

ASSESSMENT OF THE SOCIOECONOMIC EFFECTS OF ILLEGAL ARTISANAL PETROLEUM REFINERIES ON FARMERS IN GOKANA LOCAL GOVERNMENT AREA, RIVERS STATE, NIGERIA

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ABSTRACT

The environmental degradation caused by illegal artisanal refineries has led to severe pollution of agricultural land and water sources, adversely affecting crop yields and farmers' livelihoods. The primary objective of the study is to evaluate the socio-economic implications of these activities on farmers in Gokana LGA. A mixed-methods approach was employed, gathering data from 357 respondents through copies of a structured questionnaire and field observations. Descriptive statistics were used to analyze the collected data. The findings reveal that many farmers reported changes in crop yields due to artisanal refining, with some noting a decrease in quantity and others experiencing a decline in quality. Additionally, numerous respondents indicated reduced income linked to environmental pollution and increased health risks, particularly among married respondents who face heightened economic pressures. Furthermore, a significant number of respondents observed an increase in artisanal refining activities over the past five years, exacerbating these challenges. The study concludes that although some immediate physical impacts may not be evident for all crops, ongoing artisanal refining poses substantial long-term risks to agricultural sustainability and food security. The study recommends that policymakers strengthen regulatory frameworks, promote sustainable agricultural practices, engage local communities in decision-making and develop alternative livelihood opportunities. Implementing these measures is essential to enhancing farmers' well-being and ensuring sustainable agricultural practices in the Niger Delta region.

Keywords: *Agricultural Productivity; Environmental Degradation; Illegal Artisanal Refineries; Socio-Economic Impact.*

1. INTRODUCTION

The Niger Delta region of Nigeria is rich in petroleum resources, which have been exploited through oil drilling and refining for decades (Kadafa, 2012). While commercial refineries exist, many illegal, crude artisanal refineries have sprung up, tapping into oil pipelines to distill fuels for local use and sale (Ghereje, 2020). These artisanal operations employ rudimentary techniques without environmental safeguards, releasing hazardous pollutants into the air, soil and water (Glory, Chibueze, Raimi & Iyingiala, 2023). While these illegal refineries provide employment, income and cheaper energy for local communities, they pose significant environmental and socio-economic concerns (Ogele & Egbueze, 2020; Gbarakoro & Nwagbara, 2023).

Illegal artisanal refining activities severely impact the local economy and the well-being of farming communities. A primary concern is the pollution of agricultural land and water sources from oil spills, which degrades soil quality and limits productive farmland (Nta *et al.*, 2017;

Emiabata, 2021; Ottih, Barikor & Alapiki, 2023). Additionally, the presence of these illegal refineries creates a climate of fear among farmers due to potential encounters with rival gangs and security raids (Niger Delta Partnership Initiatives, 2022). These security challenges disrupt regular farming activities, reducing crop yields and affecting food security.

Moreover, the methods used to combat illegal refineries, such as burning them down, often extend to nearby farmlands, destroying crops and further reducing arable land. Government efforts like amnesty programs and the Hydrocarbon Pollution Remediation Project (HYPREP) have yet to fully address these issues (Owolabi, 2022). The United Nations Environmental Programme (UNEP) highlights the extensive soil, water, and air pollution caused by these illegal artisanal activities, leading to severe health and environmental problems (UNEP, 2011).

Pollutants from artisanal refining have far-reaching implications for agriculture. Acid rain and chemicals like sulfur dioxide (SO₂) and volatile organic compounds (VOCs) damage crops and exacerbate respiratory issues in humans (Emiabata, 2021). Studies such as those by Weli & Kobah (2014) in the Bomu oil field show the burden of air pollution by gas fire explosion degrading the air quality of surrounding communities, while Morakinyo (2023) revealed the negative impacts of flaring sites on agricultural practices within the Niger Delta. The displacement of farmers and reduced agricultural productivity threaten food security and the health of farming households (Esu & Dominic, 2013).

Despite extensive research on environmental impacts in the Niger Delta, there is a significant gap in studies focusing specifically on the effects of illegal artisanal refineries on farmers' livelihoods in Gokana LGA. Previous studies have primarily examined gas flaring or crude oil spillage, often neglecting the human factors influencing crop growth and yield (Onuh *et al.*, 2021; Mzaga, Tse & Nwankwoala, 2021; Agheyisi, 2023). The socio-economic implications of these activities on farmers remain inadequately explored.

