Oil Extraction and the Environment in Nigeria's Niger Delta: A Political-Industrial Ecology (PIE) Perspective

ABSTRACT

This paper examines the environmental impacts of oil extraction in Nigeria's Niger Delta through the lens of Political-Industrial Ecology (PIE). The Niger Delta, known for its rich biodiversity and substantial oil reserves, has experienced severe ecological degradation due to decades of oil exploitation. The environmental challenges include frequent oil spills, gas flaring, and habitat destruction, all of which threaten the livelihoods of local communities and disrupt the delicate balance of the ecosystem. By applying the PIE perspective and analyzing existing literature, government reports, and environmental assessments, this paper aims to clarify the systemic power dynamics between state and corporate interests that prioritize economic profit over environmental protection. This study explores the interconnectedness of political, economic, and environmental factors contributing to the ongoing crisis in the region. It emphasizes the need for a thorough evaluation of the forces that drive environmental degradation and offers insights into potential policy reforms aimed at achieving sustainable development in resource-rich areas like the Niger Delta.

Keywords: Political-Industrial Ecology (PIE), Oil Extraction, Environmental Degradation, Niger Delta, Governance and Corporate Accountability

1. INTRODUCTION

The Niger Delta, a region rich in biodiversity and cultural heritage, is central to Nigeria's oil production and economic stability. However, decades of oil extraction have resulted in severe environmental degradation, jeopardizing the livelihoods of local communities and disrupting ecological balance. Nigeria is Africa's largest crude oil producer, with proven reserves of 37.50 billion barrels and a production capacity of approximately 2.19 million barrels per day [1]. The adverse impacts of oil exploitation include decreased food productivity, harm to subsistence economies, habitat destruction, outbreaks of diseases, and increased social instability [2]. A study by the Nigerian Conservation Foundation estimates that oil spills over the last 50 years have ranged from 9 to 13 million barrels, significantly threatening community well-being [3]. Research by the United Nations Environmental Programme (UNEP) reveals that residents face elevated levels of petroleum hydrocarbons in contaminated water and air, posing serious health risks [4]. The environmental degradation resulting from petroleum activities in Nigeria has been substantial [5].Various factors contribute to oil spill incidents, including natural disasters such as landslides and earthquakes, operational failures such as poor maintenance and human errors, and vandalism aimed at oil theft or sabotage [41]. As a result, the Niger Delta has earned the dubious distinction of being labeled by Watts and Zalik [42] as "the most polluted place on the planet. However, Political-Industrial Ecology (PIE) provides a comprehensive framework to understand how industrial activities contribute to these

environmental crises in the Niger Delta by examining the interplay of political and economic forces with material flows like oil.

2. METHODOLOGY

This study employs a Political-Industrial Ecology (PIE) perspective to analyze the environmental impacts of oil extraction in Nigeria's Niger Delta. The research follows a qualitative approach, drawing on secondary data obtained from various online sources, including academic literature such as Scopus, Web of Science and Google Scholars; governmental reports, and assessments from international organizations such as the United Nations Environment Programme (UNEP), Nigerian agencies, including the Nigerian Conservation Foundation and the Nigerian Upstream Petroleum Regulatory Commission, alongside relevant global assessments. The primary focus of this research is to examine critical environmental issues such as oil spills, gas flaring, and land degradation within the context of political, corporate, and socio-economic dynamics. By framing these findings within the PIE perspective, the study seeks to understand the role of state-corporate alliances in fostering environmental degradation. This methodology facilitates an exploration of the systemic power relations between multinational oil corporations and the Nigerian government, revealing how economic interests often take precedence over environmental regulations. Additionally, the analysis addresses how failures in governance, weak enforcement of environmental laws, and corporate negligence exacerbate the socio-ecological challenges facing the Niger Delta.

