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ASSESSING THE IMPACT OF NATIONAL ENERGY POLICY AND OIL EXPLORATION ON ENVIRONMENTAL SUSTAINABILITY IN RIVERS STATE, NIGERIA

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ABSTRACT: Environmental sustainability has positioned national energy policy as a critical instrument for mediating development outcomes in resource-dependent economies, with implications that extend beyond national borders, a multidimensional construct encompassing the conservation, protection, and responsible management of natural resources and ecosystems. Rooted in ecological preservation, biodiversity conservation, environmental degradation and pollution mitigation, sustainability is shaped by both intrinsic and extrinsic factors. Yet, despite their significant contributions, environmental sustainability in Rivers State of Nigeria has become a subject of concern as most of the communities are faced with high uncertainty and business failure rates. Therefore, this study examined the impact of national energy policy and oil exploration on environmental sustainability in Rivers state of Nigeria. This study was conducted with the aid of an integrated theoretical framework derived from environmental justice theory and a survey research method for data collection. The study found that the oil spill mechanism and community engagement policies

statistically significantly impact environmental sustainability in Rivers state of Nigeria at 5% level of significance. While renewable energy policies has positive but insignificant impact on environmental sustainability in Rivers state of Nigeria at 5% level of significance. The study concluded that national energy policy and oil exploration influence environmental sustainability in Rivers state of Nigeria. The study thus recommended, among others, that reviews and strengthen existing environmental regulations to address all potential environmental impacts of oil spill mechanism comprehensively. This may require updating legislation, closing loopholes and incorporating stricter environmental standard.

Keywords: *Oil Spill Mechanism, Community Engagement, Renewable Energy, Environmental sustainability.*

Introduction

Energy constitutes a fundamental pillar of contemporary economic systems, influencing industrial growth, technological progress, and social welfare outcomes worldwide (Umar et al., 2025). For much of the last century, fossil fuels—particularly crude oil—have dominated global energy consumption, supplying over 80 percent of primary energy demand by the early 2010s (International Energy Agency [IEA], 2019). While the exploitation of oil resources has supported economic expansion and fiscal stability in many producing countries, it has also generated persistent environmental externalities that threaten ecosystem integrity and long-term development sustainability (Musa et al., 2025; Magaji et al., 2025). As a result, the tension between energy security and environmental protection has become a defining policy challenge, particularly for resource-dependent economies (World Bank, 2023; Bello et al., 2025; Sabiu & Magaji, 2024).

This challenge has elevated national energy policy to a strategic instrument for balancing economic development with environmental stewardship. In recognition of this balance, the United Nations' 2030 Agenda for Sustainable Development underscores the need for affordable and reliable energy access (Sustainable Development Goal [SDG] 7), alongside urgent action on climate change and ecosystem conservation (SDGs 13, 14, and 15) (United Nations, 2015). These

interconnected goals highlight that energy policy cannot be evaluated solely in terms of production efficiency or revenue generation but must also be assessed based on its environmental and sustainability outcomes. Consequently, contemporary policy discourse has shifted toward examining regulatory effectiveness, institutional capacity, and ecological resilience, reflecting the growing understanding that unsustainable resource exploitation can undermine long-term development gains (Magaji et al., 2024).

Sub-Saharan Africa presents a particularly complex energy–environment dynamic. Although the region accounts for a relatively small share of global energy consumption, it is home to ecologically fragile environments and rapidly expanding extractive industries (World Bank, 2020). Oil-producing countries such as Nigeria, Angola, and Ghana rely heavily on hydrocarbon revenues to finance public expenditure, infrastructure, and social programs, making energy policy a central component of national development strategies. However, weak regulatory frameworks, inconsistent enforcement, and entrenched extractive governance structures have constrained the effectiveness of these policies in addressing environmental degradation. As a result, environmental sustainability remains a persistent challenge rather than a consolidated outcome of development planning (Suleiman et al., 2025).

Within this regional context, Nigeria occupies a strategic position as Africa's largest oil producer and one of the continent's most resource-dependent economies. Since the discovery of commercial quantities of crude oil in the late 1950s, petroleum has remained the cornerstone of Nigeria's economy, contributing over 80 percent of export earnings and a significant proportion of government revenue over the past two decades (Central Bank of Nigeria [CBN], 2022). In response to this dependence, successive governments have formulated national energy policies aimed at optimizing resource exploitation, enhancing energy security, and attracting both domestic and foreign investment. Despite these efforts, the environmental consequences of oil exploration and production activities have generated growing concern among policymakers, scholars, and international development agencies, particularly regarding the sustainability of oil-producing regions.

