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Evaluating the Effectiveness of Nigeria's National Oil Spill Detection and Response Agency (NOSDRA) in the Post-2006 Reform Era

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ABSTRACT

Nigeria established the National Oil Spill Detection and Response Agency (NOSDRA) under the 2006 Act to consolidate oil-spill detection, preparedness, response coordination, regulatory oversight and remediation supervision in one institution. Persistent spills, delayed responses and disputes over enforcement and clean-up nevertheless raise the question of whether the reform has produced effective institutional performance. A cross-sectional, mixed-methods design was used. A structured questionnaire with open-ended items yielded 130 valid responses from NOSDRA personnel, host-community and civil-society respondents, and oil-company officials in nine Niger Delta states. Likert items were coded 1 = strongly agree to 5 = strongly disagree, so lower scores indicate stronger agreement. Analysis used descriptive statistics, Cronbach's alpha, Mann–Whitney U tests and thematic analysis. Awareness of the Act and of NOSDRA's mandate was high (item means 1.61–1.85). Detection was not perceived as proactive: respondents were undecided that NOSDRA detects most spills before communities report them (M = 3.17), and 80.8% of those identifying the reporter of the most recent spill named community members. Reported response most often took one to three days (48.1%), and 14.8% reported more than a week. Enforcement and remediation oversight attracted moderate agreement (item means 2.18–2.49). NOSDRA staff were significantly more favourable than community/CSO respondents on awareness, detection, enforcement and remediation (all $p < .01$; mean differences 0.69–0.81 scale points), and community/CSO means for detection and enforcement lay beyond the neutral midpoint. Staff disagreed that the agency is adequately funded (M = 3.67) or equipped (M = 3.55). Funding deficits were the most frequent coded challenge (72% of responses), followed by staffing and training gaps (30%), weak enforcement or legal powers (26%), political interference (22%) and inadequate equipment or technology (20%). All seven proposed reforms attracted strong agreement (M = 1.45–1.63); legal amendment (50%) and dedicated funding (45%) dominated open-ended solutions. The 2006 reform created a well-understood institutional framework, but its operational effectiveness is constrained by resources, technical capacity, legal powers and stakeholder confidence. Closing the gap between mandate and performance requires predictable and independent

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funding, strengthened enforcement and compensation provisions, independent detection and verification capacity, clearer inter-agency coordination, and genuine community participation. The evidence is perceptual and should be complemented by verified administrative and environmental data.

INTRODUCTION

Since oil was found in commercial quantities at Oloibiri in 1956, petroleum has been central to Nigeria's economy, and the country is now Africa's largest crude oil producer. Decades of exploration, production and transportation have also generated persistent environmental risk, concentrated in the Niger Delta. Spills arising from corrosion, equipment failure, operational error, sabotage and illegal bunkering contaminate soil, surface water and groundwater, damage mangrove and freshwater ecosystems, and erode the farming and fishing livelihoods on which host communities depend (Nwilo & Badejo, 2005; Ite et al., 2013; United Nations Environment Programme [UNEP], 2011). The social consequences extend to public-health risk, food insecurity and a long record of grievance and conflict between communities, companies and the state (Ikelegbe, 2010; Ibeanu & Luckham, 2007; Uzoma, 2025).

Before 2006, responsibility for oil-spill management was scattered across the Department of Petroleum Resources (since succeeded by the Nigerian Upstream Petroleum Regulatory Commission), the Nigerian National Petroleum Corporation, the Federal Environmental Protection Agency and the Federal Ministry of Environment. Overlapping mandates were associated with delayed response, inconsistent enforcement, weak accountability and limited technical capability (Aghalino, 2009; Amnesty International & Centre for the Environment, Human Rights and Development [CEHRD], 2011; Nwapi, 2017). The National Oil Spill Detection and Response Agency (Establishment) Act, 2006 responded by creating NOSDRA as the focal institution for spill detection, monitoring, preparedness and response coordination. Its tasks include a national oil-spill contingency plan, a reliable spill database, supervision of clean-up and remediation, and ensuring that polluters bear the cost of clean-up and compensation. Since then, the agency has introduced Joint Investigation Visits (JIVs), formal reporting procedures, stakeholder-engagement frameworks and capacity-building programmes, and has explored GIS, remote sensing and the Nigerian Oil Spill Monitor to improve detection.

The post-2006 record is nonetheless paradoxical. NOSDRA has institutionalised spill reporting, improved the mapping and documentation of incidents and given response a clearer focal point; yet the Niger Delta continues to experience frequent spills from ageing, poorly maintained infrastructure and from third-party interference such as pipeline vandalism, sabotage and crude-oil theft, while the agency's own database and JIV findings are regularly contested by companies and communities alike. The enactment of the Petroleum Industry Act (PIA) 2021, which created the Nigerian

Upstream Petroleum Regulatory Commission (NUPRC) and the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA), has since reshaped the institutional landscape and raised questions about jurisdictional overlap (Atsegbua, 2022). The existence of a statutory agency, in other words, does not automatically ensure effective regulation. Effectiveness depends on procedural capacity and substantive outcomes as well as formal authority (Baldwin & Cave, 1999), and, in resource-dependent settings, the regulator's independence may be shaped by funding arrangements, information asymmetries and its relationships with the firms it oversees (Stigler, 1971; Laffont & Tirole, 1991).

The gap between the agency's intended and actual role can be stated concretely. An ideal NOSDRA would be technically proficient, financially autonomous and legally empowered; it would monitor the Niger Delta proactively through satellite imagery, aerial patrols and community-

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based monitoring, trigger a rapid and scientifically robust response whatever the source of a spill, apply the polluter-pays principle without exception and maintain an uncontested national spill registry. In practice, the agency has been described as dependent on operators for spill notifications, data and clean-up support; as operating alongside agencies with overlapping authority; as limited by a statute that caps penalties and is silent on compensation; and as exposed to political influence and chronic under-funding. The consequences are cumulative: continuing ecological degradation, livelihood loss and food insecurity, exposure to toxic contaminants, erosion of trust in public institutions, and substantial economic loss from deferred asset value, clean-up liabilities and reputational damage.

Existing work on NOSDRA is largely legal, institutional or qualitative, and rarely compares how the agency is assessed by its own staff and by the people it is meant to protect. This study therefore evaluates NOSDRA's effectiveness in the post-2006 era through stakeholder evidence from the Niger Delta. It pursues five objectives: (O1) to review the NOSDRA Act, 2006; (O2) to assess existing strategies for managing oil spills in the study area; (O3) to evaluate NOSDRA's effectiveness in the post-2006 era; (O4) to examine the challenges the agency faces in discharging its statutory functions; and (O5) to make policy recommendations for improving its effectiveness. The paper contributes primary survey evidence that combines the internal and beneficiary perspectives, shows where those perspectives diverge, links the constraints respondents identify to specific reform options, and is explicit about the limits of perceptual evidence.

CONCEPTUAL AND INSTITUTIONAL FRAMEWORK

Detection and response

Oil-spill detection is the identification and monitoring of petroleum releases from production, transport or storage facilities, and it is the first link in the response chain. Early detection limits the spatial and temporal extent of contamination and is therefore central to reducing ecological damage (Nwilo & Badejo, 2005). Detection mechanisms range from satellite remote sensing and aerial surveillance to pipeline-integrity sensors and community reporting. In the Niger Delta, creeks, mangroves and dense vegetation complicate aerial observation, which makes community reporting an indispensable complement to technological surveillance.

Response, in turn, covers the actions taken after detection to contain, recover and remediate spilled oil and its effects. A recurrent criticism in the Nigerian literature is that response is chronically delayed, partly for logistical reasons and partly because of jurisdictional ambiguity among NOSDRA, the former Department of Petroleum Resources and state environmental agencies (Aghalino, 2009; Amnesty International & CEHRD, 2011). The JIV, a collaborative assessment involving operators, government agencies and community representatives, is the procedural cornerstone of the response framework, although its impartiality and completeness have been questioned.