3. PIE: Historical Foundations

Industrial ecology has its roots in the work of physicists and environmental engineers from the late 1960s, notably Ayres and Kneese [6], who began to systematically quantify resource flows and environmental impacts. By the 1990s, it emerged as a distinct field focusing on the transformation of resource stocks and flows across various stages of industrial ecosystems, from extraction to disposal [7]. Its methodologies such as material flow analysis, life cycle assessment, and environmental input-output modeling are quantitative and technical, aiming to reduce material and energy consumption in industrial systems. However, industrial ecology often lacks a thorough consideration of the social, political, and economic contexts within which these industrial processes operate. In contrast, political ecology, which emerged from the work of scholars like Wolf [8] and Robbins [9], critically examines the power relations that drive environmental changes. It addresses issues of equity, governance, and access to resources, focusing on how political and economic systems impact environmental outcomes. Political ecology emphasizes the social dimensions of environmental degradation, particularly how marginalized groups often bear the brunt of ecological harms, and it offers a lens to scrutinize the unequal distribution of environmental benefits and burdens.

4. The Political-Industrial Ecology (PIE) Approach

Political-Industrial Ecology (PIE) combines elements of political ecology and industrial ecology to explore how political and industrial actors shape environmental outcomes. As described by Newell et al. [10] in their work “Political-industrial ecology: An introduction,” PIE focuses on the ways in which resource (e.g. material and energy) flows and stocks shape (and are shaped by) environmental, socio-economic, and political processes and patterns over time and space.”Therefore, it can be said thatPIE emphasizes the socio-ecological impacts of industrial processes while considering the power dynamics between state and corporate interests.Drawing from Dawson et al. [11], research on environmental justice emphasizes the importance of social feedbacks and governance in managing ecosystem service trade-offs. In the context of the Niger Delta, similar dynamics are observed, where state-corporate alliances, economic dependence on oil, and weak governance exacerbate environmental degradation. The PIE perspective helps analyze how these structural factors contribute to ongoing ecological harm and socio-political inequalities in the region.”By examining resource flows and power dynamics, PIE reveals how marginalized communities disproportionately suffer from environmental harm, enabling a deeper understanding of the structural forces perpetuating ecological degradation and social inequality.

5. Environmental Degradation in the Niger Delta

The Niger Delta suffers extensive environmental degradation due to oil extraction, characterized by frequent oil spills, gas flaring, and inadequate regulatory oversight. These activities have led to the pollution of air, soil, and water, resulting in the destruction of mangrove forests and significant loss of biodiversity [12]. Nwankwoala and Nwaogu [5] highlight that oil spills are a primary environmental challenge in the region, with over 1,000 oil production wells and 47,000 km of pipelines contributing to numerous incidents. Between 1976 and 2005, over three million barrels of oil were spilled, with current estimates suggesting that more than 115,000 barrels are spilled annually [13].

Table 1:Oil Spillage situation from 2010 to 2018.

Year	Number of Spills	Quantity of Oil Spilled (Barrels)
2010	537	17,658.10
2011	673	66,906.84
2012	844	17,526.37
2013	522	4,066.20
2014	1087	10,302.16
2015	753	32,756.87
2016	434	1,658.98
2017	429	9,097.05
2018	567	9,718.22
Total	**5848**	**169,690.79**

Source: Department of Petroleum Resources, [44]

Ilaobuchi et al. [18] ascertain that Oil spillage remains a significant environmental and economic concern in Nigeria, particularly in the Niger Delta region, where the petroleum industry operates. The author's obtained data from the NOSDRA Oil Spill Monitoring website reveals consistent patterns of oil spill occurrences, with certain companies consistently contributing to higher spill volumes. The case of Ogoniland exemplifies the critical situation. An independent scientific assessment by UNEP in Ogoniland reveals that pollution resulting from over 50 years of oil operations in the region has penetrated deeper and wider than previously understood. This unprecedented assessment spanned 14 months, during which the UNEP team examined over 200 locations and surveyed 122 kilometers of pipeline rights of way. They reviewed more than 5,000 medical records and engaged over 23,000 individuals through local community meetings. Detailed investigations into soil and groundwater contamination were conducted at 69 sites, demonstrating that even areas appearing unaffected on the surface are severely contaminated underground, necessitating immediate action to protect human health and mitigate risks to affected communities[14].Oil spills are defined as the release of liquid hydrocarbons into the environment due to human activities [15]. In the Niger Delta, the frequency of spills is alarming, with over 1,000 oil production wells and 47,000 km of pipelines contributing to numerous incidents [16]. Between 1976 and 2005, more than three million barrels of oil were spilled in Nigeria, with over 9,000 spill incidents recorded [17]. More recent estimates suggest that over 115,000 barrels of oil are spilled into the Niger Delta annually [13].