Gokana LGA is heavily impacted by artisanal refining due to its abundance of oil fields. Illegal artisanal refining in Gokana LGA severely impacts agricultural sustainability by degrading farmland and contaminating water sources. This leads to reduced crop yields, financial instability, and health risks for farmers. Despite awareness of these issues, there is limited research on the specific socio-economic impacts on farmers' productivity and livelihoods. Addressing this gap is vital for developing effective mitigation strategies.

This study aims to assess the effects of these illegal refineries on the livelihood of farmers in Gokana LGA, Rivers State, Nigeria. The objectives are to assess the socio-demographic characteristics of the farmers and investigate the socio-economic impacts of illegal artisanal petroleum refining on farmers in Gokana LGA. The scope of the study focuses on the socio-economic implications of illegal artisanal petroleum refineries for farmers, including their socio-demographic characteristics and their perception on the socio-economic effect of this activity on their livelihood.

2. CONCEPTUAL FRAMEWORK

2.1 Artisanal Petroleum Refineries

Artisanal refining refers to small-scale crude oil processing that often occurs outside formal regulatory frameworks (Mezie-Okoye, 2022). Known colloquially as “*kpo-fire*” in the Niger Delta region of Nigeria, these operations are typically conducted by local communities seeking alternative means of livelihood in the absence of formal employment opportunities (Agheyisi,

2023). However, artisanal refineries have significant negative impacts on the environment, public health, and socio-economic development.

These refineries utilise locally available resources and knowledge but lack proper equipment and safety measures. The processes involved are primitive, often using metal containers heated over open fires to produce kerosene, diesel, and gasoline (Glory *et al.*, 2023). Artisanal operators illegally siphon crude oil from pipelines and process it in makeshift facilities, contributing to environmental degradation and social issues (Ikezam, Elenwo, & Oyegun, 2021).

The environmental consequences of artisanal refining are severe. The emissions from these operations release harmful pollutants that degrade air quality and pose health risks to local populations (Ephraim-Emmanuel, Enembe, & Ordinioha, 2023). Studies have linked exposure to these pollutants with respiratory diseases and other health problems (Onuh *et al.*, 2021; Ikezam *et al.*, 2021). Furthermore, improper disposal of waste products contaminates local water sources, threatening food security and agricultural productivity (Suku, Ugwoha, & Orikpete, 2024).

2.2. Agricultural Activities

Agricultural activities encompass a range of practices related to the cultivation of crops and rearing of animals for food and other products essential for human sustenance (Food and Agriculture Organization (FAO), 2017). In Nigeria, agriculture is a dominant economic activity, with over 70 million acres of fertile land supporting various staple and cash crops (FAO, 2023). However, farming practices remain largely traditional and manual, with about 70% of families relying on crop production for their livelihoods. The major crops grown include cereals (maize, rice), tubers (yam, cassava), legumes (beans), and oil seeds (groundnuts), cultivated across different regions based on climatic conditions (FAO, 2023). Traditional farming methods involve manual labour with minimal mechanization or external inputs (Enete & Amusa, 2010).

2.3. Agricultural Livelihood

The concept of agricultural livelihood refers to the means by which individuals sustain themselves through agricultural practices (FAO, 2016). It encompasses production, processing, marketing of agricultural products, and natural resource management. Agricultural livelihoods are vital for food security and poverty reduction but are often vulnerable to risks such as climate change and market fluctuations.

In the Niger Delta region, where artisanal petroleum refineries pose significant threats to public health and environmental integrity, agricultural livelihoods face severe challenges. The adverse effects of artisanal refining include the loss of arable land and contamination of water sources critical for farming (Ikezam *et al.*, 2021). To enhance resilience in agricultural livelihoods affected by artisanal refining, measures such as alternative livelihood programs and community-based monitoring are essential (Ottih *et al.*, 2023). These initiatives can help mitigate the negative impacts on farmers' health and productivity while promoting sustainable food systems.

2.4. Sustainable Livelihood Framework

This study is underpinned by the Sustainable Livelihood Framework (SLF), developed in the mid-1980s by Robert Chambers and Gordon Conway. The SLF provides a comprehensive approach to assessing and understanding livelihoods, particularly in rural areas, based on six core concepts: people-centered, holistic, dynamic, building on strengths, macro-micro links and sustainability (Kollmair & Gamper, 2002).

The SLF recognizes that livelihoods are influenced by a range of factors, including access to resources, market conditions, climate and government policies (Mazikana, 2023). It

acknowledges the dynamic nature of livelihoods, which can change over time due to various external factors (Kollmair & Gamper, 2002). The framework emphasizes building on the assets and capabilities of individuals and communities (Matiwane & Matiwane, 2023), while also highlighting the interconnectedness between local and national levels.