Regulatory effectiveness and environmental governance

Baldwin and Cave (1999) distinguish formal, procedural and substantive dimensions of regulatory effectiveness. Applied to oil-spill management, formal effectiveness concerns the existence and use of statutory powers; procedural effectiveness concerns reporting, investigation, coordination and fair decision-making; and substantive effectiveness concerns timely containment, adequate clean-up and reduced environmental harm. This tripartite lens organises the interpretation of results in Section 5.

Environmental governance, meanwhile, refers to the regulatory processes, institutional arrangements and decision-making systems through which environmental resources and impacts are managed, with authority distributed across public institutions and non-state actors (Lemos & Agrawal, 2006). Nigeria's oil sector operates under a hybrid regime that combines federal oversight (NOSDRA, NUPRC, the Federal

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Ministry of Environment), corporate self-regulation and traditional community governance. Scholars have repeatedly noted a structural mismatch between the density of regulatory instruments and the capacity to enforce them (Ikelegbe, 2010; Ako, 2011).

Theoretical perspectives

Four perspectives frame the analysis. Institutional theory distinguishes formal rules from the informal norms that support compliance and predicts that the creation of an agency is necessary but insufficient for effectiveness; bureaucratic integrity, political independence and societal expectations of accountability must accompany it (North, 1990; DiMaggio & Powell, 1983). Regulatory-capture theory holds that regulators may come to serve the interests of the industries they oversee, through information asymmetry, political pressure, dependence on industry resources or revolving-door practices (Stigler, 1971; Laffont & Tirole, 1991; Ekhator, 2016).

Principal–agent theory highlights the difficulty of monitoring an agent whose operational knowledge may exceed that of its overseer, here the government and citizens as principal and NOSDRA as agent (Jensen & Meckling, 1976; Moe, 1984). Good-governance theory supplies a scorecard of accountability, transparency, participation, rule of law, effectiveness and equity (World Bank, 1992; United Nations Development Programme [UNDP], 1997). These perspectives do not establish that capture has occurred; they are used as lenses for interpreting respondents' concerns about independence, operator dependency and enforcement.

The NOSDRA Act, compensation and the polluter-pays principle

The Act provides the statutory basis for a national response to oil spills, but its limits are a recurring theme in the legal literature. Yashim et al. (2026) argue that the compensation framework is structurally designed to fail: the Act does not give the agency explicit power to award compensation, a limitation reinforced by constitutional constraints on administrative bodies and affirmed in *Shell Nigeria Exploration Company Limited v National Oil Spill Detection and Response Agency*. Victims are consequently pushed into a court system characterised by protracted litigation, disputes over quantum, the "sabotage" defence frequently invoked by operators, the cost of expert evidence and jurisdictional traps, and a growing number seek redress in foreign courts. Udungeri (2024) adds that the polluter-pays principle has been misunderstood and misapplied in Nigerian law, which complicates the imposition of prevention, clean-up and remediation duties on operators, and identifies overlapping regulatory responsibility as a primary institutional barrier. Data reliability is a related concern: corporate self-reporting of spill data, which feeds NOSDRA's inventory, has been reported to be unreliable or understated (Amnesty International & CEHRD, 2011; Frynas, 2005).

Evidence on NOSDRA's performance and the research gap

Early post-2006 evaluations found the agency severely under-resourced and heavily reliant on operator notifications, a built-in conflict of interest (Aghalino, 2009). Analyses of NOSDRA-recorded spill volumes found discrepancies with independent estimates, attributed to measurement differences and suspected operator under-reporting (Ite et al., 2013). Studies of enforcement practice describe episodic and inconsistent action, with major operators contesting fines in prolonged litigation (Nwapi, 2017) and with the political economy of oil insulating large operators from stringent regulation (Ekhator, 2016). A comparison with the National Environmental Standards and Regulations Enforcement Agency suggests that leadership and organisational culture, not only legal mandate, shape regulatory credibility (Okonkwo, 2014). Independent assessment of the environment points the same way: UNEP (2011) documented contamination that had persisted for decades without remediation, and satellite-based work links spill intensity with vegetation loss alongside weak post-spill remediation (Orimoogunje et al., 2010).

Early assessments of the PIA 2021 warn of overlap between NOSDRA and the new

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upstream and downstream regulators, while suggesting that host-community provisions could strengthen reporting incentives if properly implemented (Atsegbua, 2022; Okafor & Mudiaga-Odje, 2023). Six gaps follow: few longitudinal assessments, limited attention to the agency's internal capacity, scarce quantitative analysis of response effectiveness, preliminary treatment of the PIA 2021, the absence of beneficiary-centred evaluation, and the lack of structured comparison with peer agencies. The present study addresses the internal-capacity, quantitative and beneficiary-perspective gaps through survey evidence; the longitudinal, administrative-data and comparative gaps remain open and are returned to in Section 8.

MATERIALS AND METHODS

Research design and study area

The research protocol specified a convergent-parallel mixed-methods design combining a structured questionnaire, semi-structured interviews and document analysis (Creswell & Plano Clark, 2017; Creswell & Creswell, 2018). In the analysis reported here, only the structured questionnaire and its open-ended items were available. The study is therefore best described as a cross-sectional survey with embedded qualitative content, and no independent spill database, administrative performance series, interview dataset or document analysis is claimed. Figure 1 shows how the five objectives map to evidence and findings.

The study area is the Niger Delta, which spans approximately 70,000 km² and comprises nine states: Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo and Rivers. The protocol also recognised that petroleum-related spills occur elsewhere along the value chain (for example around refineries, depots and pipelines in Lagos, Ogun, Kwara and Kaduna), but respondents in the analysed data were drawn from the nine Niger Delta states.

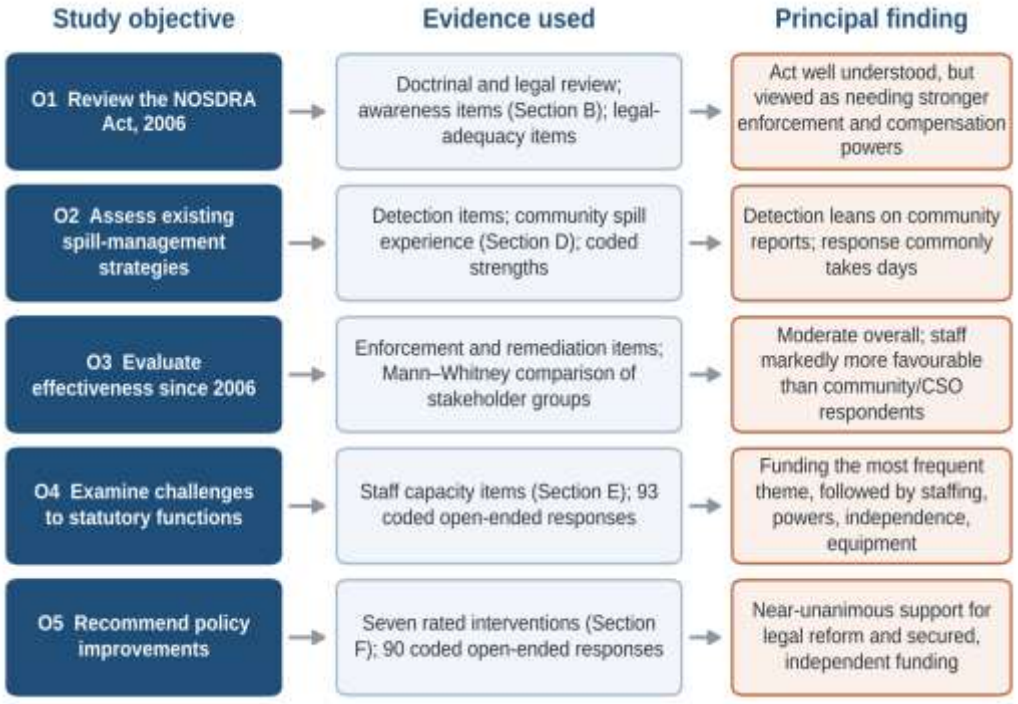


Figure 1. Study framework: the five objectives, the questionnaire evidence used to address each, and the principal finding for each. Open-ended response counts refer to the coded items described in Section 3.3.

