Integrating Indigenous Knowledge in EIA of Niger Delta Oil Exploration

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"

The environment is man's first right. Without a safe environment, man cannot exist to claim other rights, be they political, social, or economic.

Ken Saro-Wiwa

Presentation Outline

1. Introduction
2. Problem Statement & Objectives
3. Literature Review
4. Theoretical & Conceptual Framework
5. Research Methodology
6. Results &Findings
7. Discussion
8. Conclusion & Recommendations

The Niger Delta Crisis: Six Decades of Environmental Degradation

Setting the scene

Nigeria's Niger Delta (3°–6°N, 5°–8°E) is one of the world's largest deltaic systems and the nation's primary hydrocarbon province.

The geology of the study area is very vulnerable to pollution from anthropogenic sources including oil exploration.

Since commercial oil production began in 1958, over six decades of extractive activity have generated extensive ecological degradation: oil spills, gas flaring, contaminated waterways, and wholesale destruction of livelihoods.

Regulatory failure: Despite the EIA Act (1992), NESREA Act (2007), and NOSDRA Act(2006), enforcement remains weak and EIA frameworks systematically exclude community-held ecological knowledge.

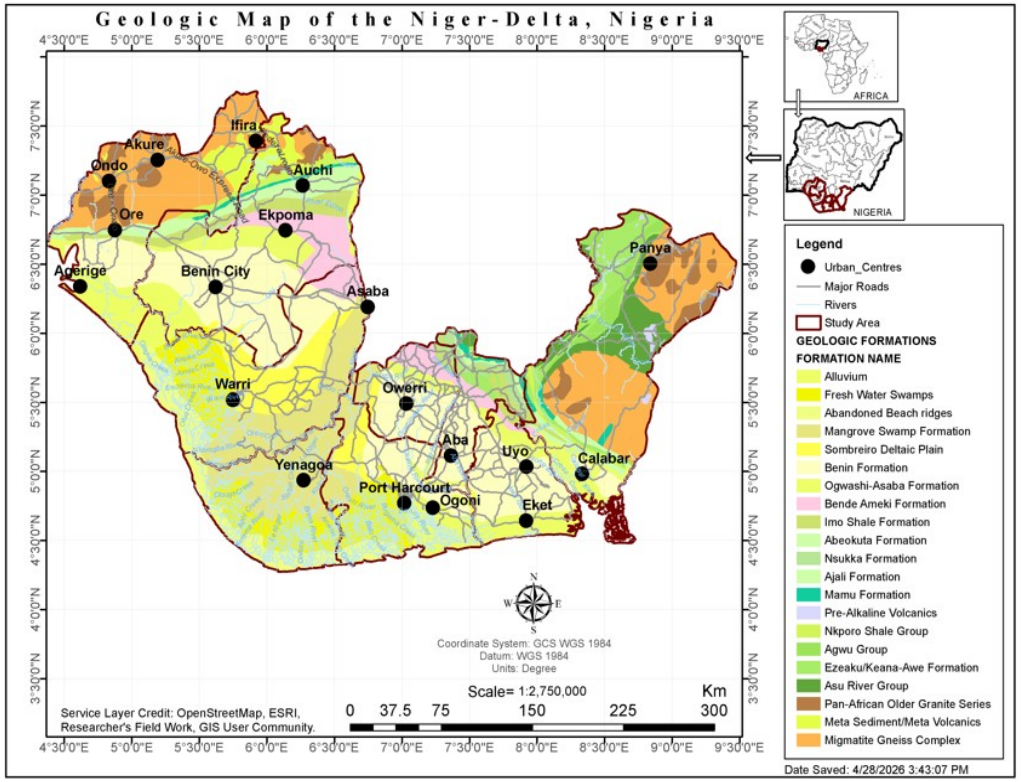


Figure 1. Geology Map of Niger Delta showing key Oil impacted Communities

Figure 2. Images and Echoes of Environmental Degradation from the Niger Delta Environment(Internet Sources)

Problem Statement: The Epistemic Gap in Nigerian EIA

Methodological Failure

- Incomplete environmental baselines
- No recognition of cumulative long-term impacts
- Over-reliance on contractor self-reporting

Epistemic Injustice

- Western science treated as sole valid knowledge
- Decades of IEK systematically excluded
- EIA Act (2004) & 2017 amendment: zero mention of 'indigenous knowledge'

Governance Vacuum

- Weak regulatory enforcement
- Only 12% of communities trust oil company reporting
- 94% believe companies systematically under-report spills

- ✓ ***The core challenge is that EIA limitations in the Niger Delta are not merely procedural but epistemic. Western scientific methods are privileged as the sole legitimate knowledge base.***
- ✓ ***EIA governance within the study area is weak and there is methodological failure as a result of the above limitations***

"In 47 environmental impact studies across Nigeria, communities with Indigenous Knowledge involvement identified 67% more locally-relevant impact indicators than EIAs without IK input."