By adopting the SLF, this study aims to provide a structured analysis of the impacts of illegal artisanal petroleum refineries on farmers' livelihoods in Gokana LGA. This approach allows for the proposal of targeted mitigation strategies and offers a comprehensive understanding of how interventions can support sustainable livelihoods, enhance resilience, and promote well-being in affected communities.

2.4.1 Literature Review

Artisanal petroleum refining in the Niger Delta has emerged as a response to socio-economic challenges, providing local employment but also causing significant environmental and health issues (Suku *et al.*, 2024). Studies have explored the socio-economic implications, environmental degradation, and public health risks associated with these practices.

Yang *et al.* (2004) investigated the association between living near oil refineries in Taiwan and the risk of preterm birth, finding that mothers living within 3 km of oil refineries had a significantly higher prevalence of preterm births compared to those in control areas. This highlights the potential public health impacts of industrial air pollution. Mezie-Okoye (2022) examined the socioeconomic implications of artisanal refining in Nigeria's Niger Delta, revealing that while these refineries provide economic benefits, they also result in serious health consequences, including air pollution and fatalities. The study emphasizes the need for awareness about the environmental impacts of artisanal refining. Onwuna *et al.* (2023) assessed residents' perceptions of soot pollution from artisanal refineries, finding widespread discomfort and health complaints among those living nearby. This underscores the urgent need to address environmental and health risks in the Niger Delta.

Onuh *et al.* (2021) highlighted environmental pollution caused by illegal artisanal refineries, linking their activities to oil spills, water contamination, and biodiversity loss. The study stresses that these operations hinder cleanup efforts and pose significant ecological threats.

Ikezam *et al.* (2021) reported severe environmental pollution from artisanal refineries, leading to respiratory illnesses and economic losses due to damaged farmlands and fishing waters. The authors call for stricter regulations and sustainable development strategies. Uzoekwe (2019) investigated gas flaring's impact on soil fertility, finding significant reductions in soil nutrient levels near flare sites. Similarly, Okeke (2019) noted that gas flaring negatively affects soil quality indicators essential for agriculture. Despite existing studies highlighting both benefits and drawbacks of artisanal refining, there remains a significant gap in understanding its specific impacts on farmers' livelihoods in Gokana LGA. Most research has focused on environmental pollution and health effects rather than directly assessing agricultural productivity and farmer incomes.

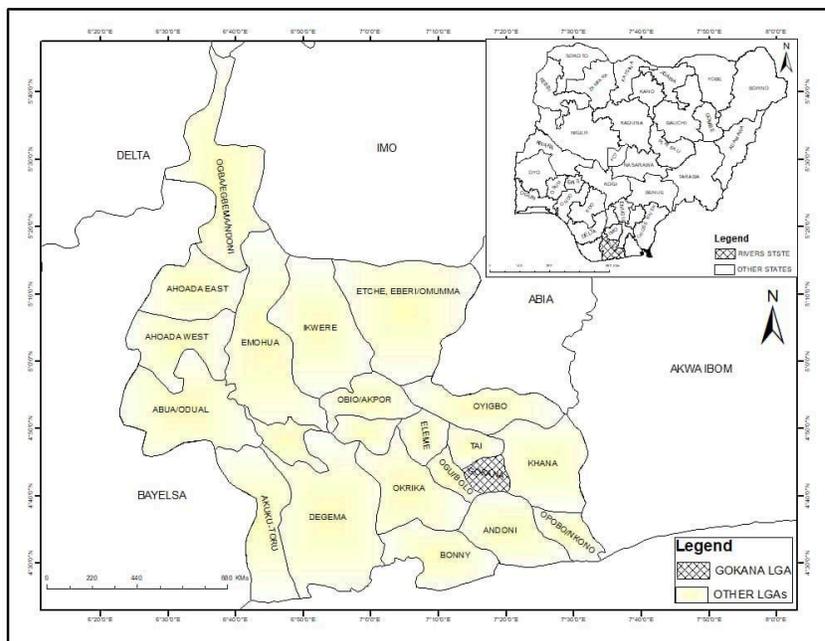


Figure 1: Gokana LGA in Rivers State, Nigeria
 Source: Department of Geography, Nigerian Defence Academy, Kaduna. 2024

3. MATERIALS AND METHODS

This study employed a mixed-methods approach to assess the effects of illegal artisanal petroleum refineries on farmers' livelihoods in Gokana Local Government Area (LGA), Rivers State, Nigeria. A survey research design was utilised, with primary data collected through copies of a structured questionnaire and supplemented by field observations. The questionnaire focused on various aspects including the socio-demographic characteristics of the respondents and socio-economic impacts of artisanal refining.