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Population, sampling and respondents

Purposive sampling was used to secure representation across stakeholder groups. The population comprised (i) NOSDRA staff at headquarters, zonal and field levels, including directors, zonal coordinators, field officers and technical staff; (ii) adult residents of oil-impacted communities and representatives of civil-society organisations (CSOs) with documented experience of spills and of interaction with NOSDRA; and (iii) environmental, compliance and community-relations officials of international and indigenous oil companies. Communities were selected on the basis of at least one major spill in the preceding ten years, evidence of interaction with NOSDRA, a diversity of livelihoods and accessibility; key informants were required to have at least three years' experience in spill-related roles. States with the highest incidence of spills (Rivers, Bayelsa, Delta) were allocated proportionally larger samples.

A total of 130 valid questionnaires were analysed, about 90% of a target of 145. Respondent-category information is reported inconsistently in the source: the narrative gives 70 NOSDRA staff, 30 community/CSO respondents and 10 oil-company officials, whereas the demographic tables and figures describe a profile in which roughly three-quarters of respondents are NOSDRA staff and one-quarter community/CSO, with denominators of about 54 respondents (about 45 for state). Item-level sample sizes also vary because some sections were administered only to particular groups. This paper therefore reports item-level N as given, reports demographic percentages as they appear in the source narrative and figures, and avoids inferences that depend on exact subgroup sizes.

Instrument, validity and reliability

The questionnaire (Table 1) took 15–20 minutes to complete and was administered face to face or by drop-off and pick-up. Community respondents received translated versions and, where needed, assistance from trained local research assistants. Content validity was assessed by two academic reviewers and one industry expert. Internal consistency of each multi-item construct was assessed with Cronbach's alpha against the conventional threshold of 0.70. Open-ended items covered NOSDRA's mandate (n = 100), its strengths (n = 102), its weaknesses and challenges (n = 93), the most effective solutions and specific policy changes (n = 90 combined) and lessons from other countries (n = 51).

Table 1. Structure of the questionnaire and its relation to the study objectives.

Sec.	Content	Administered to	Obj.
A	Demographics: age, gender, education, occupation or role, tenure, state	All (role and tenure items group-specific)	Context
B	Awareness and understanding of the Act and NOSDRA's mandate (six items; open-ended mandate question)	All	O1
C	Perceived effectiveness: detection (5 items), enforcement (4), remediation (4), global impact item	All; remediation items answered by a subset	O2, O3
D	Spill experience: frequency, timing, reporter, response time, impacts	Community members only	O2
E	Institutional challenges: funding, staffing, equipment, independence, coordination, legal powers, compensation, enforcement (12 items)	NOSDRA staff only	O4
F	Seven rated policy interventions; open-ended solutions and lessons	All	O5

Source: study questionnaire (Appendix I of the thesis).

Data analysis and presentation conventions

Responses were summarised with frequencies, percentages, means and standard deviations. Because Likert-type indices from a

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small, non-normally distributed sample violate parametric assumptions, NOSDRA staff and community/CSO respondents were compared with Mann–Whitney U tests on each effectiveness construct. Open-ended responses were coded thematically (Braun & Clarke, 2006); because themes overlap, percentages of coded responses are not additive. Data entry and cleaning followed the protocol (Microsoft Excel, then SPSS version 27 or later).

Four presentation conventions are used throughout. First, all Likert items run from 1 = strongly agree to 5 = strongly disagree, with 3 as the neutral midpoint; as a descriptive convention, means up to 2.5 are read as agreement, 2.5–3.5 as undecided and above 3.5 as disagreement. Second, 95% confidence intervals are computed from the reported mean, standard deviation and *N* using a normal approximation. Third, because questionnaire items are worded in both directions, a statement of capability (for example "NOSDRA is adequately funded") is distinguished from a statement of a barrier (for example "Detection is hindered by inadequate equipment"): for the former, a lower mean is more favourable, whereas for the latter, a lower mean is more problematic. Fourth, for the institutional-capacity items, an aligned constraint score is also given, defined as the reported mean for barrier statements and 6 minus the reported mean for capability statements, so that all twelve items can be read in a single direction (lower = stronger agreement that the item is a constraint). The aligned score is a presentational transformation and does not alter the underlying data.

Ethical considerations and reporting

Participation was voluntary, with written or verbal informed consent obtained before data collection and consent forms read aloud in local languages where literacy was low. No personal identifiers were collected, data were stored securely with access limited to the researcher and supervisor, and findings are reported without identifying individuals. Because discussing spills may evoke distress, referral information for support services was to be offered and interviews paused if participants became distressed. The study followed the principles of the Declaration of Helsinki (World Medical Association, 2013) and institutional authorisation procedures. The source does not name an ethics committee or approval reference; this should be added if formal approval was obtained.

RESULTS

Results are organised by objective. Throughout, a lower mean indicates stronger agreement, and items are interpreted according to their wording (Section 3.4).

Respondent profile and instrument reliability

The respondent profile is highly educated and concentrated in the states with the heaviest oil activity (Table 2). More than half of respondents were aged 36–45 years (53.7%), gender was almost evenly split (50.0% male, 48.1% female), and 85.2% held at least a bachelor's degree, reflecting the professional character of agency staff and the inclusion of community leaders and CSO representatives. About three-quarters of respondents were NOSDRA staff (75.9%) and one-quarter were community or CSO respondents (24.1%). Rivers (33.3%) and Delta (20.0%) together supplied more than half of the respondents who indicated a state, consistent with the sampling emphasis on high-incidence states. Among staff, 48.1% were technical staff, 9.3% administrative staff and 7.4% field officers, with the remainder in scientific, information and directorate cadres; 29.6% had 6–10 years and 27.8% had 11–15 years of service.

Table 2. Demographic characteristics of respondents (percentages as reported).

Category	% of respondents
Age (years)	
18–25	13.0
26–35	24.1
36–45	53.7

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Category	% of respondents
46 and above	9.3
Gender	
Male	50.0
Female	48.1
Not indicated	1.9
Highest educational qualification	
No formal education	3.7
Primary	5.6
Secondary	5.6
Bachelor's degree	35.2
Master's degree and above	50.0
Respondent category	
NOSDRA staff	75.9
Community members / CSO	24.1
State	
Rivers	33.3
Delta	20.0
Bayelsa	11.1
Imo	8.9
Cross River / Akwa Ibom / Edo (each)	6.7
Ondo	4.4
Abia	2.2

Note: Percentages are as reported in the source narrative and figures. The frequency columns in the source tables (which sum to 130) do not reconcile with these percentages; the implied denominators are about 54 respondents (about 45 for state). Oil-company officials are not separately identifiable in the category percentages. Reliability was generally good (Table 3). Six of eight constructs exceeded the 0.70 threshold, with awareness (α = 0.982), remediation effectiveness (α = 0.907) and policy recommendations (α = 0.930) showing excellent internal consistency. Enforcement effectiveness returned α = 0.616, marginally below the threshold; this is attributable to the mixed wording of its four items, one of which (political interference) is a barrier statement rather than an effectiveness statement. The detection construct (α = 0.784) also combines one barrier item with four effectiveness items. Composite scores for these two constructs should therefore be read cautiously, although the individual items remain informative.

