying income sources is noted for its consistently elevated average scores (Household Heads: 4.10; Farmers: 4.12; Fishermen: 4.05; Traders: 4.08), highlighting that livelihood diversification serves as a major coping strategy. This is additionally supported by strong consensus on reliance on non-farm income (Household Heads: 4.20; Farmers: 4.25; Fishermen: 4.12; Traders: 4.18), indicating a significant alteration away from traditional jobs in response to environmental degradation. Adaptations in agriculture are seen through Changes in fishing/fish-trading activities (Household Heads: 4.15; Farmers: 4.20; Fishermen: 4.05; Traders: 4.10) and a decrease in farm size (Household Heads: 3.95; Farmers: 4.00; Fishermen: 3.92; Traders: 3.98), suggesting that farmers are modifying their production methods to address declining soil productivity. Additionally, small-scale trading (Household Heads: 4.18; Farmers: 4.22; Fishermen: 4.15; Traders: 4.20) is recognized as a commonly pursued alternative means of generating income.

Participation in refining activities (average scores between 3.80 and 3.90) indicates a contradictory coping method, where those affected partake in the very processes contributing to environmental harm, likely driven by economic necessity. Migration, with means ranging from 3.80 to 3.90, also illustrates spatial adaptation, although the marginally higher standard deviations imply a broader range of responses among respondents. Support systems are visible through community assistance (average scores from 4.10 to 4.18) and external support (averaging between 3.85 and 3.95), emphasizing the significance of both local support networks and outside interventions in alleviating impacts. Local adaptive practices (means falling between 4.05 and 4.15) further reinforce that respondents are actively modifying their approaches in response to changing environmental conditions. The overall mean scores (Household Heads: 4.02; Farmers: 4.05; Fishermen: 3.98; Traders: 4.06) reflect a strong level of agreement across all groups based on their livelihoods. In addressing the research question, the findings provide robust statistical evidence demonstrating that coping strategies incorporate livelihood diversification, involvement in informal and non-farm economic activities, alterations in agriculture, migration, community support systems, and, in certain instances, engagement in artisanal refining. These results highlight the adaptive capabilities of impacted communities, even while operating within limited socio-economic and environmental frameworks.

Research Question Two: How do all groups of respondents perceive the effects of artisanal refining practices on different elements of the natural environment, including land, water, air quality, and biodiversity in the Okrika Local Government Area?

Table 2: Results of the Descriptive statistics of Respondent's perceived Environmental Impact Perception across Groups

Items	Household Heads (154) Mean	SD	Decision	Farmers (61) Mean	SD	Decision	Fishermen (77) Mean	SD	Decision	Community Leaders (31) Mean	SD	Decision
Soil contamination	4.3	0.76	Agree	4.35	0.73	Agree	4.4	0.7	Agree	2.45	0.68	Disagree
Water pollution	4.32	0.75	Agree	2.38	0.72	Disagree	4.45	0.68	Agree	4.48	0.66	Agree
Air pollution	4.25	0.79	Agree	4.3	0.76	Agree	4.35	0.72	Agree	2.4	0.7	Disagree
Vegetation loss	4.2	0.82	Agree	4.25	0.79	Agree	4.3	0.75	Agree	2.35	0.72	Disagree
Aquatic life damage	4.28	0.77	Agree	2.33	0.74	Disagree	4.45	0.68	Agree	4.48	0.66	Agree
Farming/fishing difficulty	2.22	0.8	Disagree	4.3	0.76	Agree	4.38	0.7	Agree	4.42	0.68	Agree
Ecosystem damage	2.3	0.76	Disagreed	4.35	0.73	Agree	4.4	0.7	Agree	2.45	0.68	Disagree
Environmental degradation	3.33	0.74	Agree	4.38	0.72	Agree	4.42	0.69	Agree	4.46	0.67	Agree
Poor waste management	4.18	0.83	Agree	4.22	0.8	Agree	4.3	0.75	Agree	4.35	0.72	Agree
Severe pollution	4.35	0.73	Agree	4.4	0.7	Agree	4.45	0.68	Agree	4.5	0.65	Agree
Grand mean	3.773	0.775	Agree	3.926	0.745	Agree	4.39	0.705	Agree	3.634	0.682	Agree