A multi-stage sampling technique was employed to ensure representative sampling. In the first stage, five farming communities (Bomu, K-Dere, Kpor, B-Dere and Mogho) were purposively selected for the study from the sixteen communities in Gokana LGA based on agricultural activities and artisanal refining activities. The second stage utilised snowball sampling to identify individual farmers within these communities, an approach particularly useful given the lack of a comprehensive farmer database.

The sample size of 399 was determined using the Yamane (1967) formula, based on the projected 2022 population of 336,300 (City Population, 2022). Out of 399 questionnaires administered, 357 valid responses were obtained, yielding a response rate of 89.5%. Data collection was conducted during the rainy season by four trained research assistants fluent in the local Gokana language. Data analysis was performed using the Statistical Package for Social Sciences (SPSS), employing descriptive statistics such as frequencies and percentages.

Gokana Local Government Area (LGA) in Rivers State, Nigeria is located in the South-South geopolitical zone with its headquarters at Kpor. It was created in 1991 from the former Gokana/Tai/Elemo LGA, Gokana and comprises sixteen communities: Kpor, Bodo City, Biara, Deeyor, B-Dere, K-Dere, Bera, Nwe-ol, Mogho, Bomu, Yeghe, Deken, Lewe, Gbe, Barako, and

Nwebiara. The LGA spans 126 km², lying between 10 to 25 meters above sea level and is bounded by Tai, Khana, Andoni, and Ogu/Bolo LGAs. The tropical climate features a wet season from April to October and a dry season from November to March, with cumulative annual rainfall between 1,600mm and 2,200mm and temperatures ranging from 31°C to 34°C (Wizor & Eludonyi, 2020; Nigerian Meteorological Agency, 2024).

Gokana's economy is predominantly agrarian, with farming and fishing as primary activities. The region cultivates crops such as cassava, yam, cocoyam, vegetables, plantain, oil palm, okra, rice, beans, soya beans, guinea corn, maize, and groundnut, which account for approximately 70% of the agricultural sector (Gabriel, Onyukwu, & Ikpeze, 2015; Nlerum & Kue, 2015). The rich soil and favorable climate support these crops, providing significant income. Despite traditional farming practices, there is a growing emphasis on sustainable agriculture to combat challenges like limited access to modern implements and the impact of oil spills.

4. RESULTS AND DISCUSSION

Table 1 Demographic Characteristics of Respondents

Sex	Frequency	%
Male	156	43.7
Female	201	56.3
Total	357	100.0
Age		
18-25	21	5.9
26-35	78	21.8
36-45	149	41.7
46-55	71	19.9
56- above	38	10.7
Total	357	100.0
Marital status		
Never married	26	7.3%
Married	322	90.2
Widowed	9	2.5
Total	357	100.0
Farming experience		
Since childhood	109	30.5
1 year < 2 years	27	7.6
2 years < 5 years	63	17.6
5 years< 10 years	51	14.3
10 years and above	107	30.0
Total	357	100.0
Estimated Monthly Income		
<₦30,000	65	18.2
₦30,000 – ₦60,000	161	45.1
₦ 61,000 - ₦90,000	43	12.0
₦91,000-₦120,000	27	7.6
Above ₦120,000	61	17.1
TOTAL	351	100.0

Source: Fieldwork (2023)

4.1 Demographic and Socio-Economic Characteristics of the Respondents

In this study, the demographic and socioeconomic variables of the respondents, including their sex, age, marital status, farming experience and monthly income were considered and presented in Table 1. The results from Table 1 reveal the gender distribution of respondents, indicating that 43.7% were male and 56.3% were female. The higher percentage of female respondents can be attributed to traditional roles in farming and food production in rural areas, where women often remain while men seek opportunities in urban centers. This finding suggests that women may be more affected by the impacts of illegal artisanal petroleum refining on agriculture due to their greater involvement in agricultural activities. The study agrees with Odunze and Abubakar (2019) whose study examined the effect of gas flaring on crops in Andoni, Rivers State and found more female respondents at 57.7%.

The majority of respondents (41.7%) were aged 36-45 years, followed by 21.8% aged 26-35 years. This suggests that the most active farming participants are within their prime working years. The younger age group (18-25) was less represented (5.9%), likely due to migration for non-agricultural opportunities. These findings are consistent with studies by Esu and Dominic (2013) and also Nlerum and Kue (2015) whose studies revealed a predominance of middle-aged farmers in the Niger Delta.