Table 3. Cronbach's alpha reliability coefficients by construct.

Construct	Items	N (complete)	α
Awareness of NOSDRA (Section B)	6	130	0.982
Detection effectiveness	5	130	0.784
Enforcement effectiveness	4	115	0.616
Remediation effectiveness	4	110	0.907
Spill impact on livelihood (community subsample)	5	57	0.817
Community spill-response experience (community subsample)	5	57	0.841
Institutional challenges (staff subsample)	12	65	0.809
Policy recommendations	7	123	0.930

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Note: α ≥ 0.70 is the conventional threshold for acceptable reliability. Enforcement (0.616) is the one construct below it.

Objective 1: awareness of the Act and perceptions of its adequacy

Respondents reported strong awareness of the Act and of NOSDRA's responsibilities. All six awareness items had means between 1.61 and 1.85, between "strongly agree" and "agree", with confidence intervals that lie entirely in the agreement band (Table 4). Awareness was highest for NOSDRA's detection and monitoring role (M = 1.61) and lowest, though still strong, for communities' rights under the Act (M = 1.85). When asked in an open-ended question what NOSDRA's primary mandate is (*n* = 100), the great majority described it correctly in terms of detection, prevention, response, remediation and regulatory enforcement; only ten respondents indicated limited knowledge of NOSDRA.

Table 4. Stakeholder awareness of NOSDRA and the 2006 Act.

Awareness item	N	Mean	SD	95% CI
Aware of the existence of the NOSDRA Act, 2006	130	1.65	0.99	1.48–1.82
Aware NOSDRA is responsible for spill detection and monitoring	130	1.61	1.02	1.43–1.79
Understands NOSDRA's statutory mandate	130	1.76	1.01	1.59–1.93
Aware NOSDRA enforces environmental regulations	130	1.80	1.03	1.62–1.98
Understands the rights of affected communities under the Act	130	1.85	1.02	1.67–2.03
Aware of oil companies' obligations under the Act	130	1.80	1.00	1.63–1.97

Note: 1 = strongly agree, 5 = strongly disagree; lower means indicate stronger agreement. All items are effectiveness-direction statements.

High awareness, however, did not translate into confidence in the Act as an enforcement instrument. Among staff, the statement that the Act provides adequate legal powers for effective regulation had a mean of 2.80 (SD = 1.25, *n* = 65), within the undecided band and only marginally on the agreeing side, while the statement that the absence of explicit provisions for awarding compensation has weakened NOSDRA's effectiveness had a mean of 2.52 (SD = 1.06, *n* = 67), at the boundary between agreement and indecision.

These are lukewarm rather than critical positions. By contrast, support for amending the Act was strong: strengthening enforcement powers (M = 1.49) and empowering NOSDRA to award compensation (M = 1.63) both attracted strong agreement among all respondents (Section 4.6), and legal or Act amendment was mentioned in half of the open-ended solutions. Together, the findings suggest that respondents regard the Act as adequate in principle but insufficient in practice, particularly on enforcement, penalties and redress; the evidence for a specific statutory deficiency comes mainly from the reform items and open-ended responses rather than from the legal-adequacy items.

Objective 2: detection and existing management strategies

Perceived detection performance was less favourable than awareness (Table 5). Respondents agreed only moderately that NOSDRA detects spills in a timely manner (M = 2.48), and means for modern technology (M = 2.74) and regular field surveillance (M = 2.93) fell in the undecided band. The statement that NOSDRA detects most spills before communities report them was the weakest item (M = 3.17, SD = 1.13); its confidence interval spans the neutral midpoint, so respondents on balance neither endorsed nor rejected it. Respondents agreed that inadequate equipment and resources hinder detection (M = 2.20).

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Table 5. Perceptions of oil-spill detection effectiveness.

Detection item	Type	N	Mean	SD	95% CI
NOSDRA detects oil spills in a timely manner	Cap.	130	2.48	1.11	2.29–2.67
Uses modern technology (satellite, GIS) for detection	Cap.	130	2.74	1.20	2.53–2.95
Conducts regular field surveillance	Cap.	130	2.93	1.08	2.74–3.12
Detects most spills before communities report them	Cap.	130	3.17	1.13	2.98–3.36
Detection is hindered by inadequate equipment/resources	Barr.	130	2.20	1.05	2.02–2.38

Note: 1 = strongly agree, 5 = strongly disagree. Cap. = capability statement (lower mean is more favourable); Barr. = barrier statement (lower mean indicates a more serious problem).

The community-experience items reinforce the point (Table 6; Figure 2). Of those answering, 60.0% had personally experienced an oil spill, most often one to three incidents in the previous five years (51.9%), and 57.7% placed the most recent spill six to twelve months earlier. Of those identifying who reported that spill, 80.8% named community members, 11.5% the oil company, and 3.8% each NOSDRA and a CSO. The reported time to NOSDRA response was one to three days for 48.1%, within 24 hours for 22.2%, four to seven days for 14.8% and over a week for 14.8%; the thesis figure shows the underlying counts as 6, 13, 4 and 4 (n = 27), and the reporter percentages are consistent with counts of 21, 3, 1 and 1 (n = 26). Because these figures rest on small subsamples and on respondents' recollection, they indicate patterns rather than precise rates, and they are not audited response records. They also describe who reported the spill to the authorities, which is not necessarily who first detected it.

Table 6. Community spill experience, reporting source and reported response time.

Category	%	Implied n	Basis
Ever experienced an oil spill			
Yes	60.0	—	A
No	40.0	—	A
Incidents witnessed in the past five years			
1–3	51.9	—	A
3–6	29.6	—	A
6–10	11.1	—	A
10 and above	7.4	—	A
Timing of most recent spill			
Within last 6 months	23.1	—	A
6–12 months ago	57.7	—	A
1–2 years ago	11.5	—	A
Over 2 years ago	7.7	—	A
Who reported the most recent spill			
Community members	80.8	21	B
Oil company	11.5	3	B
NOSDRA	3.8	1	B
Civil-society organisation	3.8	1	B
Reported time to NOSDRA response			
Within 24 hours	22.2	6	C

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1–3 days	48.1	13	C
4–7 days	14.8	4	C
Over 1 week	14.8	4	C

Note: Percentages are as reported in the source. A = frequencies given in the source table (e.g. 72 of 120) do not reconcile with the percentages, so only percentages are shown; B = counts implied by the percentages (n ≈ 26); C = counts shown in the source figure (n = 27).

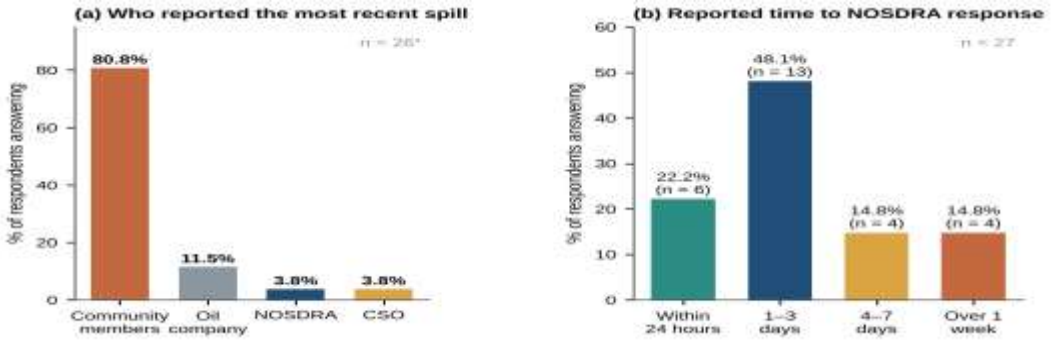


Figure 2. (a) Who reported the most recent spill; (b) reported time to NOSDRA response. Percentages are as reported; counts in panel (b) are those shown in the source figure. * n implied by the reported percentages.

