The Cost-Benefit Analysis of Artisanal Refining of Crude Oil in the Niger Delta, Nigeria

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Abstract

This paper explores the costs and benefits of artisanal refining crude oil in the Niger Delta, a region rich in oil but facing significant socio-economic challenges. Artisanal refining, involving illegal and risky crude oil processing, has become a key source of income for local communities. The research examines its economic benefits, such as job creation and fuel availability, alongside its environmental, health, and social costs. The paper combines surveys and indebt interviews with diverse stakeholders, especially marginalized groups as the instrument. The analysis highlights the role of artisanal refining in providing employment where formal opportunities are scarce but also exposes its severe environmental damage, health risks, and social instability. Using the Sustainable Livelihoods Framework and Environmental Justice Theory, the paper uncovers the tension between short-term economic survival and long-term sustainability challenges. The findings reveal that while artisanal refining provides temporary economic relief, its long-term effects on the environment, health, and society are harmful. The paper thus calls for inclusive policies that address the needs of all groups, reduce the negative impacts of artisanal refining, promote alternative livelihoods, and support the Niger Delta's sustainable development.

Key Words: Artisanal Refining, Crude Oil, Cost-Benefit, Niger Delta, Nigeria.

1. Introduction

The Niger Delta region, a vital ecological and economic hub in Nigeria, has faced significant challenges due to decades of oil exploration and production activities.

Renowned for its rich biodiversity and vibrant coastal ecosystems, this region has also become the epicenter of artisanal refining of crude oil, a practice born out of socio-economic necessity. Artisanal refining locally referred to as " kpoo fire" involves the illegal and rudimentary processing of crude oil into usable petroleum products. While this activity has become a critical livelihood strategy for many impoverished communities in the region, it comes with profound economic, environmental, and social implications. As oil exploration and production continue to dominate the region's economy, the growth of artisanal refining of crude oil underscores the need to understand the broader impacts of this informal sector.

Artisanal refining of crude oil has provided immediate economic relief by creating informal employment opportunities and ensuring local access to refined petroleum products. For many individuals in the Niger Delta, it serves as a vital source of income in a region plagued by high unemployment and limited access to formal economic opportunities (Nwachukwu & Ocho, 2020). The practice has also contributed to local fuel supply chains, offering cheaper alternatives for nearby communities. In many instances, artisanal refining operations support entire communities that otherwise might be excluded from the formal economy due to a lack of infrastructure and economic resources (Kew, 2021). This practice also alleviates the high demand for fuel in the region, making petroleum products more accessible and affordable. However, the benefits of artisanal refining are overshadowed by its significant costs, both to the environment and the social fabric of the region.

The unregulated nature of artisanal refining contributes to severe environmental degradation. The process results in frequent oil spills, deforestation, and pollution of air, soil, and water. According to Agbonifo (2017), the crude oil used in artisanal refining is often processed in open pits or makeshift refineries, leading to the contamination of surrounding ecosystems. These environmental impacts have devastated ecosystems, reduced agricultural productivity, and decimated fish stocks, undermining the traditional livelihoods of farmers and fishers who depend on the region's natural resources. In addition to affecting wildlife and water bodies, the pollution has made agriculture and fishing increasingly unviable in many parts of the Niger Delta. For example, oil spills contaminate rivers and

farmlands, destroying crops and causing long-term soil infertility (Jike, 2019). As a result, the primary sources of food and income for local populations are jeopardized, contributing to increased poverty in the region.

A study by Ibeanu et al. (2020) noted a significant rise in respiratory diseases and skin conditions among populations living near artisanal refining sites. This exposure to toxic fumes and chemicals, including benzene and sulfur, is a major health risk in the region. Additionally, polluted water sources have contributed to a rise in waterborne diseases, such as cholera, typhoid, and dysentery, further straining local health systems and reducing the quality of life for residents (Ajaero & Okunola, 2020).

Economically, artisanal refining exacerbates Nigeria's revenue losses by facilitating crude oil theft and diverting resources from formal channels. The Nigerian government loses billions of dollars annually to these illegal activities, weakening the nation's fiscal capacity and undermining efforts toward sustainable development (Okafor & Ogbonna, 2021). Artisanal refining is often tied to crude oil theft, commonly known as "bunkering," where stolen crude oil is refined illegally, depriving the government of its share of oil revenue. This results in not only financial losses but also further destabilizes the economy and national development. Moreover, the informal nature of the practice perpetuates insecurity and fosters corruption. Artisanal refining operations are frequently associated with criminal networks and militant activities in the region, which exacerbate existing security challenges and hinder development (Nnadi, 2020).

Despite various government interventions to address artisanal refining, the practice persists due to deeply rooted socio-economic issues, including poverty and the lack of alternative livelihoods. A report by the Nigerian Bureau of Statistics (2019) found that the unemployment rate in the Niger Delta is significantly higher than the national average, which pushes many individuals toward artisanal refining as a means of survival. Existing approaches have largely focused on eradicating the activity rather than addressing its underlying causes, resulting in limited success. Government policies have often failed to provide alternative sources of livelihood or adequately invest in infrastructure and social programs that could reduce the reliance on artisanal refining (Eze & Nwogugu, 2020).

Furthermore, the lack of effective enforcement of environmental laws and regulations has allowed these illegal refineries to operate unchecked, perpetuating their environmental and socio-economic costs (Ajaero, 2021).

In this connection, the paper seeks to conduct a cost-benefit analysis of artisanal refining of crude oil in the Niger Delta, Nigeria, by examining its economic benefits, such as income generation and local fuel availability, alongside its environmental, health, and social costs. The paper aims to provide a comprehensive understanding of its impacts. According to Agbonifo (2017), it is essential to understand the interplay between the positive short-term economic outcomes and the long-term detrimental effects of artisanal refining on both the environment and the local population. The analysis will inform policies and strategies that balance the need for economic empowerment with the imperative of environmental sustainability and national development. A holistic approach is necessary to mitigate the negative externalities of artisanal refining while exploring sustainable alternatives that address the region's socio-economic challenges.

Therefore, the following research questions are formulated to aid this study:

i. What are the key economic income generation, employment opportunities and livelihoods benefits derived from artisanal refining of crude oil for individuals and communities in the Niger Delta?
ii. How does artisanal refining of petroleum products contribute to environmental degradation in the Niger Delta?
iii. What are the health impacts of artisanal refining on populations living near refining sites?
iv. What social challenges do communities engaged in artisanal refining face in the Niger Delta?