Marital status data indicates that 90.2% of respondents were married, reflecting cultural norms in the Niger Delta where marriage is highly valued. This demographic characteristic is significant as it indicates that those reporting on the impacts of the illegal artisanal refining have personal responsibilities that heighten their awareness of environmental degradation's effects on agricultural productivity and food security. This study agrees with Suku *et al.* (2024), that the environmental degradation caused by artisanal refining often leads to reduced agricultural yields, thereby diminishing the income of farming families. This economic strain is particularly pronounced among married respondents, who may already be facing financial pressures to provide for their families.

Farming experience in the study area varied, with 30.5% having farmed since childhood and 30% for over ten years. Those with extensive farming experience are likely more cognizant of the environmental degradation caused by illegal refineries. This distribution aligns with Odunze and Abubakar's (2019) findings, where 57% of respondents had over ten years of farming experience.

Monthly income levels revealed that 45.1% of respondents earn between ₦30,000 and ₦60,000 per month, indicating economic vulnerability despite being above the national minimum wage as at the time of the study (2023). A significant portion (18.2%) earns less than ₦30,000 monthly, highlighting economic challenges faced by many farmers in the area. These findings suggest that low incomes could exacerbate vulnerabilities to the negative effects of artisanal refining. This finding agrees with Ojide's (2016) study, which indicated that about 65% of respondents earned less than ₦60,000 monthly.

Table 2: Types of crops grown in the study area.

Crops	Count	Percentage of Respondents (N=357)
Maize	96	26.1
Plantain and Banana	167	46.8
Rice	12	3.4
Yam	60	16.8
Vegetable	60	16.8
Cassava	326	91.3
Others	24	6.7
Total	745	
Estimated Farm sizes cultivated (Acre)		%
<1	149	49.7
1-2	84	23.5
3-4	54	15.1
5-6	43	12.0
>6	27	7.5
Total	357	100.0

Note: Multiple responses were allowed.

Percentages are calculated based on the total number of respondents (N=357).

Source: Fieldwork (2023)

4.2 Crops Grown in the Study Area

The study revealed that cassava is the most commonly grown crop in Gokana LGA, cultivated by 91.3% of respondents. Plantain and banana are the next most common crops, grown by 46.8%. Maize is farmed by 26.1%, while yam and vegetables are each grown by 16.8%. Rice is the least cultivated crop at 3.4%, with other crops, including oil palm, grown by 6.7%.

The high level of cassava cultivation can be attributed to its resilience and suitability to local soil and climate conditions. Cassava's versatility as a food source and its economic value in local markets make it a staple in the region. It is a valuable crop for both subsistence and commercial farmers and has a significant economic value in the local market as it can be used to make a variety of food products such as *garri*, "starch", *akpu*, *tapioca* or cooked. All of which provide a significant source of revenue to the farmers and the processors. Conversely, rice has the lowest cultivation rate at 3.4%, likely due to its higher resource requirements and the pollution affecting local water bodies.

The significant cultivation of plantain, banana, yam and vegetables reflects their importance in local diets and their role in food security and economic stability. Overall, the dominance of cassava and plantain cultivation suggests that these crops are particularly at risk from the impacts of illegal artisanal petroleum refineries, which could have significant socio-economic implications for local food security and economic stability. The findings corroborate previous research by Uche *et al.* (2016) and Nlerum and Kue (2015), confirming that cassava remains a crucial crop in the region.

The majority of farmers (49.7%) cultivate less than 1 acre of land. Farms sized between 1-2 acres are cultivated by 23.5%, 3-4 acres by 15.1%, 5-6 acres by 12.0%, and more than 6 acres by 7.5%. The dominance of small farm sizes is likely due to land degradation and pollution from artisanal refineries, which limit the availability of arable land. Small farms are more vulnerable

to yield losses and have limited capacity for diversification, making them particularly susceptible to environmental disruptions. These sizes imply that smaller farms, often operated by economically vulnerable farmers, are disproportionately affected by the negative impacts of artisanal refining. Reduced crop yields and increased costs from land degradation can exacerbate poverty and threaten food security in Gokana LGA. These findings differ from Nlerum and Kue (2015) in Gokana, who reported larger farm sizes 2-4 acres as more common, likely due to differences in sample size and scope.