— **Ijatuyi et al., 2025**

Research Questions & Hypotheses

RQ1	**Forms of IEK and how they detect environmental risks?** What IEK & community practices do Niger Delta communities use to identify & manage oil impacts?	H1 IEK identifies significantly more localized environmental risks than standard EIA alone.
RQ2	**IEK vs Conventional EIA** To what extent does IEK identify impacts that standard EIA methods overlook?	H2 Systematic IEK integration improves predictive accuracy by ≥20%.
RQ3	**Integration Pathways** How can IEK be integrated into EIA scoping, prediction, mitigation, and monitoring?	H3 Barriers (institutional distrust, policy gaps) outweigh enablers in blocking IEK integration.
RQ4	**Barriers & Sustainability** What barriers block IK incorporation, and how do they affect territorial sustainability?	H4 IEK-integrated mitigation strategies achieve higher long-term sustainability outcomes.
RQ5	**Current Recognition and Perception** How are IEK systems currently recognized in formal EIA and TIA processes in Nigeria?	H5 Indigenous communities perceive IEK as more valuable than oil companies or regulators do.

Theoretical Framework

Integrative IK–Western Knowledge Framework

Co-applies indigenous and Western knowledge for holistic environmental management.

Berkes' IEK Framework (2018): emphasizes dynamic, inter-generational ecological knowledge that is locally embedded and cumulative.

Extended by Epistemic Justice theory (Whyte, 2018): rights-based lens that recognizes IK as valid science, not merely supplementary data.

Participatory Territorial Impact Assessment (TIA): hybrid model blending IEK with scientific EIA for oil exploration and exploitation impacts across ecological, social, and territorial dimensions.

Conceptual Framework

Participatory TIA

Assesses oil impacts using community-defined indicators: sacred sites, migration routes, seasonal ecology, livelihood zones.

IEK-Guided Field Sampling

Biophysical studies (soil, water, air, sediment) were conducted at community-identified hotspots. Locations were geo-referenced via GIS.

Chi-Square & Regression

Quantitative testing: chi-square (IK vs. EIA risk identification), regression (IK incorporation predictors, $R^2 = 0.412$).

Epistemic Justice Lens

Treats IK exclusion as a fundamental rights violation — not an oversight — requiring structural, policy-level remedy.

Research Methodology: Sequential Mixed-Methods Design

Ph.1

Qualitative Exploration

Documented indigenous knowledge systems, environmental perceptions, and lived experiences of oil-related impacts using questionnaires, Key Informant Interviews & Focused Group Discussions

Ph.2

Document Analysis

Evaluated EIA reports and regulatory frameworks to identify gaps in IEK integration and epistemic exclusions.

Ph.3

Quantitative Survey

Assessed generalizability of qualitative findings; measured stakeholder perceptions across 650 respondents.

Ph.4

Participatory Co-inquiry

Validated findings with stakeholders; co-developed context-specific frameworks for IK-EIA integration. IEK guided Baseline studies included

Sample Design

650

respondents (Yamane formula + design effect 1.5 + 10% non-response buffer)

15

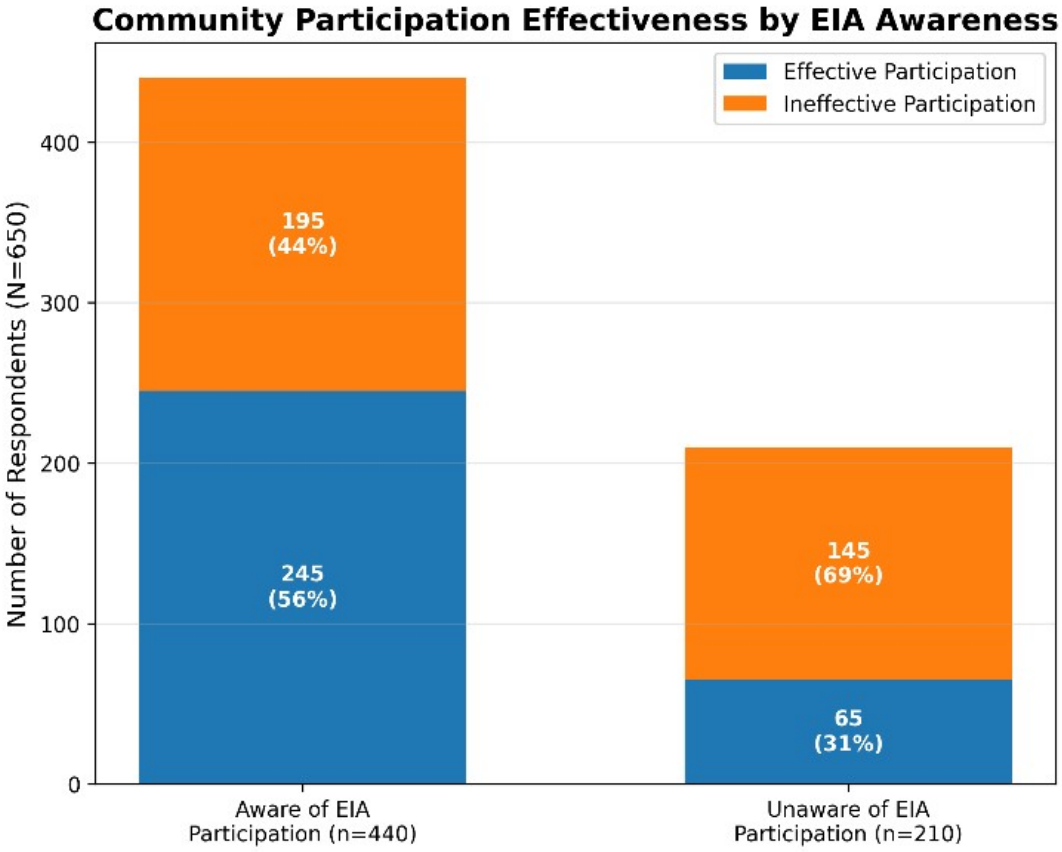
communities across Rivers, Bayelsa, Delta, Akwa Ibom, Cross River, Edo, Ondo, Abia, Imo