While the objectives of this study are to:

i. Investigate the income generation, employment opportunities, and livelihood improvements associated with artisanal refining activities.
ii. Analyze the extent to which artisanal refining contributes to environmental damage, including deforestation, water contamination, and air pollution.

iii. Assess the prevalence of health issues among affected populations, occasioned by the practice of artisanal refining.
iv. Explore issues such as social marginalization, conflicts, criminalization, and limited access to essential services among communities involved in artisanal refining.

This paper focuses on the cost-benefit analysis of artisanal refining across the Niger Delta, Nigeria. The region, which encompasses nine oil-producing states, is characterized by its ecological richness, economic significance, and persistent socio-economic challenges. Artisanal refining has emerged as a huge alternative livelihood activity within the region, driven by economic necessity and limited access to formal employment opportunities (Ogunleye & Olamide, 2021). The practice of artisanal refining involves the illegal and often hazardous processing of crude oil into refined petroleum products, typically in rudimentary and unregulated facilities (Agbonifo, 2017). This has led to a significant increase in informal employment, offering a critical source of income for many impoverished households in the Niger Delta (Nwachukwu & Ocho, 2020).

The paper is organized thematically to address the costs and benefits of artisanal refining in the Niger Delta. The first thematic focus explores the economic benefits of artisanal refining for communities across the region. Artisanal refining serves as a critical source of income and employment for many residents, offering economic relief in an area plagued by poverty and limited opportunities (Ogunleye & Olamide, 2021). According to Kew (2021), artisanal refining is often the only viable alternative for people who live in areas with minimal access to formal employment or government-driven economic programs. In this context, the practice alleviates the economic burden on local households by providing access to petroleum products that are otherwise scarce or prohibitively expensive in the region. The activity also plays a role in local energy supply chains, providing accessible and affordable petroleum products to nearby communities and indeed, Nigeria as a whole. In many rural areas of the Niger Delta, artisanal refining is the primary source of fuel for cooking and transportation (Jike, 2019). By analyzing these benefits, this theme highlights the ways in which artisanal refining contributes to the livelihoods and economic survival of individuals and

households across the Niger Delta, despite the risks and challenges associated with the practice. In this rudimentary vocation, poverty is the driving force.

The second thematic focus examines the environmental, health, and social costs of artisanal refining in the region. The unregulated nature of this practice has led to significant environmental degradation, including widespread oil spills, deforestation, and pollution of water and air (Agbonifo, 2017). Artisanal refineries often operate without regard for environmental protection, leading to oil spills that contaminate land and waterways, impacting local ecosystems and reducing agricultural productivity (Ajaero & Okunola, 2020). These environmental impacts have disrupted traditional livelihoods such as farming and fishing, which are vital for food security and income. Oil contamination of water bodies and farmlands has led to the destruction of vital agricultural resources, reducing crop yields and fish stocks (Ibeanu et al., 2020). Additionally, exposure to pollutants from refining activities has posed severe health risks to local populations, including respiratory diseases, skin conditions, and other ailments (Ajaero, 2021). According to Nwachukwu and Ocho (2020), residents living near artisanal refining operations are more likely to suffer from illnesses linked to pollution, such as chronic respiratory conditions, as well as an increased incidence of cancer due to long-term exposure to carcinogenic substances. Socially, artisanal refining has fueled insecurity, corruption, and conflicts, exacerbating instability in the region. The practice is often linked to organized criminal activities, including illegal oil bunkering and militant operations (Okafor & Ogbonna, 2021). This theme analyzes the extensive consequences of these costs, providing a comprehensive picture of how artisanal refining affects communities throughout the Niger Delta. Together, these themes address the dual aspects of artisanal refining in the Niger Delta, focusing on its economic benefits and its environmental and socio-economic costs. The economic benefits, such as income generation and local fuel availability, must be weighed against the long-term environmental degradation and social instability that result from the practice. By examining these themes across the entire region, the paper provides to informed policies and strategies to mitigate the adverse impacts of artisanal refining while enhancing its potential benefits to support sustainable development in the Niger Delta (Nwachukwu & Ocho, 2020). It is essential to develop alternative livelihood programs that can reduce reliance on illegal refining while promoting environmentally sustainable practices (Ajaero,

2021). The paper thus seeks to offer insights into how the Niger Delta can transition towards more formalized, regulated industries that preserve the ecological integrity of the region while supporting local economic development.

2. Theoretical Foundations

The paper is anchored on two primary theories: Sustainable Livelihoods Framework (SLF) and Environmental Justice Theory as its theoretical foundation. These theories provide the conceptual basis for understanding the economic benefits, environmental impacts, and socio-economic consequences of artisanal refining in the region.

The Sustainable Livelihoods Framework (SLF) was introduced by Ian Scoones in 1998 as a tool for analyzing how people sustain their livelihoods in the face of various vulnerabilities. The framework assumes that livelihoods are shaped by five types of assets or capital: human, natural, financial, physical, and social. These assets interact with the vulnerability context, defined by shocks, trends, and seasonality, as well as transforming structures and processes, such as institutions, policies, and governance. The SLF assumes that individuals and communities actively use their assets to pursue livelihood strategies that can either enhance or diminish their long-term sustainability (Scoones, 1998).

In the Niger Delta, artisanal refining represents a livelihood strategy driven by socio-economic vulnerabilities, such as poverty and unemployment. The SLF highlights how this activity provides financial capital in the short term but simultaneously erodes other capitals, particularly natural capital (e.g., polluted water and degraded farmland) and human capital (e.g., health issues from toxic exposure). The framework is critical for assessing the balance between the benefits and costs of artisanal refining as a livelihood strategy and its implications for sustainable development.

Environmental Justice Theory emerged in the 1980s from grassroots environmental movements in the United States, with key contributions by scholars like Robert Bullard, widely regarded as the "father of environmental justice." Bullard's seminal work in 1990, *Dumping in Dixie*, laid the foundation for understanding the unequal distribution of environmental risks and benefits,

particularly for marginalized communities (Bullard, 1990). The theory is built on three core assumptions: (1) environmental harms disproportionately affect marginalized and vulnerable populations; (2) procedural inequities exclude these communities from decision-making processes; and (3) recognition of cultural and social differences is essential to address environmental injustices effectively.