Open-ended responses about NOSDRA's strengths (n = 102) provide a counterpoint: respondents most often cited response and remediation capability (38%), technology and surveillance tools such as satellite monitoring, GIS and the Nigerian Oil Spill Monitor (25%), and its legal mandate and enforcement authority (21%), with the JIV framework (12%) and oversight and compliance monitoring (about one in eight) also mentioned (Figure 5b). The JIV was praised as a structured, multi-stakeholder mechanism for establishing causation. The thesis also records community reports of being excluded from key decisions during JIVs, which narrows the environmental scope of assessments; this observation arises from open-ended material and is not quantified. In sum, the strategy mix of technological surveillance, community reporting and the JIV process is functionally in place, but in practice it leans heavily on the community channel, with response to confirmed spills commonly measured in days rather than hours.

Objective 3: enforcement, remediation and the stakeholder gap

Perceptions of enforcement were moderate and similar across items (Table 7). Respondents agreed, with means from 2.20 to 2.45, that NOSDRA enforces regulations against oil companies (n = 125), conducts regular inspections and imposes appropriate sanctions, and agreed at 2.49 that enforcement is hindered by political interference. The differences among these items (at most 0.29 points) are smaller than their confidence intervals, so ranking the items is not meaningful; the more useful reading is that enforcement is rated moderately favourably on average while political interference is simultaneously acknowledged as a constraint. Remediation items produced means of 2.18–2.21 and were the most favourable of the effectiveness constructs, but they were answered by only 51–54 respondents and, like all items, measure perceived oversight rather than ecological restoration. On the single global item, "NOSDRA has made a positive impact on oil spill management in Nigeria", the mean was 2.28 (SD = 0.79, n = 54); 63.0% selected the two most agreeable points and no respondent selected the most disagreeable.

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Table 7. Perceived enforcement and remediation effectiveness.

Item	Type	N	Mean	SD	95% CI
Enforcement					
Enforces regulations against oil companies	Cap.	125	2.20	0.95	2.03–2.37
Conducts regular inspections of oil facilities	Cap.	130	2.45	0.99	2.28–2.62
Imposes appropriate sanctions on violators	Cap.	130	2.30	0.96	2.13–2.47
Enforcement hindered by political interference	Barr.	130	2.49	1.12	2.30–2.68
Remediation					
Oversees remediation of contaminated sites	Cap.	53	2.21	0.82	1.99–2.43
Ensures oil companies clean up spills adequately	Cap.	52	2.19	0.89	1.95–2.43
Monitors remediated sites for long-term restoration	Cap.	51	2.18	0.95	1.92–2.44
Remediation oversight improved since 2006 reforms	Cap.	54	2.20	0.81	1.98–2.42

Note: 1 = strongly agree, 5 = strongly disagree. Item-level N differs because some questions were restricted to relevant respondent groups. Cap. = capability; Barr. = barrier. This moderate pooled picture conceals a substantial divergence between stakeholder groups (Table 8; Figure 3). Mann–Whitney U tests showed that NOSDRA staff were significantly more favourable than community/CSO respondents on all four constructs: awareness (1.55 versus 2.36), detection (2.53 versus 3.26), enforcement (2.51 versus 3.27) and remediation (2.04 versus 2.73), each with $p < .01$.

The mean differences, 0.69 to 0.81 scale points, are large relative to a four-point range. They also change the substantive reading: staff means for detection and enforcement lie at the edge of the agreement band, whereas community/CSO means (3.26 and 3.27) lie beyond the neutral midpoint, that is, on the disagreeing side. The pooled means in Tables 5 and 7 are therefore likely to be pulled toward agreement by the staff-heavy composition of the sample. The group sizes entering each test are not reported; the magnitude of the U statistics is consistent with small groups, so the tests should be read as indicative.

Table 8. Mann–Whitney U comparison of NOSDRA staff and community/CSO respondents.

Construct	Staff mean	Comm./CSO mean	Diff.	U	p
Awareness of NOSDRA	1.55	2.36	0.81	99.0	0.0004
Detection effectiveness	2.53	3.26	0.73	122.0	0.0034
Enforcement effectiveness	2.51	3.27	0.76	97.0	0.0006
Remediation effectiveness	2.04	2.73	0.69	120.0	0.0028

Note: Lower means indicate more favourable agreement. Difference = community/CSO mean minus staff mean. Group sizes for each test are not reported in the source

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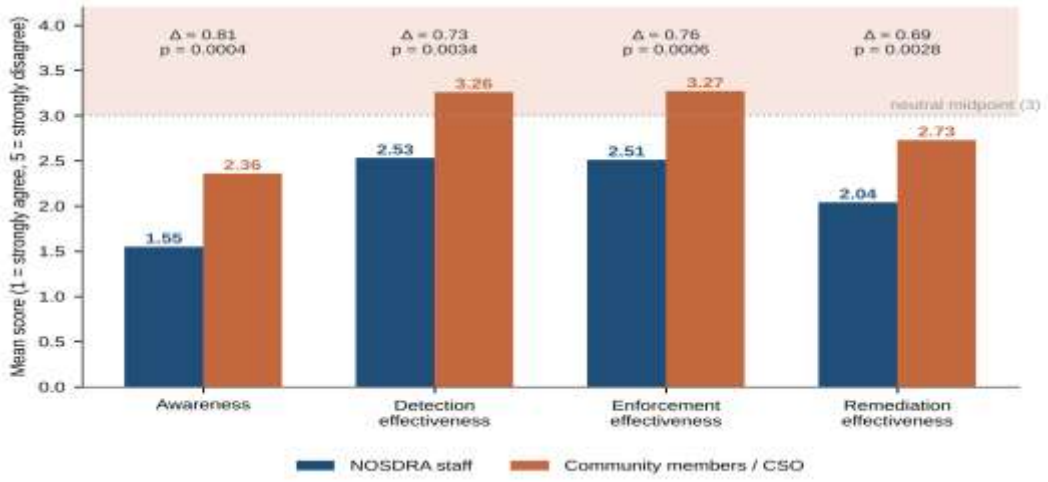


Figure 3. Mean scores by respondent group for the four effectiveness constructs. The shaded region lies beyond the neutral midpoint of 3 (disagreement). Δ = community/CSO mean minus staff mean; p-values are from Mann–Whitney U tests.

Objective 4: challenges facing NOSDRA

Staff responses on institutional capacity are shown in Table 9 as reported and as aligned constraint scores, which place all twelve items on one scale (lower = stronger agreement that the item is a constraint; Figure 4). Staff disagreed that the agency is adequately funded (M = 3.67, SD = 1.29, n = 65) or has adequate operational equipment (M = 3.55, SD = 1.21, n = 67), the two highest raw means in the questionnaire. After alignment, however, funding and equipment sit among a cluster of constraints rather than apart from it: significant challenges enforcing compliance (2.16), funding (2.33), overlapping mandates (2.36), protracted and costly legal proceedings (2.37), equipment (2.45), lack of modern detection technology (2.49) and the absence of compensation provisions (2.52) all fall in the agreement band.

Technical training (2.74), political independence (2.88), inter-agency coordination (2.98), adequacy of legal powers (3.20) and staff numbers (3.31) were weaker, and staff numbers and legal powers fall on the undecided side. Confidence intervals overlap widely among adjacent items, so only the contrast between the strongest and weakest constraints is robust. Notably, the quantitative items do not single out staff numbers as a constraint, even though staffing and training gaps were the second most frequent open-ended theme.