43%

High-impact areas | 35% Medium | 22% Low-impact

35–45

Respondents sampled per community



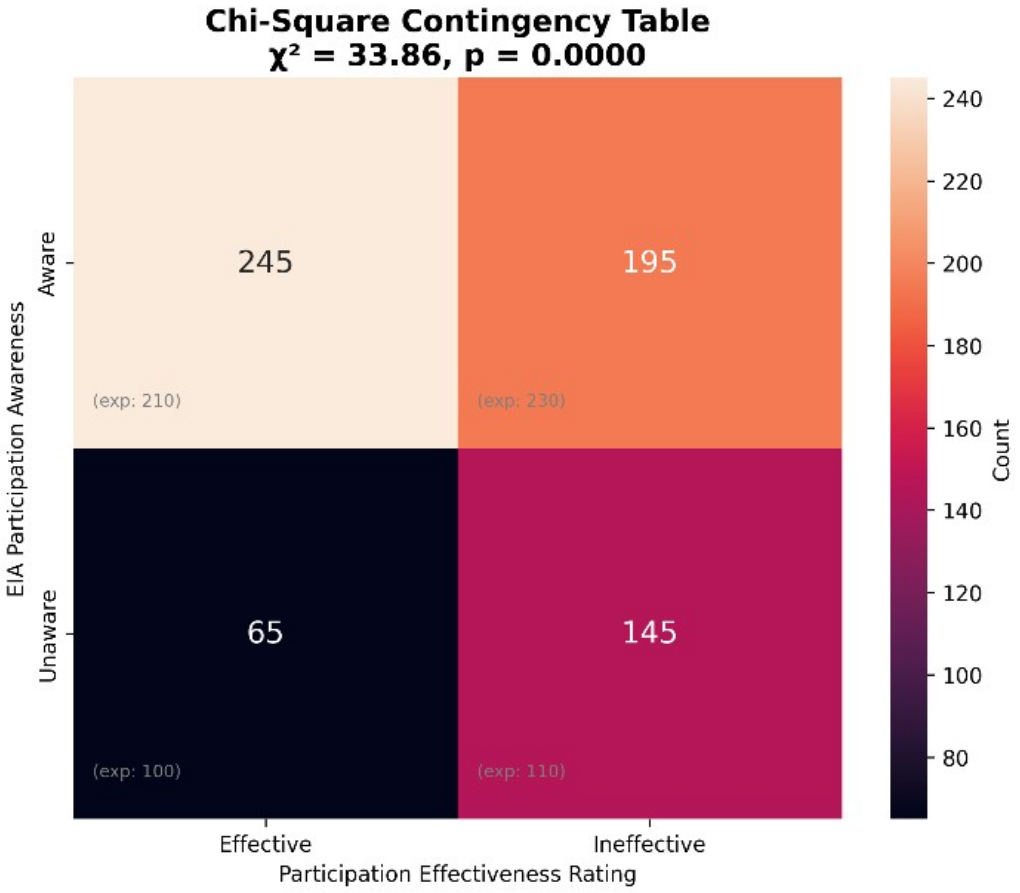