In the Niger Delta, Environmental Justice Theory helps to frame the unequal burden borne by local communities engaged in or impacted by artisanal refining. Distributive justice examines how pollution disproportionately affects these communities while the economic benefits of oil wealth are centralized elsewhere. Procedural justice addresses the exclusion of local voices from resource management and policy-making, and recognition justice highlights the neglect of cultural and socio-economic factors driving artisanal refining. This theory is critical for analyzing how governance failures and structural inequities perpetuate environmental and social harm in the region.

By integrating the SLF and Environmental Justice Theory, this paper offers a comprehensive understanding of artisanal refining in the Niger Delta. The SLF focuses on micro-level livelihood strategies and their sustainability, while Environmental Justice Theory provides a macro-level perspective on systemic inequalities and governance challenges. Together, these theories inform targeted interventions aimed at balancing the economic benefits of artisanal refining with its environmental and social costs, contributing to sustainable development in the region (Scoones, 1998; Bullard, 1990).

3. Methods and Materials

The paper adopts a descriptive research design combined with elements of case study analysis to examine the cost-benefit dynamics of artisanal refining of crude oil in the Niger Delta, Nigeria. In this connection, both primary and secondary data were collected using questionnaires and in depth interviews with stakeholders, including community members engaged in artisanal refining, environmental and public health experts, and representatives of government agencies. These data collection focused on key issues such as the economic benefits derived from artisanal refining of crude oil, the environmental degradation caused

by these activities, health impacts on affected populations, and the social challenges faced by communities involved in artisanal refining.

Similarly, secondary data were obtained through the review of existing literature, reports, and documents related to artisanal refining in the Niger Delta. These include publications from government agencies such as the Nigerian National Petroleum Corporation (NNPC) and the National Oil Spill Detection and Response Agency (NOSDRA), as well as reports from international organizations such as the United Nations Environment Programme (UNEP). Additional secondary sources include academic articles, case studies, and statistical data on the economic, environmental, health, and social impacts of artisanal refining.

4. Analysis of the Cost and Benefit of Artisanal Refining of crude oil in the Niger Delta, Nigeria

The array of literature review in this paper explores the dynamics of artisanal refining in the Niger Delta, Nigeria, its economic importance, and the environmental and social costs associated with the practice. Artisanal refining, primarily focused on the illegal processing of crude oil into refined petroleum products, has become a significant activity in the region due to the Niger Delta's vast oil reserves, poverty, and the failure of formal systems to provide adequate employment and resources. Scholars have highlighted the role of artisanal refining as both an economic lifeline and a driver of environmental degradation in the region.

Research by Okolie (2020) points out that artisanal refining provides essential income for communities, particularly in rural areas, where formal employment opportunities are scarce. The practice supports thousands of people, including workers, traders, and those involved in the distribution of refined products. However, studies also emphasize the significant economic costs associated with artisanal refining, especially in terms of lost revenue from environmental damage, health costs from pollution, and the lost potential of the formal oil sector (Eze et al., 2019). In their study, Adeyemi and Akintoye (2021) argue that while artisanal refining offers short-term economic benefits, its long-term economic costs, including the erosion of natural resources and public health crises, outweigh these advantages.

The environmental impacts of artisanal refining are widely documented, with scholars such as Abubakar and Olumide (2020) asserting that it is one of the primary causes of environmental degradation in the Niger Delta. The process of illegal refining often involves rudimentary methods that release harmful pollutants into the air, soil, and water. This has led to significant soil contamination, destruction of local biodiversity, and persistent water pollution, which directly impacts farming and fishing, the primary sources of livelihood for local populations. Olusegun and Olorunfemi (2022) note that the lack of effective regulation and enforcement has allowed these activities to continue unchecked, exacerbating the environmental crisis in the region. While artisanal refiners argue that their operations are a means of survival, environmental researchers stress that the cumulative effects of these practices could lead to irreversible damage to the local ecosystem.

Socially, artisanal refining in the Niger Delta intersects with issues of security and community resistance. Scholars such as Omokri and Okeke (2022) observe that illegal refining is often seen as a form of socio-political resistance against the government and oil companies, which are perceived to exploit the region's resources without equitable benefits for local populations. The rise of "oil theft" and the expansion of illegal refineries have become intertwined with broader grievances about resource distribution, economic marginalization, and lack of development. In this context, artisanal refining is not merely an economic activity, but also a reflection of socio-political discontent. Researchers like Udo (2021) argue that addressing the issue of artisanal refining in the Niger Delta requires not only a regulatory framework but also a broader approach that tackles the underlying socio-political issues.

The cost-benefit analysis framework for assessing artisanal refining in the Niger Delta has been explored by various scholars, who argue for the need to consider both economic and environmental factors. According to Ige and Adeyemi (2021), traditional cost-benefit analysis methods, which focus on direct financial outcomes, fail to capture the full spectrum of costs associated with artisanal refining. These include indirect costs such as the depletion of natural resources, public health expenditures, and the long-term social impact on communities. Environmental economists, like Okoro (2020), suggest that a more comprehensive

cost-benefit analysis should incorporate non-market values, such as the loss of ecosystem services, and should account for the costs of environmental remediation.

The literature suggests that despite the immediate economic benefits, the long-term social, economic, and environmental costs of artisanal refining in the Niger Delta are immense. While the practice sustains thousands of families, its contribution to environmental destruction, public health crises, and social instability presents a severe challenge. Researchers, including Adebayo and Oyetunde (2021), argue that the Nigerian government must develop and implement policies that support sustainable alternatives to artisanal refining, such as providing training in formal refining processes or promoting diversification into other sectors of the economy. Further, scholars like Okwu and Chukwuneke (2020) stress the importance of community-based approaches to addressing these issues, suggesting that long-term solutions will require cooperation between the government, local communities, and the private sector.

In conclusion, the literature on artisanal refining in the Niger Delta emphasizes the need for a balanced approach to economic development, environmental sustainability, and social justice. Scholars consistently argue that while the short-term economic benefits of artisanal refining are undeniable, the long-term costs environmental destruction, public health risks, and social unrest demand urgent attention. A comprehensive cost-benefit analysis, incorporating both quantitative and qualitative data, is essential for guiding policies that aim to mitigate these negative effects and foster sustainable development in the region. Future research and policy initiatives should focus on finding solutions that integrate economic incentives with environmental and social justice considerations to create a more sustainable future for the Niger Delta.

Thematic Analysis of Research Questions

Theme 1:
Key economic benefits of artisanal refining for individuals and communities in the Niger Delta.