6. Power Dynamics and Corporate-State Alliances

The PIE perspective allows for an examination of the power dynamics driving oil extraction and environmental degradation in the Niger Delta. Multinational oil corporations, such as Shell and Nigeria Agip Oil Company, wield significant influence over the Nigerian state, often shaping policies to their advantage. The Nigerian government's reliance on oil revenues has historically resulted in the neglect of environmental regulations in favor of economic gain. This has enabled weak enforcement of environmental standards, allowing oil companies to operate with minimal accountability for ecological damage. For instance, Shell reported that 73% of oil spills at its facilities between 2008 and 2012 were attributed to vandalism [19]; however, many incidents stem from aging infrastructure and operational failures.

Following PIE perspectives, the alignment of state interests with corporate goals creates a framework that prioritizes economic profitability over environmental protection. The systemic failure of governance mechanisms in Nigeria allows for a lack of accountability for oil companies, further exacerbating the environmental crises in the region. For example, between 2006 and 2013, over 20,000 pipeline breaks were recorded, with vandalism cited as a primary cause [20]. The 2008 and 2009 oil spills in the Bodo community, which released over 500,000 barrels of oil into the environment, serve as a stark reminder of the devastating impacts of corporate negligence and inadequate regulatory oversight.Moreover, the close alliance between the Nigerian government and multinational oil corporations' results in the prioritization of

corporate interests over environmental sustainability. This partnership thrives in a governance framework lacking transparency and accountability. The Nigerian National Petroleum Corporation (NNPC) and international oil companies have faced criticism for neglecting oil spill cleanups and implementing inadequate safety measures [21].

The failure of Nigeria's environmental enforcement mechanisms can be attributed to various factors, including rampant corruption among public officials. Bribery and coercion are commonplace, rendering regulatory agencies ineffective in holding oil companies accountable for environmental violations [22]. Despite possessing laws comparable to those in advanced nations, Nigeria's failure to enforce these laws has led to significant degradation in the Niger Delta [23]. Local governments face severe financial constraints, limiting their ability to acquire necessary resources for effective environmental management [24]. For example, in Lagos State, fines collected from environmental violations contribute to general revenue rather than supporting environmental protection initiatives, disincentivizing proactive enforcement. The inadequacy of Nigeria's constitutional framework for environmental protection poses significant challenges. The 1999 constitution lacks strong provisions empowering citizens to enforce their right to a clean environment, promoting apathy towards environmental issues. NESREA's limitations in enforcing laws within the oil and gas sector further compromise environmental justice [25].

6. Socio-Ecological Impacts of Oil Extraction

The environmental degradation caused by oil extraction in the Niger Delta has had profound socio-ecological consequences. Local communities, who rely on farming and fishing for their livelihoods, have been severely impacted by the contamination of soil and water.Historically, the Niger Delta has experienced numerous major spills, resulting in significant quantities of spilled oil. For instance, in 1978, two oil spill disasters occurred in the Niger Delta: the first from GOCON’s Escravos, resulting in a spill of 300,000 barrels of oil, and the second due to SPDC’s Forcados Terminal tank failure, resulting in a spill of 580,000 barrels of oil. Subsequent years saw further incidents, including a Texaco Funiwa-5 blowout in 1980, resulting in a spill of about 400,000 barrels of oil, and an oil spill from the Abudu pipeline in 1982, which led to the release of approximately 19,000 barrels of oil. The impact continued with spills from Idoho in 1998 (40,000 barrels), Etiama in 2000 (11,000 barrels), and Ughelli in 2005 (10,000 barrels) [45, 46]. Oil spills have destroyed farmlands, polluted fishing creeks, and rendered drinking water sources unsafe [26]. The economic losses experienced by these communities have exacerbated poverty levels and led to internal displacements [27].Petroleum fires resulting from ruptured pipelines and tankers have further compounded the environmental damage, leading to catastrophic consequences for both human and ecological systems [28]. In addition to the immediate environmental impacts, the long-term consequences of oil spills persist due to insufficient cleanup efforts. The UNEP [4] report on Ogoniland revealed that oil contamination continues to affect the region years after extraction activities ceased, highlighting the inadequacy of existing environmental management strategies. However, one notable