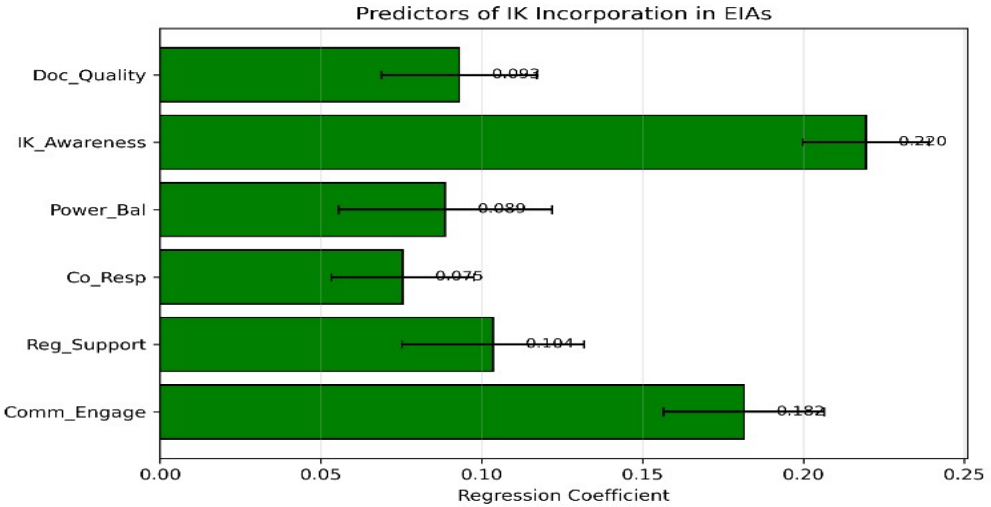
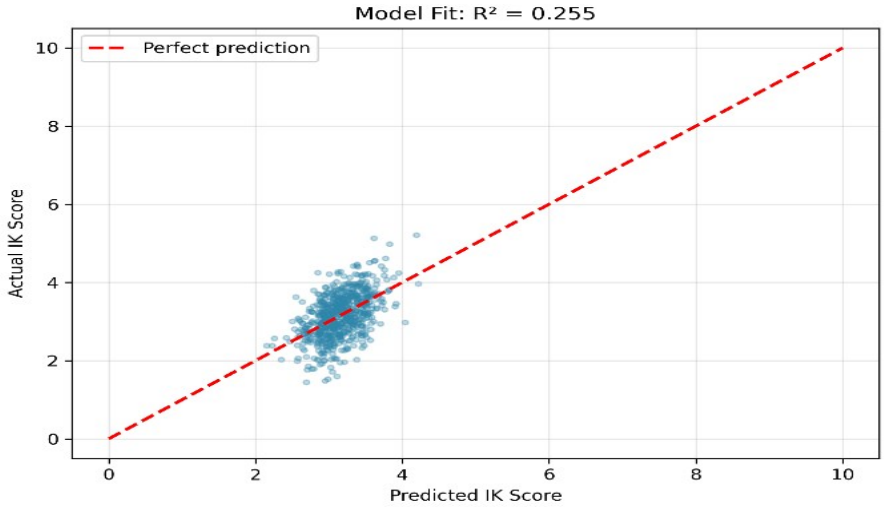
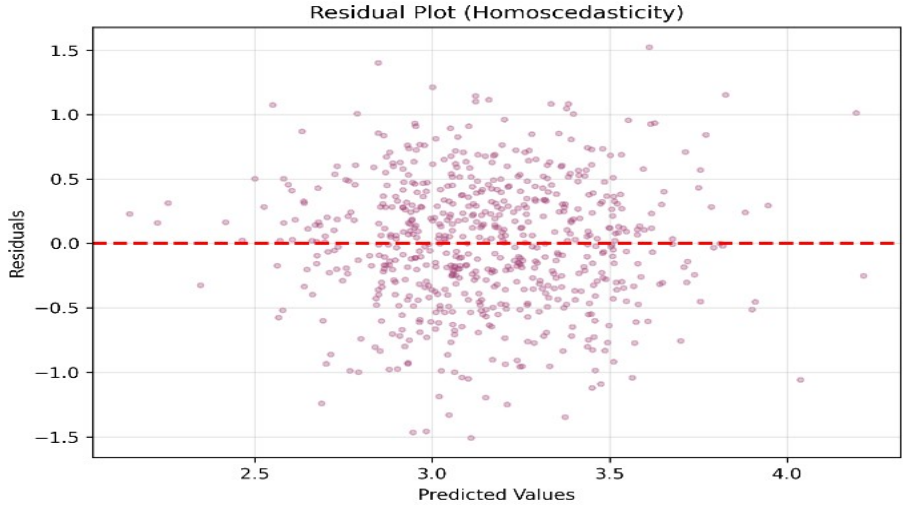