Artisanal refining has played a significant role in shaping the economic landscape of the Niger Delta and Nigeria over the past decade. Despite its informal nature and associated risks, it has emerged as a critical source of income and employment for many local communities, offering financial opportunities that are often unavailable in formal sectors. This economic activity has also contributed to improved living standards through increased household earnings, investments in education and healthcare, and support for local businesses.

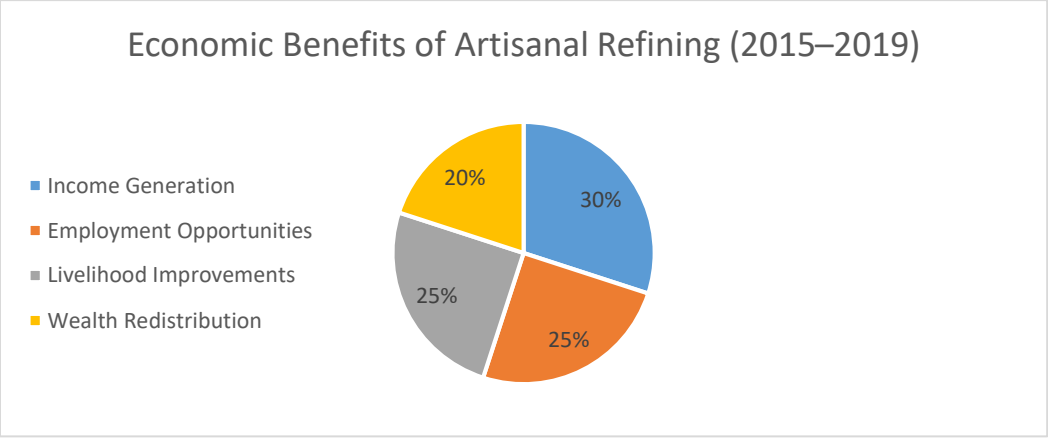
Table 1 below provides an analysis of the key economic benefits derived from artisanal refining across four dimensions income generation, employment opportunities, livelihood improvements, and wealth redistribution focusing on trends observed between 2015 and 2024.

Table: 1. Economic Benefits of Artisanal Refining (2015–2024)

Economic Dimension	Trends Over 10 Years (2015–2024	Analysis
Income Generation	- **2015–2019**: Income levels were steady, with average monthly earnings ranging between ₦100,000–₦150,000 (approx. $130–$195). - **2020–2024**: Increased demand for refined products boosted earnings to ₦150,000–₦200,000 (approx. $195–$260).	**Trend**: Income levels gradually increased as artisanal refining activities expanded to meet growing local and regional energy demands, particularly during periods of fuel scarcity.
Employment Opportunities	- **2015–2019**: Employment was moderate, involving approximately 15–20% of the local population in refining activities and related services. - **2020–2024**: Employment increased to 20–30% due to expanded	**Trend**: Employment growth mirrored the expansion of refining activities, particularly as government enforcement fluctuated,

	operations and rising involvement of youth in artisanal refining.	enabling communities to scale their operations.
Livelihood Improvements	- **2015–2019**: Incremental improvements in housing, access to healthcare, and education were reported. - **2020–2024**: Enhanced income enabled more families to invest in education and healthcare, with visible improvements in community infrastructure.	**Trend**: Over the decade, better earnings translated into long-term investments in social and economic well-being, though these benefits remained uneven across communities.
Wealth Redistribution	- **2015–2019**: Local communities began asserting control over resources, viewing artisanal refining as a way to address economic exclusion. - **2020–2024**: Increased local wealth circulation reduced reliance on oil multinationals, reinforcing local empowerment and financial independence.	**Trend**: The perception of artisanal refining as a tool for economic empowerment grew stronger, particularly in areas where government investments in development remained inadequate.

Source: Researchers' Fieldwork, 2025.



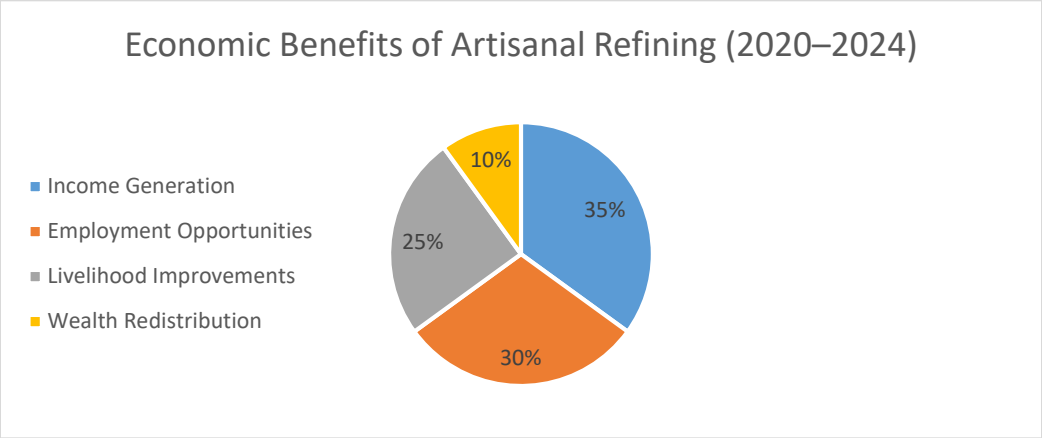


Figure 1: Showing Economic Benefits of Artisanal Refining (2015–2024).
Source: Researchers' Fieldwork, 2025.

Over the decade (2015–2024), the economic benefits derived from artisanal refining in the Niger Delta exhibited notable trends across four key areas: income generation, employment opportunities, livelihood improvements, and wealth redistribution.

From 2015 to 2019, the distribution of benefits was relatively balanced, as shown in the above pie chart. Income generation accounted for 30% of the benefits, reflecting the significant financial advantage artisanal refining provided to individuals and households compared to traditional livelihoods. Employment opportunities contributed 25%, as the sector created jobs for about 15–20% of the local population. Livelihood improvements (25%) were visible in better housing, education, and healthcare access, while wealth redistribution (20%) demonstrated how artisanal refining empowered communities by providing control over local resources and circulating wealth internally.

Between 2020 and 2024, the dynamics shifted, with income generation increasing to 35% of the benefits, reflecting growing profitability driven by rising demand for locally refined products during fuel shortages and economic disruptions. Employment opportunities also grew to 30%, as more youth and marginalized groups joined the industry. However, livelihood improvements remained steady at 25%, while wealth redistribution declined to 10%. The latter drop indicates

challenges in sustaining equitable resource control amid fluctuating government crackdowns and environmental pressures.