examples of scholarship that interrogate the socio-economic and political dynamics of resource flows include Huber's work [29, 30] on the ecological underpinnings of industrial capitalism through flows of oil. Huber emphasizes the need for an 'industrial political ecology' approach to understand how economic systems interact with environmental governance. This perspective is critical in analyzing the socio-ecological impacts of oil extraction in the Niger Delta, where weak governance structures further exacerbate the environmental crisis [21].

9. Challenges of Environmental Governance and Corporate Accountability

The International Network for Environmental Compliance and Enforcement (2009) defines environmental enforcement as the actions taken by governments to ensure adherence to environmental policies. Despite the establishment of the Environmental Impact Assessment Decree (EIAD Act 73/1992), which mandates oil companies to conduct Environmental Impact Assessments (EIAs) for major operations, compliance has been subpar. Reports indicate that Shell conducted EIAs without local community engagement, raising questions about the effectiveness of these assessments (Environmental Rights Action, 2010). Nigeria has been a historical leader in gas flaring, with approximately 2 billion standard cubic feet flared daily, contributing to environmental degradation and resource wastage. The EIAD was implemented to mitigate such impacts, yet enforcement remains weak. Despite claims of compliance by companies like Shell and Chevron, the reality reflects ongoing environmental violations, evidenced by 9,191,426 barrels of crude oil spilled between 1976 and 2009, predominantly affecting rivers and communal lands [31]. Corruption within the regulatory framework significantly hampers compliance efforts. The joint venture agreements between the Federal Government and multinational oil companies often lead to a shifting of responsibility, as noted by Bobo Brown, Shell's Public Affairs Manager. Local communities' express frustration towards oil companies, reflecting a broader discontent with governmental accountability. Additionally, systemic corruption within federal agencies tasked with monitoring compliance has allowed oil companies to evade stringent regulations, exacerbating environmental degradation [32].

Following the PIE approach; it is evident that the challenges of environmental governance in Nigeria, where the state's dependence on oil revenues hampers effective regulation of the oil industry. Despite efforts to introduce environmental policies, such as the Environmental Impact Assessment (EIA) Act, enforcement has been inadequate. Oil companies, shielded by their political and economic influence, often underreport oil spills and environmental incidents [13].Amnesty International [33] reported that many oil spills go unreported, and those that are reported are often inadequately addressed, with Shell and Nigeria Agip Oil Company spilling over 21.7 million liters of oil into the Niger Delta between 2011 and 2017 [34]. These incidents illustrate the failure of both the Nigerian state and multinational corporations to prioritize environmental protection over profit. PIE perspectives critique these systemic failures, revealing

how power dynamics perpetuate environmental injustices and hinder the potential for sustainable development.

9.Application of PIE to Oil Extraction in Nigeria's Niger Delta: A Case Study Approach

The Niger Delta has long been a site of intense environmental degradation, largely due to the activities of multinational oil companies. The frequent oil spills and pipeline ruptures in the region have led to catastrophic impacts on both local ecosystems and the livelihoods of its inhabitants. By applying the Political-Industrial Ecology (PIE) perspective to this case, we can better understand how the intersections of corporate power, state policy, and environmental injustices shape these outcomes.In the context of Political-Industrial Ecology (PIE), we can explore the relational and multi-scalar dimensions of oil extraction in the Niger Delta. As Bergmann [35] emphasizes, PIE serves as a framework to destabilize the singular value of commodities by juxtaposing price with alternative metrics, such as embodied carbon, land degradation, and labor exploitation. This approach allows for a critical examination of the stark disparities between the wealth generated by oil companies and the ecological and social costs endured by local communities. For instance, while Shell and other oil corporations report substantial profits, the fishing, farming, and drinking water resources in the Niger Delta are severely compromised. A more synthetic representation of the capitalist space-economy, as advocated by PIE, highlights the uneven distribution of wealth and the environmental harm inflicted upon these communities.