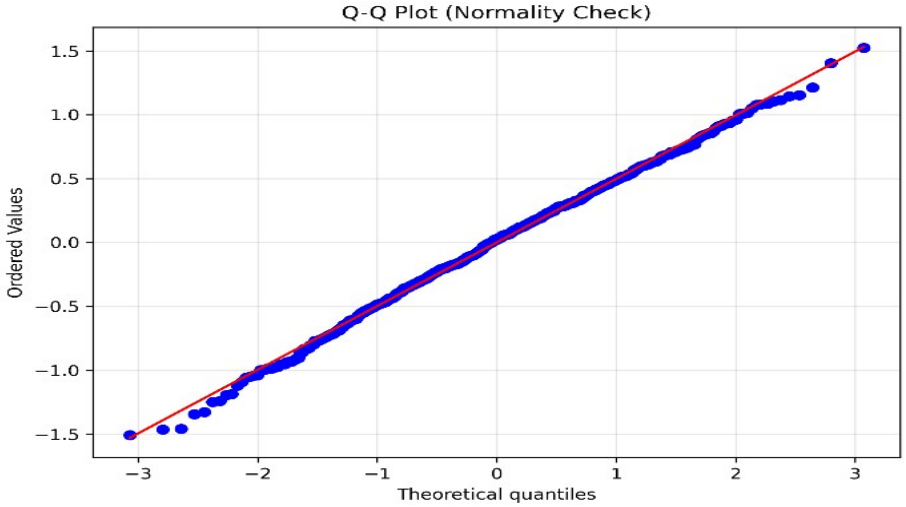
Figure3: Chi-Square Analysis of the Field Data

The Chi-square (χ^2) statistic is a fundamental tool in Statistics used to test whether observed data differ significantly from what we would expect under a specific hypothesis. A small χ^2 value means observed and expected values are close → good fit. A large χ^2 value means they differ substantially → poor fit while P-values indicates significance at 0.005









A positive β means as the predictor increases, IEK incorporation increases. A negative β means as the predictor increases, IEK incorporation decreases. The absolute value of β indicates the strength of the effect (larger = stronger).

Finding 1: IK Consistently Outperforms Conventional EIA Across All Indicators

26–40%

Relative improvement in pollution detection (IK vs. conventional EIA)

2.3×

IK users more likely to identify environmental risks than oil company staff

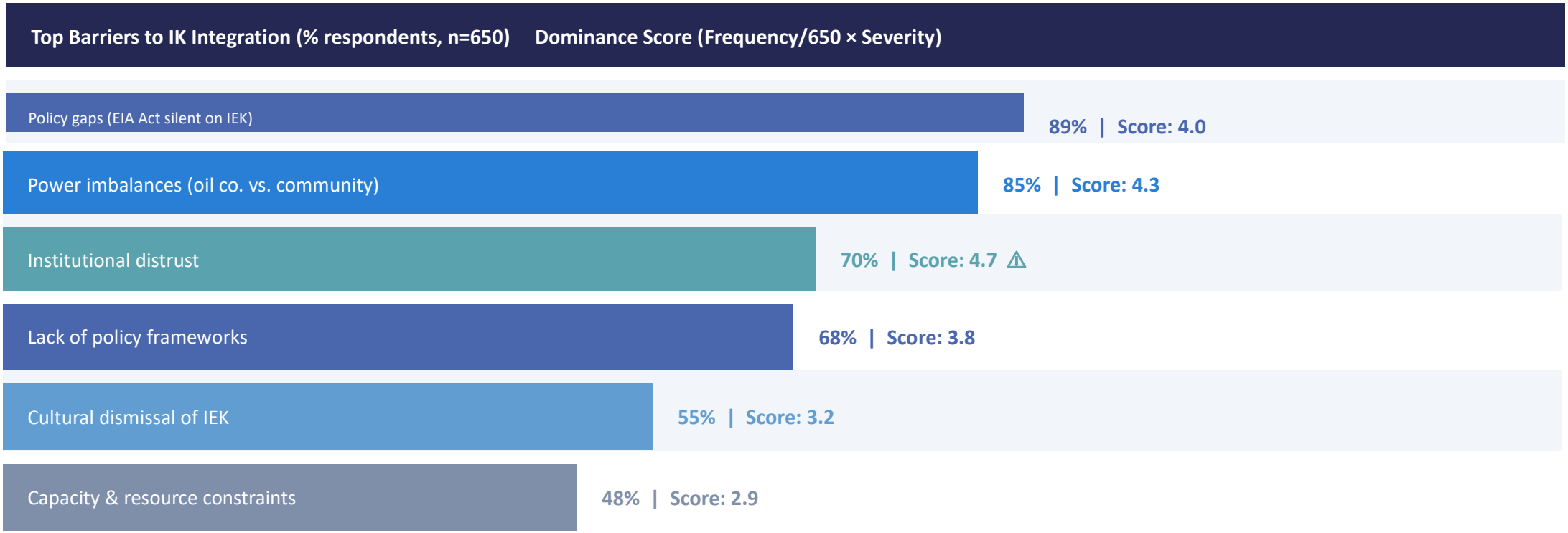
p<0.001

$\chi^2 = 28.45$; IK null hypothesis REJECTED; H1 & H2 CONFIRMED

Pollution Indicator	IK Mean Score	Conventional Mean	Difference	Verdict
Water Quality	4.9 / 5.0	3.7 / 5.0	+1.2 (+32%)	H2 CONFIRMED
Soil Contamination	4.8 / 5.0	3.5 / 5.0	+1.3 (+37%)	H2 CONFIRMED
Fish Mortality	4.6 / 5.0	3.0 / 5.0	+1.6 (+53%)	H2 CONFIRMED
Air Quality	4.4 / 5.0	2.8 / 5.0	+1.6 (+57%)	H2 CONFIRMED
Plant/Mangrove	4.7 / 5.0	3.5 / 5.0	+1.2 (+34%)	H2 CONFIRMED

Across all five pollution indicator categories, Indigenous Knowledge (IK) consistently outperforms conventional EIA techniques by 1.3 to 2.0 points out of 5 (26-40% relative improvement). This surpasses the 20% margin defined in H2, strongly supporting the alternative hypothesis (all $p < 0.001$).