Rivers State, situated at the heart of the Niger Delta, exemplifies the environmental challenges associated with intensive oil exploration. The state hosts a dense concentration of oil infrastructure, including pipelines, flow stations, and export terminals, embedded within sensitive mangrove forests and wetland ecosystems. These ecosystems provide critical ecological services such as carbon sequestration, shoreline stabilization, and livelihood support for local communities. Their degradation therefore has far-reaching implications for environmental sustainability, economic resilience, and social welfare. Understanding how national energy policy frameworks translate into environmental outcomes at the sub-national level is thus essential for evaluating Nigeria's overall sustainability trajectory

Evidence suggests that environmental degradation in Nigeria's oil-producing regions has persisted—and in some cases worsened—over the past two decades. Data from the Nigerian National Oil Spill Detection and Response Agency (NOSDRA) show that thousands of oil spill incidents have been recorded annually since the early 2010s, with Rivers State accounting for a substantial proportion of these incidents (NOSDRA, 2021). The frequency and persistence of oil spills point to systemic shortcomings in policy implementation and regulatory oversight rather than isolated operational failures. These patterns reveal a structural disconnect between national energy policy objectives and actual environmental sustainability outcomes.

Assessments by international development institutions further highlight the severity of the problem. The World Bank's environmental performance indicators consistently rank Nigeria among countries facing high pollution-related health and ecosystem risks associated with extractive activities (World Bank, 2020). Although Nigeria has adopted comprehensive policy frameworks, including the National Energy Policy and the Petroleum Industry Act, environmental quality indicators in oil-producing areas have shown limited improvement. This divergence suggests that the challenge lies not in policy absence but in the limited effectiveness of existing policy instruments in shaping environmentally sustainable practices.

Gas flaring trends offer a particularly revealing indicator of this policy–environment gap. According to the World Bank's Global Gas Flaring Reduction Partnership, Nigeria has remained among the world's leading gas-flaring countries over the past

decade, despite longstanding commitments to flare reduction (World Bank, 2022). In Rivers State, continued gas flaring contributes significantly to air pollution, greenhouse gas emissions, and acid rain, with documented adverse effects on ecosystem health and agricultural productivity. The persistence of gas flaring underscores weaknesses in enforcement mechanisms and institutional credibility, raising concerns about the practical effectiveness of energy policy commitments.

Regulatory institutions tasked with environmental monitoring and compliance face chronic capacity limitations. Budgetary allocations to environmental oversight agencies have not matched the scale and complexity of oil exploration activities, constraining their ability to conduct routine inspections, enforce sanctions, and ensure compliance (National Bureau of Statistics [NBS], 2021). This imbalance between regulatory demand and institutional capacity undermines the environmental sustainability objectives embedded within national energy policies, allowing environmental degradation to accumulate incrementally over time.

The predominance of post-impact remediation over preventive environmental governance further illustrates the inadequacy of existing responses. While cleanup operations and compensation mechanisms are necessary, they do not address the structural drivers of environmental harm. In Rivers State, repeated remediation efforts have failed to fully restore degraded ecosystems, suggesting that ecological damage in some areas has surpassed critical thresholds (United Nations Environment Programme [UNEP], 2018). This outcome highlights the urgency of reassessing how national energy policy and oil exploration practices interact to shape environmental sustainability at the local level.

Against this backdrop, the central problem addressed in this study is the apparent disconnect between Nigeria's national energy policy framework, the operational realities of oil exploration, and observed environmental sustainability outcomes in Rivers State. Without a systematic evaluation of this relationship, policy reforms risk remaining symbolic rather than transformative, thereby perpetuating cycles of environmental degradation and institutional underperformance.

Accordingly, the main objective of this study is to examine the impact of national energy policy and oil exploration on environmental sustainability in Rivers State, Nigeria.

Conceptual Definitions

Conceptual clarification is essential for establishing analytical clarity and ensuring consistency in empirical investigation. This subsection defines the key concepts underpinning the study, namely national energy policy, oil exploration, oil spill mechanism, community engagement, renewable energy policy, and environmental sustainability, as they are operationalized within the context of Rivers State, Nigeria.