The pie charts visually highlight this evolution, with income generation and employment opportunities gaining prominence over the decade, reflecting the expanding economic significance of artisanal refining. However, the slight decline in wealth redistribution underscores concerns about the uneven distribution of benefits and the growing focus on individual economic gains rather than community-wide empowerment.

Overall, the table and pie charts together reveal how artisanal refining became an increasingly important economic activity, despite accompanying challenges in wealth equity and environmental sustainability.

Theme 2: How artisanal refining contributes to environmental degradation in the Niger Delta.

The Niger Delta region has experienced significant environmental degradation due to artisanal refining activities over the past decade (2015–2024). These activities have caused widespread deforestation, water contamination, air pollution, and soil degradation, which have profoundly impacted the region's ecosystems, livelihoods, and public health. Table 2 below highlights the extent of these environmental damages, providing specific data to illustrate the severity and scale of the problem.

Table. 2: Environmental Degradation Caused by Artisanal Refining (2015–2024)

Aspect	Recorded Data (2015–2024)	Areas Mostly Affected	Analysis
Deforestation	- Over **50,000 hectares** of mangroves cleared for refining sites and fuel wood. - Annual loss: **3,500 ha**.	Bayelsa (Nembe, Brass), Delta (Burutu), Rivers	Demand for fuel wood has caused significant loss of mangroves, crucial for biodiversity, carbon storage, and coastal protection.

Water Contamination	- **40–50%** of rivers and creeks report hydrocarbon contamination. - Spill volume: **20,000–25,000 barrels/year**.	Bayelsa (Ogbia), Rivers (Bonny, Ogoni), Delta (Warri)	Crude oil spills and waste discharge severely pollute rivers, harming aquatic ecosystems, poisoning fish, and contaminating drinking water.
Air Pollution	- PM2.5 levels exceed **250 μg/m³** (WHO limit: **25 μg/m³**). - High emissions of **CO_2 and SO_2** detected.	Rivers (Port Harcourt, Bonny), Delta (Warri)	Open-air refining releases toxic gases, causing respiratory issues and contributing to global warming.
Soil Contamination	Hydrocarbon contamination in **60%** of sampled farmland. - Soil fertility reduced by **30–50%**.	Bayelsa (Nembe), Delta (Sapele), Imo (Ohaji-Egbema)	Oil residues saturate farmlands, reducing crop yields and threatening food security, leaving large tracts of land unusable.
Cumulative Effects	- Degraded land recovery: **20–30 years** without intervention. - Flooding frequency increased by **40%**.	Bayelsa, Rivers, Delta	Deforestation and contamination intensify climate vulnerability, including erosion, flooding, and loss of natural resources critical to local communities.

Source: Researchers' Fieldwork, 2025

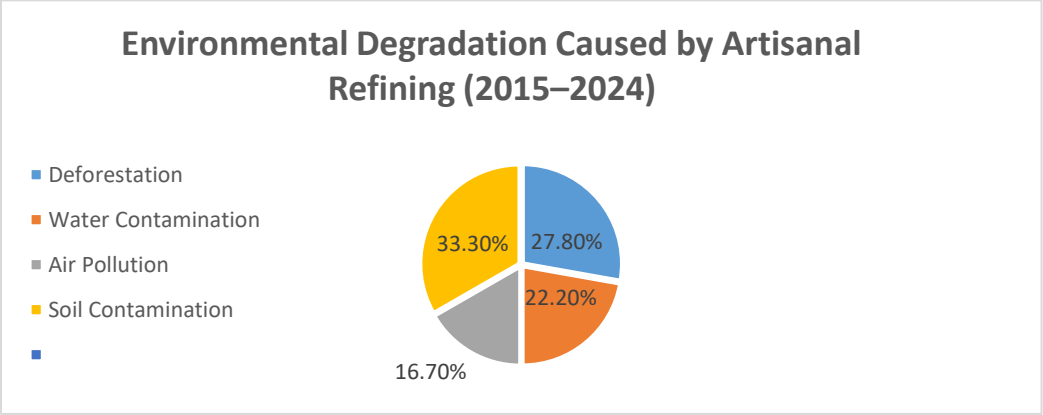


Figure. 2: Showing Environmental Degradation Caused by Artisanal Refining (2015–2024)
Source: Researchers' Fieldwork, 2025.

The recorded data from table 2, combined with the pie chart titled "Environmental Degradation Caused by Artisanal Refining (2015–2024)," reveals alarming environmental degradation due to human activities, with widespread impacts on key ecological aspects. The chart provides a proportional breakdown of the impacts, highlighting soil contamination (33.3%), deforestation (27.8%), water contamination (22.2%), and air pollution (16.7%) as the primary contributors.

Soil Contamination emerges as the most significant impact, accounting for a third of the degradation. Hydrocarbon residues have contaminated 60% of sampled farmlands, primarily in Bayelsa (Nembe), Delta (Sapele), and Imo (Ohaji-Egbema). This contamination has reduced soil fertility by 30–50%, leading to significant declines in crop yields and threatening food security. Farmlands rendered unusable leave local economies reliant on agriculture in severe distress, forcing many communities to seek alternative livelihoods. The data and chart reinforce the urgent need for soil restoration efforts to mitigate long-term impacts on agriculture and food security.

Deforestation, contributing 27.8%, is another major concern, with over 50,000 hectares of mangroves cleared, primarily in Bayelsa (Nembe, Brass), Delta (Burutu), and Rivers states, at an annual loss rate of 3,500 hectares. This

deforestation, driven by the demand for fuelwood and refining sites, poses a significant threat to biodiversity, carbon sequestration, and coastal resilience. Mangroves, which serve as natural buffers against coastal erosion and nurseries for aquatic life, are rapidly vanishing, leaving ecosystems and communities vulnerable. The proportional representation in the chart underscores the critical role of mangrove conservation in addressing environmental degradation.

Water Contamination, accounting for 22.2% of the impacts, is primarily caused by hydrocarbon contamination affecting 40–50% of rivers and creeks, with spill volumes between 20,000 and 25,000 barrels annually. Bayelsa (Ogbia), Rivers (Bonny, Ogoni), and Delta (Warri) are the most affected areas. This contamination has devastated aquatic ecosystems, poisoned fish stocks, and rendered drinking water unsafe for human and animal consumption. The chart reinforces the urgency of addressing water pollution to protect both ecosystems and the livelihoods of communities reliant on fishing and agriculture.