Table 3: Frequency of Illegal Artisanal Refineries Activities and Level of Satisfaction with Illegal Artisanal Petroleum Refineries by Respondents

Frequency of Flaring from Illegal Artisanal Refineries	Frequency	%
Irregularly	357	100.0
Total	357	100.0
Frequency of Artisanal Refineries Activities over the Past Five Years		
Increased	318	89.0
Remained the same	25	7.0
Decreased	14	4.0
Total	357	100.0
Level of Satisfaction with Artisanal Refineries		
Very satisfied	-	-
Somewhat satisfied	4	1.1
Neither satisfied nor dissatisfied	19	5.3
Somewhat dissatisfied	28	7.8
Very dissatisfied	306	85.7
Total	357	100.0

4.3 Frequency of Artisanal Refineries Activities and Level of Satisfaction Observed on Crops Yields

The findings presented in Table 3 indicate that all respondents (100%) reported irregular frequencies of activities from illegal artisanal refineries, with 89% noting an increase in these activities over the past five years (2019-2023). This rise was attributed to the proliferation of illegal artisanal refineries, which contribute significantly to air pollution through soot emissions, particularly as operations from established companies like Shell Petroleum Development Company have diminished. The term "*Kpo-fire*" is commonly used in the Niger Delta to describe the illegal refining process, which involves heating crude oil in large cauldrons over open fires, resulting in severe smoke and environmental contamination.

Respondents expressed a high level of dissatisfaction with artisanal refining activities, with 85.7% reporting they were very dissatisfied. This dissatisfaction reflects the significant negative impacts of flaring on their agricultural practices, including air pollution, soil degradation and health issues stemming from soot exposure. The flares not only release pollutants that can fall as acid rain but also increase soil temperatures, harming crop viability and reducing agricultural productivity. Additionally, the presence of illegal refining activities was reported to instill fear among farmers due to associated violence and competition among rival gangs, further complicating their ability to farm effectively. While a small proportion of respondents (1.1%) reported being somewhat satisfied with artisanal refining—potentially due to limited economic

opportunities it provides for some youth, the overwhelming majority perceive the negative consequences as outweighing any benefits. This finding aligns with previous research by Odubo & Onyige (2019), which documented similar adverse effects on agriculture in the Niger Delta. Overall, these results underscore the urgent need for effective interventions to address the environmental and socio-economic challenges posed by artisanal petroleum refining in Gokana LGA.

Table 4: Changes on Crops Observed by Farmers

Observed changes in crop yield	Frequency	%
Yes	278	77.9
No	79	22.1
Total	357	100.0
Description of changes observed		
Decreased in quantity	152	42.6
Decrease in quality	104	29.1
Increase quantity	22	6.2
Increase in quality	0	0.0
Not affected in any way	79	22.1
Total	357	100.0

Source: Fieldwork (2023)

4.4 Socio-Economic Effects of Illegal Artisanal Refineries in Gokana LGA

4.4.1 Perceived Impacts of Illegal Artisanal Refineries on Agriculture

As shown in Table 4, a majority of farmers (77.9%) reported changes in crop yields due to these activities. Specifically, 42.6% noted a decrease in quantity, and 29.1% experienced a decline in quality, highlighting the detrimental effects of pollution from oil spills, gas flaring, and other refining processes. Research corroborates these findings, indicating that crops such as cassava, maize, and peppers are particularly vulnerable to contamination and environmental degradation associated with artisanal refining. For instance, Nwankwoala *et al.* (2017) found that soil contamination from these activities leads to toxic substance accumulation, adversely affecting crop growth. Similarly, Morakinyo (2023) reported that flaring has an impact on vegetation and its growth, as well as on agricultural activities and the productivity of various plant species in the Niger Delta.

Some farmers observed that maize and waterleaf were not affected during the study period and this may likely due to the mobile nature of artisanal refining, they appeared visually healthy during the survey (Plate I). However, Pawpaw was said not to be thriving in the area since the illegal artisanal refining activities increased.



Plate I: Maize and waterleaf crops appeared unaffected by the presence of artisanal refineries within the study area

Source: Researchers Fieldwork (2023)

The overall findings suggest that while immediate physical impacts may not be evident for all crops at this time, ongoing artisanal refining without effective regulation could threaten food security and economic stability for farmers in Gokana LGA. The need for balanced enforcement of environmental regulations alongside economic alternatives is critical to preserving agricultural viability in the region. These findings align with a study by Odunze and Abubakar (2019), which documented declines in crop yields due to gas flaring and environmental degradation. Addressing these challenges is essential for safeguarding the livelihoods of farmers and ensuring sustainable agricultural practices in the Niger Delta.