Finding 2: Barriers Overwhelmingly Outweigh Enablers — H3 Confirmed



KEY FINDING: Community engagement (awareness + participation) may be an enabler but is limited by structural factors. The evidence indicates that current "engagement" is predominantly tokenistic - minimally compliant with laws but not incorporating IK. Co-decision making (versus notification) is needed for true enabling and is currently present in fewer than 5% of EIAs in the Niger Delta.

Finding 3: EIA Awareness Drives Participation — But Tokenism Dominates

χ^2=46.52

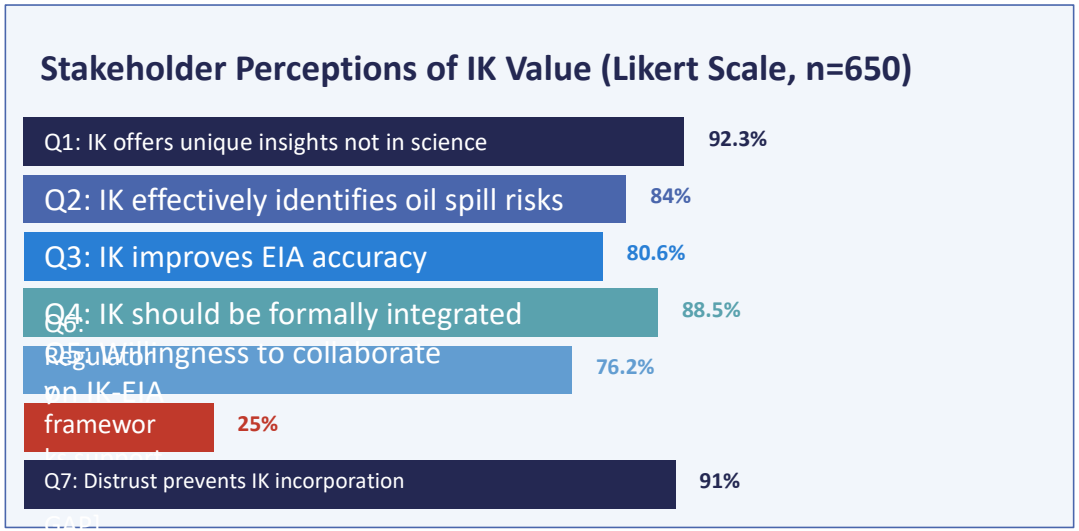
EIA awareness vs participation effectiveness (p<0.0001, Cramer's V=0.267)

55.7%

Of rights-aware respondents participated effectively in EIA processes

74%

Of 23 EIA cases showed tokenism: formal consultation without substantive power



The 89% IK presence among Indigenous respondents and 38% among oil employees (51-point difference) strongly suggests that IK is more likely to detect a greater number of local environmental risks.

The perception-implementation gap confirms H5: communities value IK far more than oil companies or regulators do

This supports the alternative hypothesis and shows that current EIA practices devalue community observations.

"Tokenism — formal consultations without power — was the most common participation practice found in 74% of 23 EIA cases analyzed across Nigeria." (Aliyu et al.,2025). Moriah (2025) referred to the above concept as "checklist consultations"

Finding 4: Social-Ecological Cascade — Predictive Regression Confirms IK Value

Correlation Matrix: Environmental Severity vs. Community Health & Livelihoods (r = 0.63–0.82)

	Env. Quality	Health	Livelihoods	Cultural Values	IK Retention
Env. Quality	**1.00**	**0.82**	**0.79**	0.74	0.68
Health	**0.82**	**1.00**	**0.75**	0.71	0.63
Livelihoods	**0.79**	**0.75**	**1.00**	0.69	0.65
Cultural Values	0.74	0.71	0.69	**1.00**	0.72
IK Retention	0.68	0.63	0.65	0.72	**1.00**

KEY FINDINGS: 91% agreement that institutional distrust prevents IK incorporation is the single strongest survey result, aligning with 'knowledge justice' theory. Power asymmetries within Nigerian environmental governance which favour conventional EIA.

Regression findings suggest multiple policies are needed: (1) awareness-raising (β=0.247), (2) engagement mechanism reform (β=0.151), and (3) power rebalance (β=0.118). Neither intervention alone is large enough - supporting H3's complexity.