Table 9. Institutional capacity and challenge indicators reported by NOSDRA staff

Item as worded	Type	N	Mean	SD	Aligned	95% CI (aligned)
Significant challenges enforcing compliance	Barr.	67	2.16	1.00	2.16	1.92–2.40
NOSDRA is adequately funded to fulfil its mandate	Cap.	65	3.67	1.29	2.33	2.02–2.64
Overlapping mandates have hindered effectiveness	Barr.	67	2.36	1.10	2.36	2.10–2.62
Legal proceedings against oil companies are protracted/costly	Barr.	66	2.37	1.16	2.37	2.09–2.65
NOSDRA has adequate equipment for its operations	Cap.	67	3.55	1.21	2.45	2.16–2.74

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Item as worded	Type	N	Mean	SD	Aligned	95% CI (aligned)
NOSDRA lacks modern detection/monitoring technology	Barr.	66	2.49	1.30	2.49	2.18–2.80
Absence of compensation provisions has weakened effectiveness	Barr.	67	2.52	1.06	2.52	2.27–2.77
Staff lack adequate technical training	Barr.	67	2.74	1.19	2.74	2.46–3.02
NOSDRA operates independently of political interference	Cap.	60	3.12	1.23	2.88	2.57–3.19
Effective coordination with other agencies (e.g. NESREA, NUPRC)	Cap.	67	3.02	1.24	2.98	2.68–3.28
The Act provides adequate legal powers	Cap.	65	2.80	1.25	3.20	2.90–3.50
NOSDRA has sufficient staff	Cap.	68	2.69	1.30	3.31	3.00–3.62

Note: Items are listed from strongest to weakest aligned constraint. Aligned score = mean for barrier statements and 6 − mean for capability statements; lower = stronger agreement that the item is a constraint. Raw means are as reported. Cap. = capability; Barr. = barrier

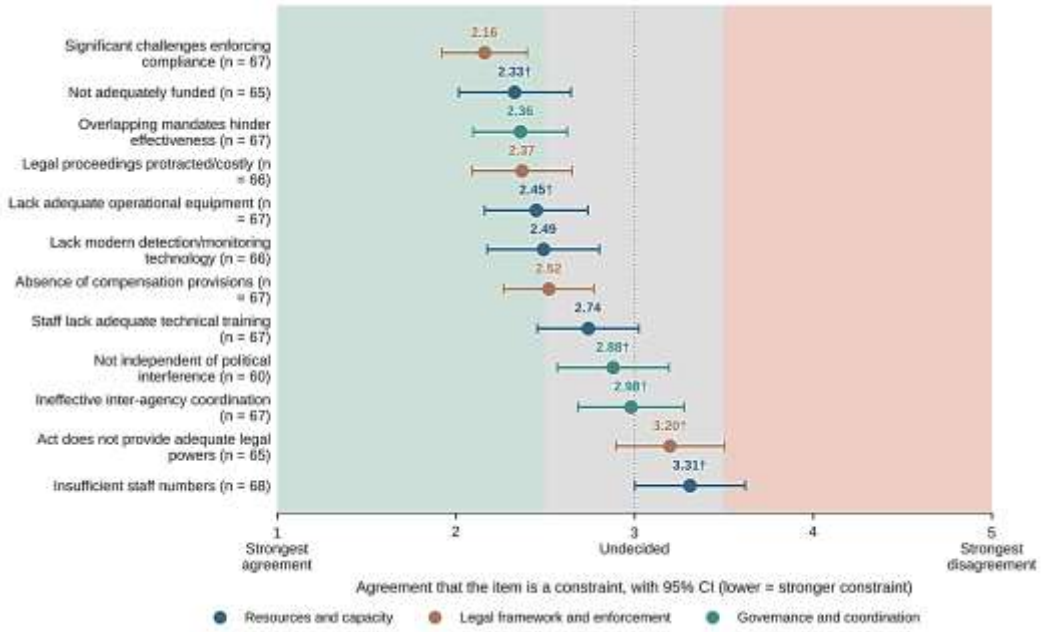


Figure 4. Aligned constraint scores for the twelve institutional items (NOSDRA staff). † item reverse-scored because the questionnaire statement describes a capability. Points show means with 95% confidence intervals; colour indicates domain.

Thematic analysis of open-ended responses (93 responses across the weaknesses and challenges items) confirms the importance of resources and adds detail (Table 10; Figure 5a). Funding deficits dominated, appearing in 72% of responses (for example, “chronic underfunding and capacity constraints”). Manpower, staffing and training gaps followed at 30%, weak enforcement or legal powers at 26%, political interference or lack of independence at 22% and inadequate equipment, technology or logistics at 20%. A smaller but analytically important theme (4%) was operator dependency: the concern that

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NOSDRA relies on operator-supplied equipment, logistics and data, which undermines the impartiality of oversight. The themes overlap, so the percentages are not additive.

Table 10. Thematic analysis of open-ended responses on challenges and strengths

Theme	Share of coded responses	Domain
Weaknesses and challenges (93 responses)		
Funding deficits	72%	Resources
Manpower, staffing and training gaps	30%	Resources
Weak enforcement or legal powers	26%	Legal framework
Political interference / lack of independence	22%	Governance
Inadequate equipment, technology or logistics	20%	Resources
Operator dependency	4%	Governance
Strengths (102 responses)		
Response and remediation capability	38%	Operations
Technology and surveillance tools (satellite, GIS, Nigerian Oil Spill Monitor)	25%	Operations
Legal mandate and enforcement authority	21%	Legal framework
Joint Investigation Visit framework	12%	Procedure
Oversight and compliance monitoring	about 12%	Procedure

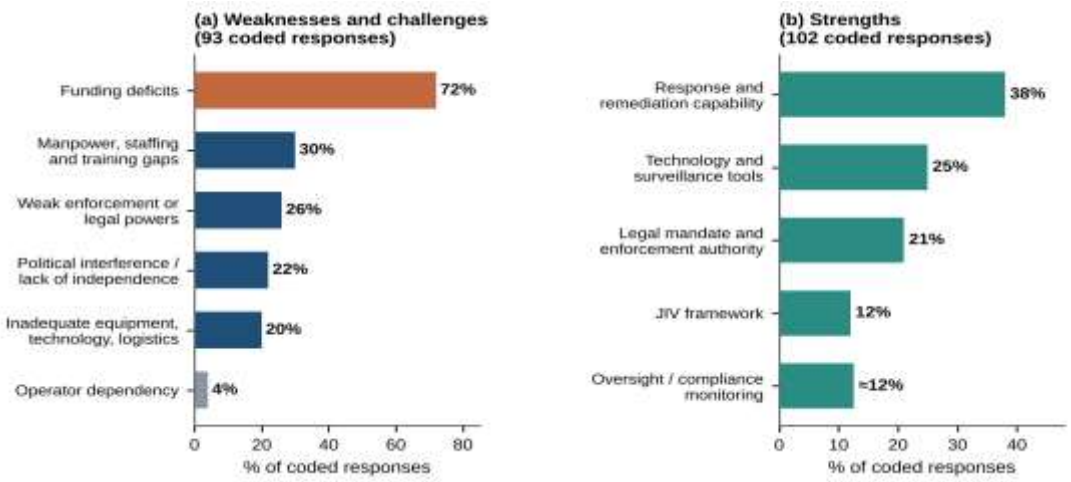


Figure 5. Thematic analysis of open-ended responses: (a) weaknesses and challenges (93 responses), with funding highlighted; (b) strengths (102 responses). Themes overlap, so percentages are not additive.