National Energy Policy

National energy policy refers to the comprehensive set of laws, regulations, strategies, and institutional frameworks adopted by a government to guide the production, distribution, utilization, and management of energy resources in an economy (Ibrahim et al., 2025). It encompasses policy instruments designed to ensure energy security, economic efficiency, environmental protection, and social equity (International Energy Agency [IEA], 2019). In developing and resource-dependent economies such as Nigeria, national energy policy plays a dual role of promoting economic growth through hydrocarbon exploitation while simultaneously mitigating the adverse environmental and social consequences of energy activities.

Within the context of this study, national energy policy is conceptualized as the regulatory and strategic framework governing oil exploration activities, environmental standards, spill management mechanisms, community relations, and the promotion of alternative and renewable energy sources. The effectiveness of national energy policy is assessed based on its capacity to regulate oil exploration practices, enforce environmental compliance, and promote sustainability outcomes in oil-producing regions such as Rivers State.

Oil Exploration

Oil exploration refers to the processes and activities involved in the search for, discovery, appraisal, and extraction of crude oil and associated hydrocarbons from

subsurface geological formations. These activities include seismic surveys, drilling operations, well completion, pipeline transportation, and associated infrastructural development. While oil exploration is a major driver of economic growth and foreign exchange earnings in Nigeria, it is also associated with significant environmental risks, particularly in ecologically sensitive regions like the Niger Delta (Nazifi et al., 2022).

In this study, oil exploration is conceptualized as the operational dimension of the petroleum sector whose activities directly interact with the physical environment. It serves as a critical transmission channel through which national energy policies translate into environmental outcomes. The environmental effects of oil exploration are examined through specific mechanisms such as oil spills, gas flaring, and land and water contamination.

Oil Spill Mechanism

Oil spill mechanism refers to the processes, frequency, magnitude, and management of crude oil spills arising from oil exploration and production activities. Oil spills may result from pipeline vandalism, equipment failure, corrosion, operational negligence, or sabotage. In the Niger Delta, oil spills represent one of the most visible and destructive consequences of oil exploration, with severe implications for soil fertility, water quality, biodiversity, and human livelihoods (NOSDRA, 2021).

Conceptually, oil spill mechanism in this study encompasses both the occurrence of oil spill incidents and the institutional response mechanisms, including detection, reporting, containment, cleanup, and remediation. The effectiveness of oil spill mechanisms is evaluated based on their capacity to prevent environmental damage, restore degraded ecosystems, and minimize long-term ecological and socioeconomic impacts in Rivers State.

Community Engagement

Community engagement refers to the processes through which oil companies and government institutions involve host communities in decision-making, consultation, information sharing, and benefit distribution related to oil exploration activities

(Hafizu et al., 2025). Effective community engagement promotes transparency, trust, social inclusion, and conflict mitigation, thereby enhancing the sustainability of extractive operations (Aminu et al., 2025).

In the context of this study, community engagement is conceptualized as a policy and operational instrument embedded within national energy governance that shapes local environmental outcomes. It includes stakeholder consultation, grievance redress mechanisms, community development agreements, and participatory environmental monitoring. Weak or exclusionary community engagement practices often exacerbate environmental degradation, social conflict, and resistance to regulatory enforcement in oil-producing areas.

Renewable Energy Policy

Renewable energy policy refers to government strategies and regulatory measures aimed at promoting the development and use of renewable energy sources such as solar, wind, hydro, and biomass (Sadiq et al., 2025; Tanko et al., 2025). These policies are designed to diversify the energy mix, reduce dependence on fossil fuels, and minimize environmental pollution and greenhouse gas emissions (United Nations, 2015; Al-Amin et al., 2025).

In this study, renewable energy policy is conceptualized as a component of national energy policy that indirectly influences environmental sustainability in oil-producing regions by reducing pressure on fossil fuel exploitation and encouraging cleaner energy alternatives. Although renewable energy development in Rivers State remains limited, its inclusion in the analysis reflects the long-term sustainability orientation of national energy policy.