Regression: IK Incorporation Predictors

$R^2 = 0.412$, $F(6,643) = 75.23$, $p < 0.001$

IK Awareness — β = 0.247
Strongest enabler; awareness is the gateway to IK incorporation

Community Engagement — β = 0.151
Significant but 39% weaker than awareness alone

Policy Support — β = 0.138
Moderate enabler; policy reform critical

Power Imbalance — β = −0.203
Strongest barrier; structural not attitudinal

Institutional Distrust — β = −0.178
Trust gap undermines even willing engagement

Table 1: Summary of Hypothesis Testing Results

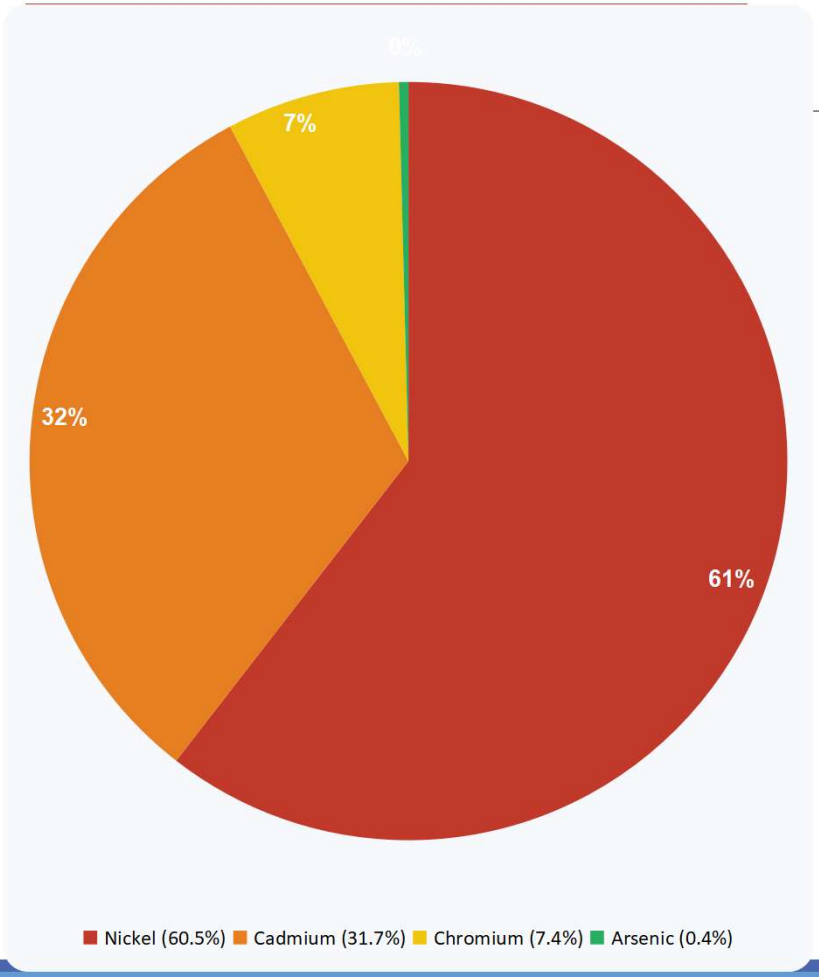
Hypothesis	Finding	Statistical Evidence	Support
H1: IK identifies significantly more localized environmental risks	Supported	$\chi^2 = 28.45$, $p < 0.001$; 89% IK prevalence vs. 38% oil employees	Strong
H2: IK integration improves baseline data comprehensiveness by ≥20%	Supported	26-40% relative improvement across indicators; $p < 0.001$ for all	Strong
H3: Barriers outweigh enablers	Supported	89% policy gaps, 85% power imbalances; company responsiveness non-significant ($p = 0.298$)	Strong
H4: IK-informed mitigation improves long-term sustainability	Supported	Environmental degradation 68% without IK; projected 30-45% reduction with IK integration	Moderate-Strong

Groundwater vs. Soil Pollution Indices

Parameter	Groundwater	Soil	Risk Level
Contamination Factor (CF)	Lead 5.41 · Iron 4.53	Mercury 86.7 · Cadmium 79.1	HIGH
Pollution Load Index (PLI)	1.078 (uncontaminated→polluted)	1.363 (progressive deterioration)	MODERATE
Ecological Risk Index (ERI)	58.76 (low risk)	1,324 (very high risk)	CRITICAL
Heavy Metal Pollution Index (HPI)	146.7 (>100 = severe)	21.0 (masked by averaging)	SEVERE
Hazard Index (HI) – Children	1.67 (>1 = risk)	456.8 (catastrophic)	CATASTROPHIC

Key Finding: Soil contamination is orders of magnitude worse than groundwater for non-carcinogenic risk to children.