Respondents' Perceived Environmental Impact across Groups

Table 2 illustrates the findings from the descriptive statistics regarding the perceived environmental effects among various respondent categories, including heads of households, agricultural producers, fishermen, and community representatives. The findings indicate that all four groups recognized environmental degradation linked to hydrocarbon activities as a serious environmental issue, as reflected by the overarching grand mean scores of 3.773 for household heads, 3.926 for farmers, 4.390 for fishermen, and 3.634 for community leaders. Given that all grand mean scores exceeded the established threshold value, it is evident that participants across these categories acknowledged the presence of environmental impacts in their localities. The standard deviation figures, which varied between 0.682 and 0.775, demonstrate a relatively minor range in responses, implying that individuals within each category shared similar views on environmental consequences. In the case of household heads, the data in Table 4.8 reveals their consensus on several key environmental impacts: soil contamination (Mean = 4.30, SD = 0.76), water pollution (Mean = 4.32, SD = 0.75), air pollution (Mean = 4.25, SD = 0.79), loss of vegetation (Mean = 4.20, SD = 0.82), harm to aquatic life (Mean = 4.28, SD = 0.77), inadequate waste management (Mean = 4.18, SD = 0.83), and extreme pollution (Mean = 4.35, SD = 0.73) were viewed as critical environmental issues facing their communities. However, they expressed disagreement regarding the assertion that agricultural and fishing activities had become more challenging due to environmental shifts (Mean = 2.22, SD = 0.80), as well as the notion that

ecosystem damage was a pressing issue (Mean = 2.30, SD = 0.76). The overall grand mean of 3.773 (SD = 0.775) suggests that heads of households viewed environmental degradation as a significant problem, particularly concerning pollution, contamination, and waste management.

The perspective of farmers, as presented in Table 4.8, indicates a strong recognition of the impact of environmental degradation on their means of living. Farmers acknowledged several environmental issues, including soil contamination (Mean = 4.35, SD = 0.73), air pollution (Mean = 4.30, SD = 0.76), loss of vegetation (Mean = 4.25, SD = 0.79), challenges in farming and fishing (Mean = 4.30, SD = 0.76), damage to ecosystems (Mean = 4.35, SD = 0.73), environmental degradation (Mean = 4.38, SD = 0.72), ineffective waste management (Mean = 4.22, SD = 0.80), and intense pollution (Mean = 4.40, SD = 0.70) as major environmental issues. In contrast, they disagreed that water pollution (Mean = 2.38, SD = 0.72) and damage to aquatic life (Mean = 2.33, SD = 0.74) constituted significant environmental concerns. The grand mean of 3.926 (SD = 0.745) indicates that farmers generally perceived a high level of environmental degradation, particularly in relation to aspects that directly influence agricultural productivity, soil health, plant life, and challenges to their livelihoods.

For fishermen, Table 4.8 indicates the highest degree of awareness regarding environmental impacts among all surveyed groups, achieving a grand mean score of 4.390 (SD = 0.705). Fishermen expressed agreement on issues such as soil contamination (Mean = 4.40, SD = 0.70), water pollution (Mean = 4.45, SD = 0.68), air pollution (Mean = 4.35, SD = 0.72), loss of vegetation (Mean = 4.30, SD = 0.75), harm to aquatic life (Mean = 4.45, SD = 0.68), challenges in farming and fishing (Mean = 4.38, SD = 0.70), damage to ecosystems (Mean = 4.40, SD = 0.70), environmental decline (Mean = 4.42, SD = 0.69), ineffective waste management (Mean = 4.30, SD = 0.75), and high levels of pollution (Mean = 4.45, SD = 0.68). This suggests that fishermen see environmental deterioration as having extensive repercussions on aquatic habitats, water quality, and their working conditions. The relatively elevated mean scores across all factors imply that fishermen are the most impacted group due to their direct reliance on natural resources, especially rivers and aquatic ecosystems, for their means of livelihood. The results pertaining to community leaders in Table 4.2 indicate that they also consider environmental deterioration to be a significant issue, reflected by a grand mean of 3.634 (SD = 0.682). Community leaders acknowledged issues like water pollution (Mean = 4.48, SD = 0.66), damage to aquatic life (Mean = 4.48, SD = 0.66), challenges in farming and fishing (Mean = 4.42, SD = 0.68), environmental decline (Mean = 4.46, SD = 0.67), ineffective waste management (Mean = 4.35, SD = 0.72), and high pollution levels (Mean = 4.50, SD = 0.65) as critical environmental challenges. Conversely, they did not agree that soil contamination (Mean = 2.45, SD = 0.68), air pollution (Mean = 2.40, SD = 0.70), loss of vegetation (Mean = 2.35, SD = 0.72), and damage to ecosystems (Mean = 2.45, SD = 0.68) were major issues. This indicates that community leaders focused more on evident community-level effects like pollution, disruption of livelihoods, and waste management rather than specific ecological factors. The insights from Table 4.2 illustrate that perceptions of environmental degradation vary among different occupational and social groups based on their interaction with the natural environment. Fishermen displayed the highest awareness of environmental impacts, highlighting their susceptibility to water pollution, damage to aquatic ecosystems, and declining fishing conditions. Farmers also conveyed significant environmental concerns, particularly with soil quality, loss of vegetation, and agricultural efficiency. Household heads and community leaders recognized environmental issues as well, although they exhibited differences in which specific ecological indicators, they deemed most critical. The findings suggest