Table 5: The Effect of Artisanal Refineries on Income and Livelihood Gokana LGA

Effect of Artisanal Refineries on Income	Respondents	%
Decreased income	298	83.5
No effects on income	46	12.9
Increased income	13	3.6
Total	357	100.0
	Respondents N=357	% N=100
How artisanal refineries affect income and livelihood		
Reduces income and savings	283	79.2
Increases expenses and debts	264	74.0
Forces migration or relocation	232	65.0
Creates conflicts or insecurity	179	50.1
Other	41	11.5
Total	Multiple responses allowed N=357	

Source: Fieldwork (2023)

4.5 Effect of Illegal Artisanal Refineries on Farmers Income

Findings from Table 5 indicate that 83.5% of respondents reported a decrease in income due to the presence of these illegal refineries. A further breakdown reveals that 79.2% experienced reduced income and savings, while 74.0% faced increased expenses and debts. Additionally, 65.0% of respondents indicated that artisanal refining forced migration or relocation, and 50.1% reported conflicts arising from these activities.

The decline in income was primarily attributed to environmental pollution from crude oil spills, which negatively impact crop yields and disrupt farming activities. A reduction in the farmers income tends to arise from the contamination of the drinking water sources which are mostly rivers in the rural areas and an inability for a lot of them to fish as the crude oil from tapped and leaking pipelines tend to seep into and contaminate some water bodies. The farmers also complained of having to spend a lot more money in washing their clothes and repainting their houses, which they said are always blackened by soot as well as rusting of roof and all these have significant impact on their income. Farmers often avoid their lands due to safety concerns related to violence among rival gangs involved in illegal refining.

While a small fraction (3.6%) noted an increase in income, likely due to being beneficiaries in the illegal artisanal activities, the overall findings underscore significant socio-economic challenges faced by farmers in Gokana LGA. These results align with previous study by Wizer & Eludonyi (2020), which documented similar adverse effects on livelihoods due to environmental degradation caused by artisanal refining practices.

Table 6: Health Effect of Artisanal Petroleum Refineries

Perceived Effect of Illegal Artisanal Refineries on Health	Respondents (N = 357)		% (N=100.0%)	
	Yes	No	Yes	No
Respiratory problems (Cough/Catarrh)	289	68	81.0	19.0
Eyes problems	174	183	48.7	51.3
Skin problems	204	153	57.1	42.9
Psychological impact	139	218	39.0	61.0
Body weakness especially in the mornings	302	45	84.6	15.4

Source: Fieldwork (2023)

4.4 Perceived Effect of Illegal Artisanal Refineries on Farmers Health

The health impacts of artisanal refineries are significant, as illustrated in Table 6. A majority of respondents reported various health issues related to the activities of these refineries. Specifically, 84.6% indicated experiencing body weakness, while 81.0% reported respiratory problems such as cough and catarrh. Skin problems were noted by 57.1% of respondents, and psychological impacts affected 39%. These findings highlight the pervasive health risks associated with emissions from artisanal refining, which releases harmful pollutants into the environment.

The presence of soot and other emissions from artisanal refineries contributes to respiratory ailments, eye irritation, and skin conditions. Pollutants such as sulfur dioxide and particulate matter have been linked to these health issues in previous research (Suku *et al.*, 2023; Ephraim-Emmanuel *et al.*, 2023). The emissions not only affect those directly involved in refining but also pose risks to the broader community, particularly farmers whose livelihoods depend on healthy ecosystems. In addition to physical health issues, the psychological toll on farmers is notable. The constant fear of explosions or violence related to illegal refining activities

can lead to chronic stress and anxiety, further exacerbating health problems. Farmers reported difficulties sleeping due to noise and light pollution from the illegal refinery operations, contributing to fatigue and decreased productivity during the farming season.

Moreover, the contamination of water sources poses additional health risks. Many farmers rely on local rivers for drinking water and irrigation; however, crude oil spills and leaks from artisanal refining have rendered many water bodies unsafe for use. This not only affects their health but also disrupts agricultural practices, leading to further economic strain. The findings underscore a strong association between artisanal refining activities and adverse health effects among farmers in Gokana LGA. Immediate action is essential to address air quality issues, provide healthcare access for affected individuals, and explore alternative livelihood options that prioritize community well-being. These results align with studies conducted by Glory *et al.* (2023), which documented similar health risks associated with exposure to artisanal petroleum refineries in the Niger Delta.