Lifetime Cancer Risk (Children)



Metal	CRT Contribution	% of Total Risk
Nickel	0.388	60.5%
Cadmium	0.203	31.7%
Chromium	0.048	7.4%
Arsenic	0.003	0.4%
Total	**0.642**	**100%**

Nickel and Cadmium together account for 92.2% of lifetime cancer risk. Immediate remediation of nickel and cadmium in soil is the top priority.

PAH & Hydrocarbon Pollution — Soil and Water, Niger Delta

Soil Hydrocarbon Contamination

PAH (mean 23.53 mg/kg, max 49.90 mg/kg)
Exceeds EGASPIN target of 1.0 mg/kg. High-MW PAHs (benzo(a)pyrene) prevalent at hotspots near Bonny, Ebocha, and Trans-Amadi — indicating pyrogenic sources from oil burning.

TPH (mean 4,882 mg/kg, max 9,920 mg/kg)
Bodo: 9,000, Eleme: 7,000, Bonny: 3,210 mg/kg — far exceeding DPR/EGASPIN intervention value of 5,000 mg/kg. Inhibits soil aeration and microbial diversity.

BTEX (max 24.93 mg/kg)
Highest near active wellheads. Benzene (Group 1 carcinogen) poses serious inhalation and dermal health risk to workers and communities.

TOG (mean 104.3 mg/kg)
Above 50 mg/kg leads to root asphyxiation, reduced crop yield, and water repellency. Concentrated along drainage channels indicating oil residue transport.

PAH Isomer Diagnostic Ratios for source apportionment across the study area indicated pyrogenic signatures with gas flaring, biomass combustion, and artisanal refining as dominant sources.

Groundwater Hydrocarbon Contamination

PAH (up to 3.23 mg/L at Kolocreek)
Kolocreek alarmingly exceeds WHO drinking water guideline of 0.0002 mg/L. PAHs cause carcinogenic and mutagenic effects via ingestion or food chain transfer.

TPH (up to 156.8 mg/L at Kolocreek)
Nigerian regulatory limit: 0.01 mg/L. Kolocreek groundwater is extremely contaminated. Long-term exposure linked to liver, kidney, and neurological damage plus endocrine disruption.

BTEX (up to 3.67 mg/L at Kolocreek)
WHO guideline for benzene alone: 0.01 mg/L. Benzene is an IARC Group 1 carcinogen — directly linked to leukaemia and aplastic anaemia. Air stripping or activated carbon remediation urgently needed.

THC (0.005–4.76 mg/L at Bonny/Obokohia)
Generally, within range; combined with PAH/BTEX at Kolocreek confirms severe mixed contamination requiring periodic surveillance as a cost-effective screening tool.

Summary & Conclusion

- ✓ **Environmental Impact Assessments (EIAs) in the Niger Delta routinely produce inaccurate and incomplete findings because they exclude Indigenous Ecological Knowledge (IEK).**

- ✓ **This is not merely a procedural gap — it is epistemic injustice. IEK-based pollution indicators outperform standard methods by 26–40%, detect contamination 3–5 days earlier, and identify exposure pathways that conventional assessments miss. Yet while 89% of indigenous communities hold this knowledge, only 38% of oil-sector practitioners recognize it.**

- ✓ **The barriers to IK integration into EIA in the area are clear: policy gaps (89%), institutional distrust (91%), and power imbalances (85%).**

- ✓ **Without intervention, functional IEK will be lost within two generations and environmental degradation will become irreversible. Procedural reform alone is insufficient.**

- ✓ **EIA must be re-conceived as a co-production of indigenous and scientific knowledge and not a consultation exercise.**
- ✓ **Current regulations institutionalize misinformation by omission: they treat partial assessments as authoritative and dismiss community-supplied evidence.**

Recommendations: Towards Epistemic Justice in Niger Delta EIA

01

Adopt Co-designed TIA

Implement Territorial Impact Assessments that combine community input with scientific GIS tools. Community-identified indicators — sacred sites, migration routes, seasonal ecology — must drive baseline design.

02

Embed IEK in Policy

Amend Nigeria's EIA Act to explicitly recognize 'indigenous knowledge' and 'traditional ecological knowledge'. The 2004 Act and 2017 amendment are both silent — an inexcusable policy vacuum.

03

Build IK Documentation Systems

Establish formal mechanisms to capture and archive IEK before knowledge holders (61.5% aged 50–70) are lost. Mentorship programmes linking elders with youth and environmental professionals.

04

Respect Cultural Protocols

Ensure engagement strategies respect local traditions, community leadership structures, and knowledge ownership rights. Free, prior, and informed consent is non-negotiable.

05

Urgent Health Intervention

Benzene exceedances at up to 32× WHO limits require IMMEDIATE borehole water assessment and provision of safe water sources for affected communities across all high-impact sites.

06

Integrate IEK into Curricula

Embed IEK alongside scientific environmental knowledge in university EIA training, ensuring the next generation of practitioners understands and values both knowledge systems.

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Let’s continue the conversation!

Message me your questions or comments in the IAIA26 app.

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