Air Pollution, making up 16.7% of the degradation, reflects the severe impacts of toxic emissions from open-air refining processes. Air quality in the Niger Delta is critically compromised, with PM2.5 levels surpassing 250 $\mu g/m^3$—ten times the WHO-recommended limit. Areas such as Rivers (Port Harcourt, Bonny) and Delta (Warri) experience heightened emissions of CO_2 and SO_2, contributing to respiratory illnesses and global warming. Although it has a smaller share compared to soil and water impacts, its effects on human health and climate change are profound.

Cumulative Effects: The compounded impacts of deforestation, pollution, and contamination have intensified environmental and climate vulnerabilities in Bayelsa, Rivers, and Delta. Degraded lands require 20–30 years for recovery without intervention, while flooding frequency has risen by 40%. The destruction of natural defenses, such as mangroves, and the contamination of soil and water resources heighten the risks of erosion, flooding, and resource scarcity, undermining the resilience and sustainability of affected communities.

The pie chart visually emphasizes the uneven distribution of these impacts, complementing the data analysis by highlighting the need for targeted

interventions in the most affected areas. Soil and water restoration efforts, alongside mangrove conservation and air quality improvement, are critical for mitigating ongoing environmental degradation and fostering sustainable development in the Niger Delta region.

Theme 3. The prevalence of health issues among affected populations.

Artisanal refining poses significant health risks to populations living near refining sites, particularly in regions like the Niger Delta. Prolonged exposure to pollutants from these activities has resulted in widespread health issues, including respiratory diseases, skin conditions, gastrointestinal illnesses, and long-term chronic effects. The contamination of air, water, and soil, compounded by poor access to healthcare and clean resources, exacerbates these challenges, leaving vulnerable communities at risk. Below is a table summarizing the documented health impacts and their associated sources of pollution:

Table. 3: Health and Environmental Impacts of Artisanal Refining in the Niger Delta (2015–2024)

Health Dimension	Findings from Data (2015–2024)	Health Impacts	Key Affected Areas
Air Pollution	PM2.5 levels exceed 250 μg/m³ (WHO limit: 25 μg/m³). High emissions of CO_2 and SO_2 from open-air refining.	Respiratory diseases, such as asthma, bronchitis, and chronic obstructive pulmonary disease (COPD). Increased risk of cardiovascular diseases due to prolonged exposure to fine particulate matter and toxic gases.	Rivers (Port Harcourt, Bonny), Delta (Warri)
Water Contamination	40–50% of rivers and creeks contaminated by hydrocarbons, with spill volumes of 20,000–25,000 barrels annually.	Skin conditions, such as dermatitis and rashes, from contact with polluted water. Gastrointestinal illnesses and systemic	Bayelsa (Ogbia), Rivers (Ogoni, Bonny), Delta (Warri)

		toxicity due to consumption of contaminated water. Bioaccumulation of toxins may lead to chronic diseases, including cancer.	
Soil Contamination	Hydrocarbon residues affect 60% of farmland, reducing soil fertility by 30–50%. Contaminated crops absorbed by humans.	Health risks from consuming crops grown in contaminated soil, including gastrointestinal issues, developmental disorders, and long-term risks of cancer from hydrocarbons and heavy metals.	Bayelsa (Nembe), Delta (Sapele), Imo (Ohaji-Egbema)
Combined Effects of Exposure	Communities face overlapping exposure to air, water, and soil pollutants due to artisanal refining. Cumulative effects worsen health outcomes.	Increased prevalence of multi-system illnesses, including respiratory, gastrointestinal, dermatological, and neurological conditions. Children and pregnant women are particularly vulnerable, leading to developmental delays and adverse birth outcomes.	All major refining areas in Bayelsa, Rivers, Delta
Economic Implications	Degraded ecosystems and reduced agricultural productivity contribute to malnutrition and increased reliance on polluted resources (e.g., fish from contaminated waters).	Malnutrition-related health issues from food scarcity. Prolonged exposure to polluted environments causes financial strain due to medical costs and lost productivity, further exacerbating poverty and poor living standards.	Entire Niger Delta region

Social Factors	Lack of access to clean water, air, and health infrastructure amplifies the impacts of pollution-related illnesses.	Widespread health issues reduce life expectancy and quality of life, especially in marginalized communities with limited healthcare access.	Remote areas near artisanal refining sites

Source: Researchers' Fieldwork, 2025.

The data from 2015–2024 reveal significant environmental and health issues resulting from pollution in various regions. Air pollution in areas such as Port Harcourt, Bonny, and Warri is notably severe, with PM2.5 levels far exceeding the WHO's recommended limit. This has led to a spike in respiratory conditions like asthma, bronchitis, and COPD, while prolonged exposure to fine particulate matter and toxic gases increases cardiovascular risks. These air quality issues are compounded by the emissions of CO_2 and SO_2 from open-air refining activities, further contributing to the region's environmental and public health challenges.

Water contamination remains another major concern, with hydrocarbon pollution affecting up to 50% of rivers and creeks, particularly in Bayelsa, Rivers, and Delta. The annual spills of thousands of barrels of oil result in a range of health impacts, including skin conditions from water contact and gastrointestinal illnesses from consumption of polluted water. Additionally, the bioaccumulation of toxins in aquatic life raises the long-term risk of cancers and other systemic diseases. The pervasive contamination of water sources exacerbates the already dire situation in these communities, where clean water access is scarce.

Soil contamination, linked to hydrocarbon residues affecting up to 60% of farmlands, also poses a serious health threat, particularly in Bayelsa, Delta, and Imo. The reduction in soil fertility has led to poor agricultural yields, and the consumption of contaminated crops exposes the population to serious health risks, such as gastrointestinal issues and long-term developmental disorders. These impacts are worsened by the presence of heavy metals and hydrocarbons in the soil, which contribute to cancer risks and other chronic health conditions.

The combined effects of air, water, and soil pollution create a complex web of health issues in communities near artisanal refining sites. The cumulative exposure to these pollutants has led to an increase in multi-system illnesses, affecting respiratory, gastrointestinal, dermatological, and neurological health. Vulnerable groups such as children and pregnant women face the greatest risks, including developmental delays and adverse birth outcomes. These overlapping health challenges underscore the widespread and interconnected nature of environmental pollution in the region.