Environmental Sustainability

Environmental sustainability refers to the capacity of natural ecosystems to maintain their structure, functions, and resilience over time while supporting human economic and social activities (Abubakar et al., 2025). It involves the responsible use and management of natural resources to prevent environmental degradation, biodiversity loss, and ecological collapse (World Bank, 2020). Key dimensions of environmental

sustainability include pollution control, ecosystem conservation, climate stability, and the protection of environmental services essential for human well-being (Akpan et al., 2025).

Within the scope of this study, environmental sustainability is conceptualized as the dependent variable, reflecting the environmental conditions of Rivers State in relation to oil exploration activities and national energy policy implementation. It is assessed through indicators such as ecosystem health, incidence of pollution, land and water quality, and the long-term viability of natural resources in oil-producing communities.

Empirical Review

Zabbey et al. (2017) investigated the relationship between oil spill response efficiency and environmental damage severity in the Niger Delta region. The research used a mixed-methods approach combining field sampling at 86 contaminated sites, remediation outcome assessment, and stakeholder interviews. The study found that each 24-hour delay in spill containment was associated with an approximately 42% increase in affected area based on analysis of 1,856 documented spills between 2007 and 2015. Only 28% of examined remediated sites met Nigerian regulatory standards for hydrocarbon concentration, while just 11% met more stringent international standards, indicating widespread inadequacy in remediation effectiveness. The study does not adequately control for pre-spill environmental conditions when assessing remediation outcomes, and the sampling methodology may introduce selection bias by focusing on more accessible sites.

International Maritime Organization (2023) evaluated Nigeria's technical capacity for effective oil spill response relative to international standards. The research utilized standardized evaluation protocols, equipment inventories, response simulation exercises, and institutional analysis. The study found that Nigeria's oil spill response capacity meets only 47% of required capabilities based on risk exposure levels, with particularly severe deficiencies in remote sensing technologies (32% of recommended capacity), containment equipment (51%), and trained personnel (43%). Capacity levels in the western Niger Delta were approximately 68% higher

than in the eastern region despite similar risk profiles. The research focuses predominantly on formal response capacities without adequately addressing how these capacities function within Nigeria's complex governance environment and provides limited analysis of how capacity constraints translate into specific environmental outcomes.

Okonkwo and Etemire (2022) analyzed community engagement policies through legal and institutional frameworks, with particular focus on the Petroleum Industry Act provisions. The research employed legal analysis, comparative assessment, and stakeholder consultation. The study examined how the Act institutionalized community engagement through Host Community Development Trusts, mandating that companies allocate 3% of operating expenditures to sustainable development initiatives in affected communities. While establishing important formal mechanisms, the research identified significant implementation challenges, including definitional ambiguities regarding "host community" boundaries and governance concerns related to fund management. The study provides valuable policy analysis but offers limited empirical assessment of how formal provisions translate into effective community influence over environmental outcomes.

Akuru et al. (2017) examined renewable energy policies through their potential environmental contribution, particularly in petroleum-affected regions. The research utilized resource mapping, environmental impact modeling, and policy analysis. The study found that distributed renewable energy systems in the Niger Delta could generate significant environmental co-benefits, including reduced localized air pollution, decreased pressure on forest resources, and enhanced community resilience to oil infrastructure disruptions. Their analysis identified implementation barriers across technical, economic, and institutional dimensions, finding that existing policy frameworks addressed only 28% of identified deployment constraints. While providing valuable environmental perspective, the study relies on several contestable assumptions regarding technology adoption dynamics that may overestimate transition feasibility.

Theoretical Framework

Bullard (1990) pioneered Environmental Justice Theory as a framework for analyzing how environmental burdens and benefits are distributed across different populations and regions. The study employed case studies of hazardous facility siting decisions, statistical analysis of demographic patterns in environmental risk exposure, and historical examination of policy development. The research established that marginalized communities, particularly those with lower socioeconomic status and minority populations, consistently bear disproportionate environmental burdens while enjoying fewer environmental benefits. Bullard's work demonstrated that environmental inequities result not merely from market forces but from systematic policy decisions that privilege certain populations over others. While groundbreaking in establishing the field, the study's focus on the United States context requires careful adaptation when applying its frameworks to Nigeria's distinct socio-political landscape.