Objective 5: policy priorities

All seven proposed interventions attracted strong agreement (Table 11), with means from 1.45 to 1.63 and standard deviations at or below 1.04, indicating consensus across staff and community respondents. Strengthening community engagement and awareness (M = 1.45) and increasing federal budgetary allocation (M = 1.47) were the most strongly endorsed, followed by strengthening enforcement powers (1.49), institutional independence (1.51) and clearer inter-agency coordination (1.51). Because

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all intervals overlap, the ordering within this range should not be over-interpreted; the finding is the breadth of the consensus. Open-ended responses (90 combined) point the same way: legal or Act amendment, particularly to strengthen enforcement powers, raise penalties and explicitly empower NOSDRA to award compensation, appeared in 50% of responses, and increased or dedicated funding, including proposals for a polluter-funded levy, in 45%.

One respondent proposed "a dedicated funding stream for NOSDRA drawn directly from operator levies and spill penalties", which links the funding and independence themes. On lessons from other countries (n = 51), respondents emphasised advanced detection technology such as satellite monitoring, artificial intelligence and drones (24%), transparency, governance and rapid response (19%) and prevention rather than reactive clean-up (14%), citing independent, well-funded regulatory models in Norway, the United States and the United Kingdom.

Table 11. Stakeholder-rated policy recommendations (n = 120).

Recommendation	N	Mean	SD	95% CI
Strengthen community engagement and awareness programmes	120	1.45	0.86	1.30–1.60
Increase federal budgetary allocation to NOSDRA	120	1.47	0.95	1.30–1.64
Amend the Act to strengthen enforcement powers	120	1.49	0.97	1.32–1.66
Grant greater institutional independence from politics	120	1.51	0.78	1.37–1.65
Establish clearer inter-agency coordination mechanisms	120	1.51	0.81	1.37–1.65
Recruit and train additional technical staff	120	1.61	0.90	1.45–1.77
Amend the Act to empower NOSDRA to award compensation	120	1.63	1.04	1.44–1.82

Note: 1 = strongly agree, 5 = strongly disagree. Items are ordered by mean.

DISCUSSION OF FINDINGS

Mandate versus performance

The results describe a gap between a well-understood mandate and its perceived implementation, which Baldwin and Cave's (1999) three dimensions help to locate (Figure 6). Formally, the Act is known and its purposes are correctly understood. Procedurally, detection depends heavily on community notification, and response is commonly experienced as taking days. Substantively, enforcement and remediation are rated moderately by respondents overall, but this study did not measure contaminant concentrations, remediation completion or ecosystem recovery, so it cannot say whether oversight produces restoration.

The pattern is what institutional theory would predict: formal creation of an agency is necessary but not sufficient, and effectiveness depends on resources, independence and a supportive accountability environment (North, 1990). It also echoes earlier observations that Nigerian regulators often hold sound instruments on paper but struggle to convert them into environmental and social outcomes (Ite et al., 2013).

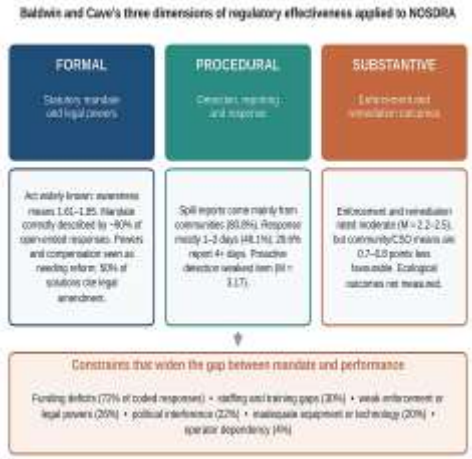


Figure 6. Synthesis of findings against Baldwin and Cave's formal, procedural and substantive dimensions of regulatory effectiveness, and the constraints identified by respondents. Percentages are shares of coded open-ended responses.

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Detection and the community-reporting channel

Community members were the dominant reported source of spill notification, and respondents were undecided on whether NOSDRA detects most spills before communities do. Community reporting is valuable in a geographically dispersed, difficult-to-access delta, and it should be nurtured, particularly if PIA host-community provisions strengthen incentives to report promptly (Okafor & Mudiaga-Odje, 2023). But it measures who tells the agency, not who first knew, and a system in which the regulator learns of spills mainly from those who live beside them is reactive by design. Respondents agreed that inadequate equipment and resources hinder detection, and only moderately that the agency uses modern technology or conducts regular field surveillance.

These findings point to investment in satellite and remote-sensing monitoring, GIS, aerial and drone observation, reliable communications and field logistics, with trained staff and protocols for validating reports, as a complement to, not a replacement for, community reporting. Reported response times raise a parallel concern: 48.1% reported a response in one to three days, and about 30% reported four days or longer. These are perceptions, not audited records, yet delays lengthen the area and duration of contamination and weaken confidence in the system (Nwilo & Badejo, 2005; UNEP, 2011).

The perception gap between staff and communities

The statistically significant gap between staff and community/CSO assessments is the central comparative result. It has at least three plausible explanations that the data cannot separate. Staff may know more about internal processes and constraints; community respondents judge the agency by their experience of notification, investigation, response and clean-up; and each group may be subject to bias, with staff protecting the agency and community members voicing frustration, a risk anticipated in the study design. What the data do show is that agency performance is experienced differently by those who run the system and those who live with its consequences, and that the pooled means mask this: community/CSO means for detection and enforcement lie on the disagreeing side of neutral. The practical implication is that agency self-assessment should be complemented by independent evaluation and by transparent reporting of incident milestones, investigation outcomes and clean-up status, which are the information gaps through which divergent perceptions persist.

Resources, independence and operator dependency

Funding is the most frequently cited challenge (72% of coded responses), and staff disagreed that the agency is adequately funded or equipped. The aligned scores show that funding and equipment belong to a cluster of constraints that also includes enforcement difficulty, overlapping mandates and protracted legal proceedings; the quantitative evidence therefore supports funding as one of the leading constraints, while its primacy rests chiefly on the open-ended themes. The two are connected: a regulator without predictable resources cannot sustain independent surveillance, laboratory support, training or rapid deployment. This is where operator dependency, although mentioned by only 4% of respondents, carries theoretical weight. Where the regulator relies on regulated companies for logistics, equipment or data, information asymmetry and perceived conflict of interest increase, which is the mechanism that principal–agent and regulatory-capture perspectives identify (Jensen & Meckling, 1976; Laffont & Tirole, 1991).

Earlier studies describe the same dependence on operator notifications and data (Aghalino, 2009; Ite et al., 2013). The present data do not show that capture has occurred; they show that respondents perceive the structural conditions under which it could. The proposed polluter-funded levy with independent audit is attractive precisely because it addresses both funding and dependence, though it would need safeguards so that operators do not acquire influence through payment.

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Legal powers, compensation and the PIA 2021

The legal findings are subtler than a simple verdict of inadequacy. Staff were undecided on whether the Act gives adequate powers (M = 2.80) yet strongly endorsed amending it, and difficulty enforcing compliance (aligned score 2.16) and protracted legal proceedings (2.37) were among the strongest constraints. One reading is that the Act's powers look adequate on paper but are hard to use: fines are disputed in court, evidence is contested, and the Act is silent on compensation, which pushes victims to the courts and the "sabotage" defence (Yashim et al., 2026; Nwapi, 2017).

The compensation gap is also a justice issue, because communities bear delay and cost. Strengthening the Act should therefore pair stronger penalties and administrative orders with procedural safeguards, transparent criteria and resources to implement them. The PIA 2021 adds a further layer: staff agreed that overlapping mandates hinder effectiveness (aligned score 2.36) but were undecided on whether inter-agency coordination is effective (2.98), consistent with warnings that the creation of NUPRC and NMDPRA could produce either useful redundancy or diffused responsibility (Atsegbua, 2022). Clarifying roles without weakening NOSDRA's statutory mandate is thus a priority.