that environmental degradation linked to hydrocarbons has influenced various aspects of community life, including natural resources, economic activities, and the sustainability of livelihoods.

H_o1: There is no significant difference in the coping strategies adopted by farmers, fishermen/fish traders, household heads/adult residents, traders/artisans, and community leaders/youth leaders/environmental stakeholders in response to the effects of artisanal refining in Okrika Local Government Area.

Table 3: One-Way ANOVA Results on Coping Strategies Adopted in Response to Artisanal Refining Impacts among Household Heads, Farmers, Fishermen/Fish Traders, and Traders/Artisans

Source of Variation	Sum of Squares	Df	Mean Square	F-value	Sig. (p-value)	Decision
Between Groups	1.628	3	0.543	1.542	0.204	Not Significant
Within Groups	99.420	282	0.352			
Total	101.048	285				

Table 4: Results of the Post Hoc Test (Tukey HSD)

Comparison	Mean Difference	Sig.	Decision
Household Heads vs Farmers	-0.03	0.944	Not Significant
Household Heads vs Fishermen	0.04	0.823	Not Significant
Household Heads vs Traders	-0.04	0.862	Not Significant
Farmers vs Fishermen	0.07	0.591	Not Significant
Farmers vs Traders	-0.01	0.995	Not Significant
Fishermen vs Traders	-0.08	0.537	Not Significant

Table 3 displays the outcomes of the One-Way ANOVA conducted on the coping strategies utilized by household heads, farmers, fishermen/fish traders, and traders/artisans in relation to the impacts of artisanal refining. The results demonstrate that there are no statistically significant differences found among the four groups of respondents concerning the coping strategies they implemented. The analysis yielded an F-value of 1.542 along with a p-value of 0.204, which exceeds the significance threshold of 0.05. Thus, the null hypothesis (H_o1), which posits that there is no notable difference in the coping strategies used by the different respondent groups due to artisanal refining impacts, is upheld. This finding implies that, despite varying occupations and livelihood sources, the respondents exhibit comparatively similar adaptation and coping methods when addressing the repercussions of artisanal refining. The mean square value between groups was 0.543, in contrast to the within-group mean square value of 0.352, indicating that the

differences observed among the groups are minimal and likely arise from natural variations among individuals rather than systematic distinctions across stakeholder types.

Table 4 provides the results of the Tukey HSD post hoc test regarding the differences in coping strategies among household heads, farmers, fishermen/fish traders, and traders/artisans. The findings reveal that all pairwise comparisons did not yield statistically significant results. The comparison between household heads and farmers showed a mean difference of -0.03 with a p-value of 0.944, whereas the difference between household heads and fishermen indicated a mean difference of 0.04 with a p-value of 0.823. The analysis between household heads and traders also revealed no significant difference, presenting a mean difference of -0.04 and a p-value of 0.862. Likewise, when comparing farmers with fishermen and traders, the recorded p-values were 0.591 and 0.995 respectively, while the comparison between fishermen and traders resulted in a p-value of 0.537. As all p-values surpassed 0.05, there is no indication of significant differences in coping strategies among the respondent groups. These findings support the ANOVA results, suggesting that coping responses to the impacts of artisanal refining are largely consistent throughout the communities, regardless of occupation or stakeholder classification. Thus, H_{04} is validated, confirming that respondents employ similar strategies to manage the social, economic, and environmental outcomes linked to artisanal refining operations in Okrika Local Government Area.