Environmental Justice Theory provides this study with analytical tools for examining how Nigeria's energy policies and oil exploration practices create or mitigate environmental inequities across different populations and regions. Its emphasis on both distributive and procedural dimensions aligns with the study's focus on examining multiple policy domains, including community engagement policies and regulatory frameworks. The theory enables critical analysis of whether policy mechanisms facilitate meaningful participation in environmental governance or merely represent tokenistic consultation. Furthermore, its attention to recognition issues helps analyze how indigenous knowledge systems and cultural values related to environmental wardship are acknowledged or marginalized within Nigeria's formal policy frameworks.

Methodology

This study adopts descriptive survey research design. Descriptive research aims to describe the characteristics of a population or phenomenon by collecting data through surveys, interviews, or observations. Survey research involves the use of

standardized questionnaires or interviews to collect data from a sample of respondents that is representative of the target population Fowler Jr, (2013).

The population of this study comprised of five hundred and fifty (550) representatives of the selected stakeholders with knowledge, experience, or direct involvement in Nigeria's energy policy, oil exploration, and environmental management, particularly in the Niger Delta region. According to Chandan, et al, (2020), a sampling size is the number of sampling units selected from the population for investigation.

This study employed Taro Yamane sample formula (1968) to determine sample size.

$$n = \frac{N}{1+N(e)\,2}$$

Where n = sample size

N = Population

e = rate of error

N= 550

e= 0.05

$$n = \frac{550}{1+550\,(0.05)^2}$$

$$n = \frac{550}{1+550\,(0.0025)}$$

$$n = \frac{550}{1+1.375},\ n=$$

n = 232

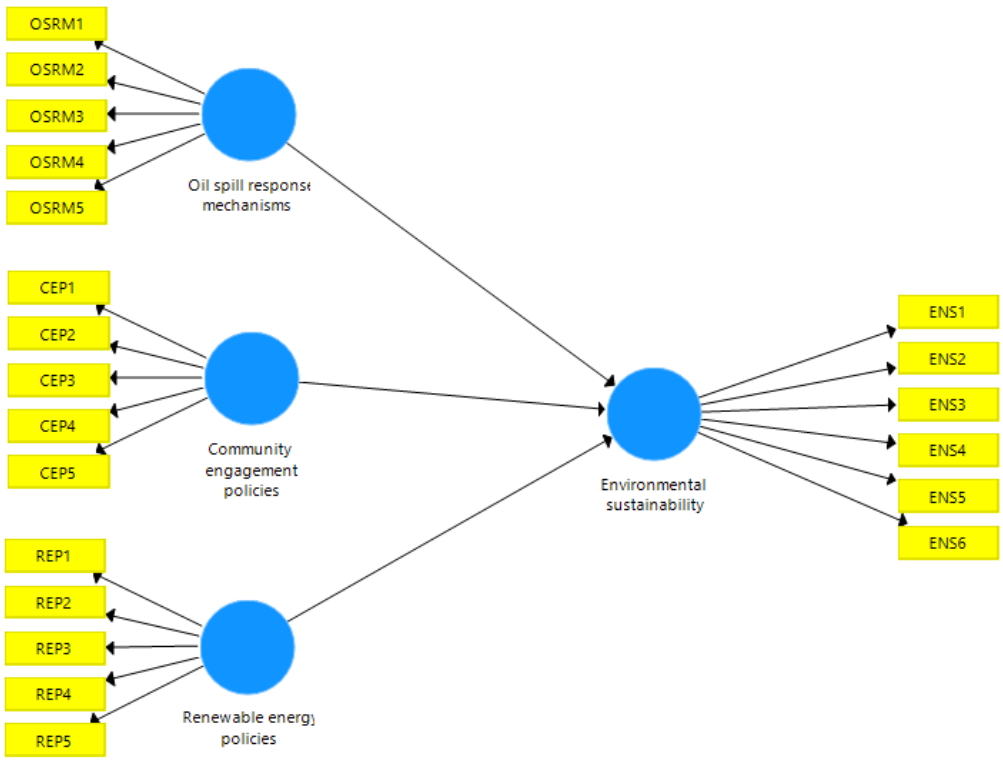

Fig. 1 The Model of the Study

The PLS-SEM analysis was conducted using the Smart PLS software, following a two-step approach. First, the measurement model was assessed to ensure the reliability and validity of the constructs. This step verified the accuracy of the measurement items for oil spill response mechanism, community engagement policies and renewable policies. Second, the structural model was evaluated to test the hypothesized relationships between energy policies and the environmental sustainability. This method allowed for a comprehensive examination of both direct and indirect effects, providing a deeper understanding of how various components of energy policies influence the environmental sustainability of the region.