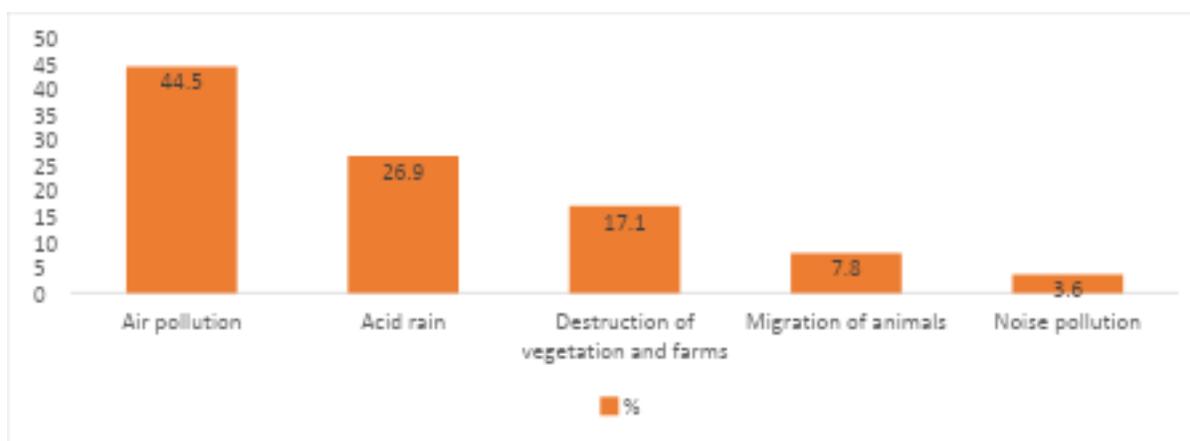


Figure 2. Perceived Environmental Effects of Illegal Artisanal Refineries in Gokana LGA

Source: Fieldwork (2023)

4.4.4 Perceived Environmental Effect of Illegal Artisanal Refineries on Farmers

The most frequently reported effect is air pollution, acknowledged by 44.5% of respondents, followed by acid rain at 26.9% figure 2. Destruction of vegetation and farmland was noted by 17.1%, while migration of animals and noise/light pollution were reported by 7.8% and 3.6%, respectively. Air pollution is particularly evident, with soot visibly coating vehicles, walls, and even the skin of individuals due to the prevalent *Kpo-fire* activities. Acid rain, recognized by nearly a third of respondents, results from pollutants released during gas flaring and can damage crops and infrastructure, as evidenced by the frequent rusting of roofing sheets in the area. These emissions also pose risks to groundwater quality, further jeopardizing drinking water supplies. The destruction of vegetation and farms can be attributed to land clearing, oil spills, and the release of toxic substances associated with artisanal refining. High temperatures from burning operations can lead to thermal stress on crops, reducing agricultural productivity. Additionally, the activities of security agents in destroying illegal refineries by burning often cause further environmental harm.

Overall, these findings indicate that illegal artisanal petroleum refineries significantly impact air quality and vegetation in Gokana LGA, with serious implications for agricultural practices and ecological balance. Addressing these environmental challenges through effective regulations and monitoring is crucial for safeguarding farmers' livelihoods and the ecosystem. These results are

consistent with previous studies by Onakpohor *et al.* (2020), which identified artisanal refineries as major sources of air pollution in the Niger Delta, and Ejiba *et al.* (2016), who highlighted the negative impacts of gas flaring on local livelihoods due to acid rain. Furthermore, Mzaga *et al.* (2021) confirmed that artisanal refining adversely alters soil properties, posing significant environmental challenges in affected regions.

5. CONCLUSION

This study highlights the significant socio-economic and environmental impacts of illegal artisanal refineries on farmers in Gokana Local Government Area, Rivers State, Nigeria. The findings reveal that these refineries contribute to environmental degradation, including air and water pollution, which adversely affects agricultural productivity and the livelihoods of farming families. A majority of respondents reported decreased crop yields and quality, alongside increased health risks associated with pollution. The demographic analysis indicates that married respondents are particularly vulnerable, facing heightened economic pressures as they strive to support their families amidst declining agricultural productivity. This underscores the urgent need for comprehensive interventions to mitigate the adverse effects of artisanal refining on local communities.

6. RECOMMENDATIONS

To address the pressing challenges arising from illegal artisanal refining activities, it is essential to strengthen regulatory frameworks to curb the illegal artisanal refining activities while promoting sustainable agricultural practices among farmers. Engaging local communities in decision-making processes regarding environmental management will empower them to take ownership of their livelihoods. Additionally, developing alternative livelihood programs will provide economic opportunities for individuals impacted by declining agricultural productivity, while investing in environmental remediation initiatives will restore contaminated land and water sources. Furthermore, launching public awareness campaigns will educate communities about the risks associated with illegal artisanal refining and promote advocacy for environmental protection and sustainable practices. By implementing these recommendations, policymakers can foster a healthier environment and more sustainable agricultural practices in the Niger Delta region, ultimately enhancing the well-being of affected communities.

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