Discussion of Findings

Coping Strategies Employed by Impacted Livelihood Groups

The results indicated that individuals from various livelihood sectors—including heads of households, farmers, fishermen, and merchants—utilize a range of coping strategies to deal with the effects of artisanal refining within Okrika LGA. The primary strategies identified encompass livelihood diversification, a greater dependency on income from non-agricultural sources, engagement in small-scale commerce, migration, reliance on community support, and even, in certain instances, involvement in artisanal refining activities. The elevated average scores (greater than 3.80) for all aspects suggest a robust consensus that families are proactively modifying their approaches to cope with environmental and socio-economic disturbances. The most significant coping method recognized is income diversification, which indicates a transition from conventional livelihoods like farming and fishing. This observation aligns with the work of Oluwole et al. (2013), who found that oil pollution in the Niger Delta compels families to find varied income sources as agricultural productivity and fish populations diminish. In a similar vein, Adewale and Jegede (2019) indicated that rural households in regions affected by oil production increasingly turn to informal economic pursuits as a means of survival. Notably, the involvement of participants in artisanal refining as a coping method stands out. This aligns with Naanen (2012), who noted that illegal oil refining in the Niger Delta is partially fueled by the collapse of livelihoods resulting from environmental damage and unemployment. The utilization of migration as a coping strategy is also in line with Watts (2004), who reported that environmental displacement frequently occurs in communities engaged in oil production. The ANOVA findings ($p > 0.05$) reveal no significant differences in coping strategies among various livelihood groups, indicating a uniformity in adaptation patterns. This observation is supported by Akinola (2018), who remarked that the consequences of oil pollution create consistent socio-economic challenges across different occupational groups in affected areas.

Perceived Environmental Effects of Artisanal Refining

The findings illustrate that all groups surveyed generally recognize significant environmental degradation due to artisanal refining. Major impacts highlighted include soil pollution, contamination of water resources, air quality deterioration, loss of vegetation, destruction of aquatic life, and widespread environmental harm. Fishermen reported the highest awareness of environmental issues (grand mean = 4.390), followed closely by farmers and heads of households, suggesting that those most reliant on natural resources possess a heightened understanding of environmental decline. These results are corroborated by UNEP (2011), which indicated considerable hydrocarbon pollution in the Niger Delta, especially in Ogoniland, where soil and groundwater contamination severely disrupts livelihoods. Likewise, Ibaba (2010) found that oil pollution drastically decreases fish populations and harms aquatic ecosystems within coastal communities. The strong agreement regarding water pollution and damage to aquatic life among fishermen corresponds with Aghalino (2009), who documented that oil spills and waste from artisanal refining significantly contribute to the depletion of fish stocks in the Niger Delta. Nevertheless, the discrepancies in perception among community leaders and heads of households reveal differences in environmental awareness, a pattern consistent with Nzeadibe et al. (2011), who noted variations in environmental risk perception based on profession and direct interactions with ecological resources. The relatively high standard deviation values indicate a moderate degree of variability in perceptions, likely reflecting differences in exposure levels and the spatial distribution of pollution, as observed by Onuoha (2016).

Relationship between Livelihood Groups and Coping Strategies

The result from the ANOVA shows no significant statistical difference ($F = 1.542$, $p = 0.204$) in the coping mechanisms utilized by the four different livelihood groups. This implies that the effects of artisanal refining lead to similar adaptive behaviors across various occupational sectors. This conclusion aligns with the findings of Adetola and Olajide (2017), who noted that environmental decline in oil-producing areas creates comparable livelihood pressures among both farming and fishing families, resulting in similar coping strategies. The results from the Tukey post hoc analysis further validate the lack of significant differences between the groups. This is in agreement with Egunjobi (2015), who contended that the environmental challenges faced by communities in the Niger Delta are fundamentally structural and not tied to specific occupations, resulting in similar socio-economic reactions. The implication is that artisanal refining exerts a comprehensive effect on rural lifestyles, driving convergence towards survival strategies that include diversification, informal trading, and migration. The results highlight that artisanal refining operations in Okrika LGA have had varied consequences that span environmental damage and changes in socio-economic structures. Even though the awareness of environmental harm is extensive and substantial, the coping methods are mostly similar among different livelihood sectors. This mirrors wider trends noted in studies from the Niger Delta, where environmental degradation has transformed rural economies, diminished the productivity of agriculture and fisheries, and heightened reliance on informal and extractive survival tactics (UNEP, 2011; Watts, 2004).

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