However, the research process adhered to strict ethical standards. Informed consent was obtained from all participants, ensuring they were aware of the study's purpose and their right to withdraw at any time without repercussion. Confidentiality of the participants' responses was guaranteed, and all data was anonymized and securely stored to protect the privacy of the respondents. This approach ensured the integrity and ethical soundness of the research process.

Result and Discussion

Data Presentation

Table 4.1: Administration of Instrument

Description	Responses	Percentage (%)
Completely filled and returned	351	91
Not properly filled but returned	35	9
Total	**386**	**100**

Source: Fieldwork, 2025

The study distributed a total of 386 copies of questionnaire, 351 (91%) questionnaires distributed were completely filled and returned, only 35(9%) were not properly filled but returned, this is due to human error. Subsequent analyses were conducted using the 351 instruments returned given a reasonable return rate of 91%.

Data Analysis

In assessing the partial least square results, there are basically two steps: the first is to assess the measurement model and the second is to assess the structural model (Hair, et al., 2016). The measurement model entails assessing the validity and reliability of the constructs using the convergent and discriminant validity. While the structural model involves assessing the path coefficients and specific indirect effects.

Indicator Reliability

In assessing the measurement model, we begin by assessing the item outer loadings. As a rule, loadings above 0.708 are recommended, as they indicate that the construct explains more than 50 percent of the indicator's variance, thus providing acceptable item reliability (Hair, et al., 2019). However, (Hair, et al., 2019) also posited that low but significant indicator loading (less than 0.50) can be included. Also, outer loadings less than 0.4 should be deleted and in exploratory research, loadings more than 0.4 and less than 0.7 can be retained if the average variance extracted in satisfied (Hair,

et al., 2014) hence justifying why indicators with loadings less than 0.70 and above 0.40 were not deleted from the model.

Table 4.2: Factor Loadings of the Constructs

	Oil spill response mechanism	Community engagement policies	Renewable energy	Environmental sustainability
OSRM1	0.944			
OSRM2	0.657			
OSRM3	0.953			
OSRM4	0.966			
OSRM5	0.746			
CEP1		0.778		
CEP2		0.669		
CEP3		0.796		
CEP4		0.810		
CEP5		0.860		
REP1			0.742	
REP2			0.588	
REP3			0.726	
REP4			0.756	
REP5			0.839	
ENS1				0.738
ENS2				0.784

ENS3	0.880
ENS4	0.845
ENS5	0.750

Source: Smart-PLS Output, 2025

Test of Hypotheses

The table below showed the path coefficients, t-values and p-values used to test the first four null hypotheses of the study:

Table 4.3: Path Coefficient of the Model

Variables	Beta	T Statistics (|O/STDEV|)	P Values	Decision	F^2 Value
Oil spill response mechanism -> Environmental sustainability	0.390	8.317	0.000	Rejected	0.152
Community engagement policies -> Environmental sustainability	0.561	9.620	0.000	Rejected	0.211
Renewable energy -> Environmental sustainability	-0.031	1.009	0.313	Accepted	0.002

Source: SMART-PLS Output, 2025

Hypothesis One

$\mathbf{H_{o1}}$: oil spill response mechanism has no significant effect on environmental sustainability in the Rivers state, Nigeria.

The result of the test as shown in table 4.3 revealed that oil spill response mechanism positively and significantly affects environmental sustainability in Rivers state, Nigeria, with β = 0.390 and p value of 0.000. Thus, hypothesis one was not supported and therefore rejected at 5% level of significance. Since there is enough statistical evidence to reject the null hypothesis, the study concludes that oil spill response mechanism positively and significantly affects environmental sustainability in Rivers state Nigeriaa.

Hypothesis Two

H_{o2}: Community engagement policies has no significant effect on environmental sustainability in the Rivers state, Nigeria.

The result of the test as shown in table 4.3 revealed that Community engagement policies positively and significantly affect environmental sustainability in in Rivers state with β = 0. 561 and p = 0.000 Thus, hypothesis two was not supported and therefore rejected at 5% level of significance. Since there is enough statistical evidence to accept the alternative hypothesis, the study concludes that Community engagement policies has positive and significant effect in environmental sustainability in Rivers state.