5.6 Implications for theory and for the evidence base

For theory, the study supports applying the formal–procedural–substantive distinction to oil-spill regulation in a resource-dependent state, and shows that perceptions of the same system differ systematically by position, which a single-perspective evaluation would miss. For the evidence base, it adds primary data from both inside and outside the agency to a literature that is largely doctrinal or qualitative. It also illustrates a measurement lesson: because Likert items were worded in both directions, naive ranking of raw means can mislead, and aligned scores are needed before items are compared. The study cannot test whether spill frequency, volume or remediation quality has changed since 2006; those questions require administrative and environmental data.

POLICY IMPLICATIONS AND RECOMMENDATIONS

The recommendations below integrate the survey findings with the reform proposals developed in the thesis. Table 12 lists them with their evidential basis; the link between each reform domain and the constraints it targets is the author's analytical judgement rather than an empirical result.

Legislative reform. The Act should be amended to empower NOSDRA to determine and award compensation, with clear timelines and appeal mechanisms (R1), and to strengthen enforcement powers: meaningful penalties that reflect current economic conditions, enforceable administrative orders without prolonged litigation, and authority to prosecute directly rather than only through the Ministry of Justice (R2). A National Oil Spill Response Decree could establish NOSDRA as the unified command authority during spill events, with binding timelines for operator notification, resource mobilisation and remediation sign-off (R3).

Funding and independence. A dedicated funding stream drawn from operator levies and spill penalties, under independent audit, would reduce dependence on the annual budget cycle and on the companies being regulated (R4). Independence could be supported by direct allocation from the Federation Account rather than through a ministry, and by protecting staff from political retribution for enforcing regulations (R5).

Technology and capacity. NOSDRA should invest in satellite-based detection, artificial intelligence and remote sensing, fibre-optic pipeline monitoring, drones and GIS (R6); upgrade the National Reference Laboratory so remediation standards can be verified (R7); and recruit and train technical staff in spill response, environmental monitoring, GIS, remote sensing and legal enforcement (R8). Community engagement and transparency. Programmes should educate communities on their rights, train them in reporting procedures, and give regular feedback on investigations and clean-up (R9). Community representatives should take part in

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JIVs as active participants rather than observers (R10).

Coordination, benchmarking and accountability. Coordination with NESREA, NUPRC and the Ministry of Environment should rest on a formal memorandum of understanding defining roles, regular meetings, a shared incident and enforcement database and joint training (R11). Nigeria can draw on Norway, the United States and the United Kingdom: prevention over clean-up, regulators with their own response capacity, unconditional operator liability, advanced detection and transparent community involvement (R12). An independent oversight mechanism including communities, CSOs and experts should monitor NOSDRA's performance and complaints (R13), and annual performance reports should publish spill numbers and volumes, response times, remediation outcomes, enforcement actions and penalties, compensation paid, and constraints faced, subject to independent audit (R14). A public incident dashboard with notification times, JIV status, responsible parties where established, clean-up progress and remediation verification would be a practical vehicle for this.

Table 12. Recommendations and their evidential basis in this study

No.	Recommendation	Evidential basis
R1	Amend the Act to empower NOSDRA to award compensation	Compensation item M = 2.52 (staff); amendment M = 1.63; legal amendment in 50% of solutions; Yashim et al. (2026)
R2	Strengthen enforcement powers and penalties	Enforcement amendment M = 1.49; enforcement difficulty aligned score 2.16; weak powers 26% of challenges
R3	Unified command framework with binding timelines	Response in days (48.1% 1–3 days); overlapping mandates 2.36; operator dominance of response
R4	Dedicated levy-based funding stream with independent audit	Funding 72% of challenges; budget allocation M = 1.47; funding in 45% of solutions; operator dependency
R5	Greater institutional independence	Independence M = 1.51; political interference 22% of challenges; interference item M = 2.49
R6	Modern detection and monitoring technology	Detection before communities M = 3.17; equipment hindrance M = 2.20; technology 24% of lessons
R7	Upgrade the National Reference Laboratory	Remediation oversight perceptions rest on small n; verification capacity not measured
R8	Recruit and train technical staff	Staffing and training 30% of challenges; recruitment M = 1.61; training aligned score 2.74
R9	Community engagement and awareness programmes	Highest-rated intervention (M = 1.45); community reporters 80.8%; staff–community gap
R10	Community participation in JIVs	JIV praised as mechanism but exclusion reported; staff–community gap 0.69–0.81
R11	Clear inter-agency coordination mechanisms	Coordination M = 1.51 (rated); coordination aligned score 2.98; overlapping mandates 2.36
R12	Adopt international best practice	Lessons from other countries (n = 51): technology 24%, transparency 19%, prevention 14%
R13	Independent oversight mechanism	Perception gap; staff self-assessment more favourable than community assessment
R14	Annual public performance reports	Perception gap; contested spill data; transparency theme (19% of lessons)
R14	Annual public performance reports	Perception gap; contested spill data; transparency theme (19% of lessons)

Note: M values are means on the 1 (strongly agree) to 5 (strongly disagree) scale; aligned scores are defined in Section 3.4.

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CONCLUSION

The 2006 establishment of NOSDRA provided an important institutional foundation for oil-spill management in Nigeria, and stakeholders recognise the agency's mandate. Perceptions of detection, enforcement and remediation, however, indicate that the statutory reform has not fully translated into consistently strong operational effectiveness. Communities remain the main reported source of spill notification, response is commonly experienced as taking days, and agency staff assess performance significantly more favourably than community and CSO respondents, whose views on detection and enforcement fall on the disagreeing side of neutral.

Respondents identify inadequate funding, limited staffing and training, difficulty enforcing compliance, overlapping mandates, political interference and insufficient equipment as the principal constraints, and they converge on a reform agenda of legal amendment, secured and independent funding, modern detection capacity, clearer coordination and meaningful community participation. Improving effectiveness therefore requires more than statutory recognition: it requires independent operational capability, predictable resources, enforceable legal powers, transparent performance reporting and genuine participation by affected communities. These conclusions rest on stakeholder questionnaire evidence and should be tested with verified administrative records, incident-level response data and independent environmental monitoring.

LIMITATIONS AND FUTURE RESEARCH

Several limitations qualify the findings. First, the design is cross-sectional and rests on self-reported perceptions rather than verified agency performance records or environmental measurements; reported response times, in particular, are recollections. Second, only the questionnaire and its open-ended items were analysed, so the triangulation that the planned mixed-methods design intended (interviews and document analysis) is absent. Third, the source contains internal inconsistencies: respondent-category totals differ between the narrative (70, 30 and 10) and the tables (which sum to fewer than 130), demographic percentages correspond to about 54 respondents rather than 130, frequencies in some tables do not match their percentages, and response-rate descriptions vary.

This paper reports percentages as given and avoids relying on subgroup totals, but these issues limit the precision of the profile and of the group comparisons, whose group sizes are not reported. Fourth, staff are over-represented, which pulls pooled means toward agreement, and Rivers and Delta supply more than half of the respondents who indicated a state. Fifth, remediation items were answered by only 51–54 respondents, and the enforcement and detection composites mix item directions (enforcement $\alpha = 0.616$). Sixth, no adjustment was made for multiple comparisons, and effect sizes were not reported. Finally, both staff over-statement and community frustration are plausible sources of response bias.

Future work should use balanced stakeholder samples with fully reported group sizes; combine surveys with verified administrative and incident-level data, including notification-to-response intervals and remediation completion; add field-based environmental measurement; include structured interviews with operators, regulators and communities; and extend to longitudinal and comparative designs, including peer agencies in other oil-producing countries. Further priorities identified in the thesis include economic valuation of spill costs, the implementation of the PIA 2021 host-community provisions, the prevalence and evidentiary basis of the "sabotage" defence, technology-adoption studies for satellite, drone and pipeline-sensor detection, and the political economy of spill regulation.

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