Furthermore, Deutz et al. [36] demonstrate that PIE can assess extraction processes from multiple lensesenvironmental, technological, and stakeholder perspectives. In the Niger Delta, certain published interviews with local stakeholders, including community leaders, oil company representatives, and government officials, could reveal the complex socio-technical assemblages that influence both the continuation of oil extraction and efforts (or lack thereof) for environmental recovery. A PIE perspective enables an analysis of how the vested interests of powerful stakeholders' corporations, political elites, and military forcesare intertwined with the regulatory and environmental challenges that have stymied efforts at cleaning up oil spills and restoring the degraded ecosystems.Huber's [30] concept of "industrial political ecology" also adds value to our understanding of oil extraction in Nigeria. Rather than blaming dispersed consumer choices for environmental degradation, Huber shifts attention to the class of actors that control industrial production and metabolismnamely, the oil corporations. In the Niger Delta, this approach emphasizes the role of corporate elites and political actors who, in their relentless pursuit of profit, have perpetuated environmental harm on a massive scale. Huber's framework can help dissect the power relations that make it difficult for local communities to challenge these entrenched corporate practices.

Urban PIE studies, such as those by Cousins [37] and Guibrunet et al. [38], also provide a methodological bridge for examining the flow of resources like oil in Nigeria. These studies highlight the importance of

looking beyond quantitative metrics and employing qualitative, place-based methods to understand resource metabolisms. Applying this to Nigeria, we can move away from a purely functionalist analysis of oil spills and instead investigate the lived experiences of communities that deal with the everyday realities of environmental degradation, such as those dependent on the Niger Delta's fragile mangrove ecosystems. This perspective is essential for understanding how corporate negligence and state complicity create environmental injustices in both urban and rural spaces in the region.

Furthermore, scholars such as Newell and Cousins [39] emphasize that this alignment creates a framework that prioritizes economic profitability over environmental protection. The Nigerian government, heavily reliant on oil revenues, often collaborates closely with multinational corporations, enabling them to operate with minimal regulatory oversight. This partnership fosters an environment where corporate interests dictate operational practices, leading to widespread environmental degradation. For instance, the lax enforcement of environmental regulations in favor of attracting foreign investment results in practices like gas flaring and oil spills, which have devastating effects on local ecosystems and communities. Furthermore, Breetz [40] highlights how these dynamics not only contribute to environmental harm but also perpetuate social injustices, as marginalized communities bear the brunt of the ecological consequences while being excluded from decision-making processes. Baka et al. [41] further supports this argument by illustrating how the governance processes surrounding biofuels and land use decisions reflect similar state-corporate dynamics, accentuating the need for a critical examination of how such alignments influence environmental policies and practices.

10. CONCLUSION

Applying the PIE perspective to oil extraction in the Niger Delta offers a more holistic and relational analysis of the environmental and socio-political dynamics at play. It moves beyond a singular focus on oil as a commodity, engaging instead with the broader assemblages of power, environmental degradation, and local struggles for justice. This approach not only sheds light on the root causes of environmental harm but also opens new avenues for envisioning more equitable and sustainable futures for the region. From a Political-Industrial Ecology (PIE) perspective, the alignment of state interests with corporate goals significantly shapes environmental outcomes in resource-rich regions like Nigeria's Niger Delta. This critical examination of the state-corporate nexus emphasizes the need for reforms that address both economic incentives and environmental protections to ensure sustainable resource management in the Niger Delta.

Conflict of interest

The authors declare no conflict of interest for this article.

Disclaimer (Artificial Intelligence)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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