Economically, the environmental degradation caused by pollution has led to reduced agricultural productivity and the loss of biodiversity, further exacerbating poverty and food insecurity. The reliance on contaminated fish and other resources for sustenance has contributed to malnutrition, which in turn drives health-related issues. The financial burden of healthcare costs and lost productivity further strains the already fragile economic systems in these areas, deepening the cycle of poverty in the Niger Delta.

Socially, the lack of infrastructure, including access to clean water, healthcare, and air quality management, amplifies the impacts of pollution. In many remote areas near artisanal refining sites, communities are left without the means to mitigate or recover from pollution-related health problems. This has led to widespread health issues, reducing life expectancy and quality of life, particularly in marginalized communities. The absence of clean resources and proper healthcare services deepens the social divide and exacerbates the living conditions of these vulnerable populations.

Theme 4: Social challenges communities engaged in artisanal refining face in the Niger Delta

Communities involved in artisanal refining in the Niger Delta face a complex array of social challenges that are deeply interconnected with issues such as social marginalization, conflicts, criminalization, and limited access to essential services. These issues are not isolated but rather reinforce one another, compounding the difficulties faced by these communities.

Social marginalization is a prominent issue, as these communities are often geographically isolated and excluded from state resources due to the informal and illegal nature of artisanal refining. The reliance on these illegal activities, which occur without government oversight, means these communities frequently lack access to basic services such as healthcare, clean water, and education. In the view of Naanen and Tolani (2014), poverty resulting in inability to pay the cost of education and post-education, unemployment have contributed to declining interest to suffer a great setback and the member of school dropouts has become high. Instead of being in school, young men, women and children take to the creaks and some water fronts to make quick money from illegal refining. Even children who are not able to go the creeks move about with jerry cans hawking bunkered fuel and kerosene. As a result, they experience a continuous cycle of poverty and limited social mobility, with their needs largely ignored by policymakers. This marginalization deepens the sense of exclusion and contributes to the overall social instability in the region.

Conflicts arise as a direct consequence of the illegal nature of artisanal oil refiners and the competition for resources. Tensions frequently erupt between artisanal refiners and law enforcement agencies, oil companies, and even other communities. Disputes over land ownership, control over refining operations, and environmental damage can escalate into violent conflicts, further destabilizing the region. These ongoing conflicts hinder social cohesion and contribute to the overall insecurity in the Niger Delta, perpetuating a climate of tension and distrust.

The criminalization of artisanal refining compounds the situation, as it exposes individuals and communities to legal risks. While artisanal refining serves as a crucial livelihood for many, the illegal status of the practice creates a fraught relationship between the communities and state authorities. The criminalization of these activities leads to arrests, the destruction of refining equipment, and sometimes violent confrontations, which only deepen the communities' sense of injustice and alienation from the state. This further exacerbates the lack of state support and exacerbates their sense of vulnerability.

Limited access to essential services is perhaps the most immediate and pressing issue. The environmental degradation caused by pollution from artisanal refining

significantly affects the health, agriculture, and living conditions of these communities. The contamination of water sources, air, and soil leads to a range of health problems, including skin conditions, respiratory diseases, and gastrointestinal illnesses, while the lack of healthcare infrastructure leaves residents without the necessary medical attention. Additionally, the pollution of agricultural land reduces food security, exacerbating malnutrition and poverty. The absence of essential services such as education and vocational training limits the long-term opportunities for individuals, perpetuating a cycle of underdevelopment and poor living standards.

In conclusion, the social challenges faced by communities engaged in artisanal refining in the Niger Delta are deeply intertwined with issues of social marginalization, conflicts, criminalization, and limited access to essential services. These interconnected issues create a complex web of struggles that undermine the social, economic, and environmental stability of the region. The lack of support from the state, coupled with the negative impacts of environmental degradation and the criminalization of artisanal refining, traps these communities in a cycle of poverty, insecurity, and marginalization.

Factors that influence the cost-benefit dynamics of artisanal refining in the Niger Delta, Nigeria

The cost-benefit dynamics of artisanal refining in the Niger Delta are influenced by several factors, which make it both a tempting and risky activity.

1. **Economic Benefits**: Artisanal refining requires low start-up costs and can offer high profits, as refined products like kerosene and diesel are in demand. It also provides employment in an area with high unemployment. These financial benefits make it an attractive livelihood for many people in the region.
2. **Environmental and Health Costs**: The refining process causes significant environmental damage, including pollution of air, soil, and water. This can harm agriculture, fisheries, and ecosystems, and over time, these costs can reduce the benefits. Additionally, exposure to toxic substances can lead to serious health problems, creating more financial strain as people seek medical care.

3. **Legal Risks**: Artisanal refining is illegal, meaning that those involved face the constant threat of raids, arrests, and equipment destruction. This increases the risk and cost of engaging in the activity, as people have to deal with the possibility of losing their investment or facing legal consequences.
4. **Social Support and Demand**: In many communities, artisanal refining is accepted as a necessary activity because it provides affordable fuel that is hard to get elsewhere. This creates local demand and support, making it sustainable in the short term. However, in areas where the practice is stigmatized, it can bring social exclusion.
5. **Technological and Infrastructure Limitations**: Artisanal refineries often use outdated and inefficient technology, which reduces the yields and increases risks. Poor infrastructure, such as bad roads and lack of waste management, also raises the cost and environmental impact of the practice.
6. **External Economic Factors**: The price of crude oil can influence profitability. When prices rise, refining becomes more expensive; when they fall, profits can decrease. Local economic conditions also affect how attractive artisanal refining is, as it becomes a fallback option in a region with few formal job opportunities.

Discussion of Findings

The Niger Delta, rich in oil reserves, has long been the site of both formal and informal oil extraction activities. Artisanal refining, an informal and illegal method of refining crude oil, has become a significant source of livelihood for many in the region despite its considerable risks. The cost-benefit analysis of artisanal refining in the Niger Delta is multifaceted, involving economic, environmental, health, and social dimensions. The following discussion provides insights based on the research questions and objectives.

1. Key Economic Benefits of Artisanal Refining

Artisanal refining provides immediate economic benefits to individuals and communities in the Niger Delta. One of the key benefits is income generation. Many people involved in artisanal refining earn an income that supports their families, as formal job opportunities are limited in the region. Studies such as Ebiede (2017) and Agboola and Emmanuel (2019) confirm that artisanal refining

serves as an important livelihood strategy for unemployed youths, offering quick financial returns in a context of economic deprivation and limited industrial employment opportunities. Artisanal refineries require low initial capital investment and minimal formal training, making them accessible to a broad population.