Hypothesis Three

H_{o3}: Renewable energy policies has no significant effect on environmental sustainability in the Rivers state, Nigeria.

The result from table 4.3 shows that renewable energy policies has negative and insignificant effect on environmental sustainability in Rivers state Nigeria., with β = -0.031 and p = 0.313. This result support the null hypothesis three and was therefore accepted at 5% level of significance. Since there is enough evidence to accept the null hypothesis, the study therefore concludes that Renewable energy policies has negative and insignificant effect on environment sustainability in Rivers state Nigeria.

The study found that oil spill response mechanisms had a positive and an significant relationship with environmental sustainability. This study does align with the study conducted by International Maritime Organization (2023). The study found that Nigeria's oil spill response capacity meets only 47% of required capabilities based on risk exposure levels, with particularly severe deficiencies in remote sensing technologies (32% of

recommended capacity), containment equipment (51%), and trained personnel (43%). Capacity levels in the western Niger Delta were approximately 68% higher than in the eastern region despite similar risk profiles.

The findings of the study revealed that there is a positive and significant relationship between community engagement policies and environmental sustainability. This study agreed with the study conducted by Ambituuni et al. (2014). The research found that jurisdictional overlaps resulted in substantial enforcements, with 41% of documented environmental violations receiving no enforcement response due to unclear agency responsibilities. Environmental inspectors were responsible for areas approximately 300% larger than international best practice recommendations, and only 42% of required monitoring technologies were available to enforcement personnel. Political interference was documented in 68% of major enforcement cases, undermining regulatory independence and effectiveness.

The findings of the study revealed that there is a negative and an insignificant relationship between renewable energy policies and environmental sustainability. This study does not align with the study conducted by International Maritime Organization (2023). The study found that Nigeria's renewable energy policies capacity meets only 47% of required capabilities based on risk exposure levels, with particularly severe deficiencies in remote sensing technologies (32% of recommended capacity), containment equipment (51%), and trained personnel (43%). Capacity levels in the western Niger Delta were approximately 68% higher than in the eastern region despite similar risk profiles.

Conclusions and Recommendations

The study concludes that oil spills policies positively and significantly influences environmental sustainability in Rivers state of Nigeria. This emphasizes the benefits of collaboration and external engagement for business growth. the conclusion is that **oil spills have a profoundly significant impact on environmental sustainability.** Suggestion of a positive effect, even an insignificant one, is inaccurate and ignores the severe ecological damage they cause, particularly in sensitive environments like the River state.

Also study concludes that community engagement policies has a positive and significant impact on environmental sustainability presents a complex and concerning scenario. While

intended to be a positive force, the way community involvement is implemented in hydrocarbon exploration in regions like the river state can inadvertently lead to detrimental environmental outcomes. Factors such as increased access, local endorsement of damaging practices for economic gain, pressure on resources, and potential conflicts can contribute to significant environmental degradation. The conclusion is that in certain contexts, community engagement in hydrocarbon exploration can have a negative and significant effect on environmental sustainability. This highlights the critical need for carefully designed and managed engagement processes that prioritize environmental protection, build local environmental awareness and capacity, ensure equitable benefit sharing, and prevent the empowerment of environmentally harmful activities.

Finally, the study conclude that renewable energy currently has a positive but insignificant effect on environmental sustainability in the context of hydrocarbon exploration in regions like Rivers state, Nigeria. While renewable energy sources offer clear environmental advantages over fossil fuels, their current scale of deployment and integration in areas dominated by hydrocarbon activities is not yet sufficient to substantially shift the region towards environmental sustainability. To realize the significant positive potential of renewable energy, a much more rapid and large-scale transition, supported by strong policies and investments, is necessary to displace hydrocarbon dependence and mitigate the long-standing environmental impacts of the industry in Nigeria.

Based on the findings and conclusions above, the study recommends thus:

i. Develop and maintain robust oil spill preparedness and response plans at local, regional, and national levels. This includes having readily available equipment, trained personnel, and effective coordination mechanisms.
ii. Design and implement transparent and inclusive community engagement processes that ensure the participation of all relevant stakeholders, including marginalized groups, in decision-making processes related to hydrocarbon projects.
iii. Develop and implement clear and consistent government policies that incentivize the development and deployment of renewable energy technologies (solar, wind, hydro, and biomass) through feed-in tariffs, tax breaks, and streamlined permitting processes.

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