These refineries produce fuel products like kerosene, diesel, and gasoline, which are in demand in local markets especially in rural areas where access to official petroleum products is scarce. Adekola, Allen, and Ogbe (2017**)** observed that local fuel production from artisanal refineries helps mitigate fuel scarcity and transportation challenges in remote Niger Delta communities. Beyond the refiners themselves, the practice creates jobs in ancillary activities such as transportation, distribution, and retail of refined products. Many people depend on this informal economy, as it is one of the few available means of livelihood in areas affected by poverty and environmental degradation. However, these economic benefits are largely short-term, and the long-term costs related to health and environmental damage may undermine these gains.

2. Environmental Degradation from Artisanal Refining

The environmental impacts of artisanal refining are severe and often irreversible. The refining process generates large amounts of waste, often discharged directly into the surrounding environment without treatment, leading to contamination of soil, water, and air. Nriagu et al. (2016) reported extremely high concentrations of hydrocarbons and heavy metals in soils and sediments around artisanal refining sites in Rivers and Bayelsa States, rendering farmlands infertile and water unsafe for human use. Similarly, Olujobi (2020) highlighted that illegal refining activities contribute significantly to environmental degradation and loss of biodiversity in the Niger Delta.

The pollution from these activities has also led to deforestation, as large areas of forest are cleared for refining operations. The emissions from these refineries including sulfur dioxide (SO_2), carbon monoxide (CO), and particulate matter (PM2.5) contribute to air pollution, damaging ecosystems and affecting the quality of life for nearby residents. Water bodies such as rivers and creeks are particularly vulnerable to contamination from oil spills and discharge of toxic substances. The

widespread contamination of water sources disrupts local fisheries, vital for food security in the region. Anifowose et al. (2012) found that artisanal refining and oil spills have destroyed aquatic habitats, leading to declining fish yields and reduced agricultural productivity, thereby worsening poverty and food insecurity.

3. Health Impacts on Populations Living Near Refining Sites

Artisanal refining poses grave health risks to individuals living near refining sites. Exposure to pollutants such as benzene, toluene, and other toxic chemicals leads to respiratory diseases including asthma, bronchitis, and chronic obstructive pulmonary disease (COPD). Fine particulate matter (PM2.5), a byproduct of the refining process, increases the risk of cardiovascular diseases and long-term lung damage. Briggs et al. (2020) documented high incidences of respiratory and dermal illnesses among residents living close to illegal refining sites in Gokana and Bonny Local Government Areas of Rivers State, linking these to exposure to hydrocarbon pollutants.

Contamination of local water sources with hydrocarbons and other chemicals also leads to gastrointestinal problems, skin conditions, and infections. People who consume contaminated water or use it for bathing and washing are particularly at risk. Prolonged exposure to these pollutants can lead to more serious conditions, such as cancer. Vulnerable groups including children and pregnant women are at heightened risk of developmental delays, birth defects, and other health complications due to exposure to environmental pollutants. Another major health hazard associated with artisanal refining is fire outbreaks. In Rivers State, Naanen and Tolani (2014) documented incidents in Kegbara-Dere and Bodo communities in Gokana Local Government Area, where more than 50 victims were either burnt to death or sustained various degrees of injuries between 2009 and 2013. These fatalities and injuries often go unreported to government authorities, reflecting the informal and clandestine nature of the practice.

4. Social Challenges Faced by Communities Engaged in Artisanal Refining

Communities involved in artisanal refining in the Niger Delta face several social challenges exacerbated by the illegal nature of the activity. One of the most prominent is social marginalization. Such communities are frequently excluded from access to basic services like healthcare, education, and clean water due to the

informal status of their livelihood. The illegal status of artisanal refining prevents them from receiving government support or development interventions, reinforcing their isolation. Okoli and Orinya (2019) argue that the criminalization of artisanal refining without viable livelihood alternatives has deepened social exclusion and fostered distrust between communities and state institutions.

Additionally, the criminalization of artisanal refining creates a hostile environment where individuals are at risk of arrest, fines, or equipment confiscation. Law enforcement agencies frequently raid refining sites, often resulting in violent confrontations and destruction of property, further deepening community grievances. Conflicts over land, resources, and the environmental consequences of refining also fuel inter-community tensions, undermining social cohesion. Limited access to essential services such as healthcare and education remains a critical issue. Pollution from refining activities worsens health crises, while inadequate medical facilities mean people cannot access the care they need. Similarly, the lack of infrastructure for waste disposal, sanitation, and clean water exacerbates the spread of disease and poor living conditions.

Conclusion

In conclusion, the cost-benefit analysis of artisanal refining in the Niger Delta reveals a complex and challenging situation. While artisanal refining provides immediate economic benefits, including income generation and job creation, the long-term costs associated with environmental degradation, health impacts, and social exclusion often outweigh these benefits. The practice contributes to the destruction of local ecosystems, public health problems, and the marginalization of vulnerable communities. Furthermore, the criminalization of artisanal refining exacerbates the vulnerability of these communities, reducing their access to essential services and increasing their exposure to conflict and violence.

To address these issues, it is essential to consider alternative livelihood opportunities, improved enforcement of environmental regulations, and better access to healthcare and social services for affected communities. Sustainable solutions should focus on balancing the economic needs of the population with long-term environmental preservation and public health protection, ensuring a more equitable and healthy future for the Niger Delta.

Recommendations

1. **Create Alternative Livelihoods.** The government and organizations should offer alternatives to artisanal refining by promoting sustainable farming, small businesses, and skills training in areas like carpentry and welding. This will help reduce reliance on illegal refining and provide long-term job opportunities for communities.
2. **Enforce Environmental Regulations.** Stronger environmental laws should be put in place to reduce pollution from artisanal refining. This includes controlling waste disposal, cleaning up polluted water, and limiting harmful emissions. Encouraging cleaner refining techniques can also help protect the environment.
3. **Improve Healthcare Access.** Healthcare services should be expanded in communities affected by artisanal refining. This includes building more health centers, training medical staff to treat pollution-related illnesses, and providing mobile clinics in remote areas to offer basic health care.
4. **Support Communities with Basic Services.** The government should improve access to clean water, education, and sanitation in communities involved in artisanal refining. Involving local leaders in decision-making about these services can ensure that the needs of these communities are met, helping to reduce social exclusion and improve quality of life.

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