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The impact of the Niger delta environment on EIA follow-up of oil and gas projects

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Abstract

Environmental Impact Assessment (EIA) Follow-Up of oil and gas projects in the Niger Delta is reported to be weak and inadequate. This study used secondary data analysis to examine the impact of the Niger Delta environment on the weak implementation of EIA follow-up of oil and gas projects in the region. The study compared the follow-up performance of projects located between two geopolitical environments of Bayelsa and Rivers states and between the ecological environments of upland and the riverine. Results showed no statistically significant difference between the projects located in Bayelsa state and Rivers state (U = 14, P= 0.505) although median performance score was higher for projects located in Bayelsa state (Mdn = 53) than for projects in Rivers state (Mdn = 28). Also, while median performance score was higher for projects located in riverine environment (Mdn = 61.1) than for projects located in the upland environment (Mdn = 31) the difference in their performance was not statistically significant (U = 9.500, P= 0.157). The study concluded that the location of oil and gas projects across different geopolitical and ecological environments within the Niger Delta region has no significant impact on EIA follow-up of the projects.

Keywords: Environmental Impact Assessment (EIA); EIA-Follow-Up; Niger Delta; Environmental and Social Management Plan (EMP)

1. Introduction

The adoption and application of Environmental Impact Assessment around the world is considered popular because of its capacity to contribute to quality environmental management decisions and drive sustainability. The follow-up component involving the implementation of Environmental Management Plan (EMP) is regarded as the engine room for achieving the goals of EIA [1, 2, and 3]. The implementation and effectiveness of EIA and indeed follow-up have been researched around the world beginning with work of [4]. Reports have shown implementation to be inadequate for all components of EIA with the implementation of EMP described as the weakest component [5, 6]. Researchers have also attempted to identify factors responsible for weak implementation [7]. However, according to [8] been sensitive to a region's context is essentially necessary to understanding the performance of EIA system and its evaluation. Studies on EIA and indeed EMP have shown that the level and quality of implementation vary from one jurisdiction to another and suggest that local factors comprising social and environmental factors could have significant impact on the implementation process. While this may be more significant at a wider level of an EIA jurisdiction, understanding these dynamics within specific sub-regions and sectors within an EIA jurisdiction is equally important. Attempts have been made by different researchers to evaluate the implementation of follow-up at various scales with [9] and [10] differentiating between the micro and macro scales. They argue that understanding practices at different scales will enhance application of corrective measures to improve practices and achieve success.

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The Niger Delta region of Nigeria is one of the most ecologically diverse and economically significant areas in sub-Saharan Africa. Rich in biodiversity and home to vast reserves of crude oil and natural gas, the region has long attracted oil and gas development projects. However, the implementation of Environmental Management Plans (EMPs)- EIA follow-up in this ecologically sensitive region has been rated as weak and inadequate to protect the environment and drive towards sustainability [11]. The work by [11] exemplifies sub-regional and sector-specific evaluation of the implementation of EMP within an EIA jurisdiction. However, the study failed to provide information on the specific relationship between the region's dynamics, in this case, the peculiar geopolitical and ecological environments within the Niger Delta and the implementation of EMP of the oil and gas projects. Further investigation is therefore necessary to fill this gap and unravel this relationship. Whereas the weak or inadequate performance of EMP could be blamed on the complex country-wide context, understanding the link with the peculiarities of the Niger Delta environment is a critical research need capable of supporting the application of measures to improve practice towards ensuring environmental sustainability, community well-being, and regulatory compliance. This study focused on Rivers and Bayelsa States, two core states in the Niger Delta that exemplify the region's socio-political diversity and ecological complexity. By comparing case project in these two states, this research seeks to understand how geopolitical and geophysical realities of the Niger Delta contribute to the weak and inadequate implementation of EIA follow- up of oil and gas projects in the region.

1.1. Study Area

The Niger Delta region refers to the area between Latitudes 4^0 and 8^0 North of the Equator and Longitudes 5^0 and 9^0 East of the Greenwich Meridian (Figure 1). It is recognized by Nigerian law as oil producing region and the states are referred to as oil producing states which includes; Abia, Akwa-Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo and Rivers States. The area covered by Bayelsa and Rivers states is located between Latitudes 04^0 15` North, $05^0$ 23` South and longitudes 05^0 22` West and $07^0$ 85` East. It shares boundaries with Imo and Delta States in the North, Akwa Ibom states in the East and the Atlantic Ocean in the West and South (Figure 1). They are the southernmost states and have the longest history of oil and gas production activities.

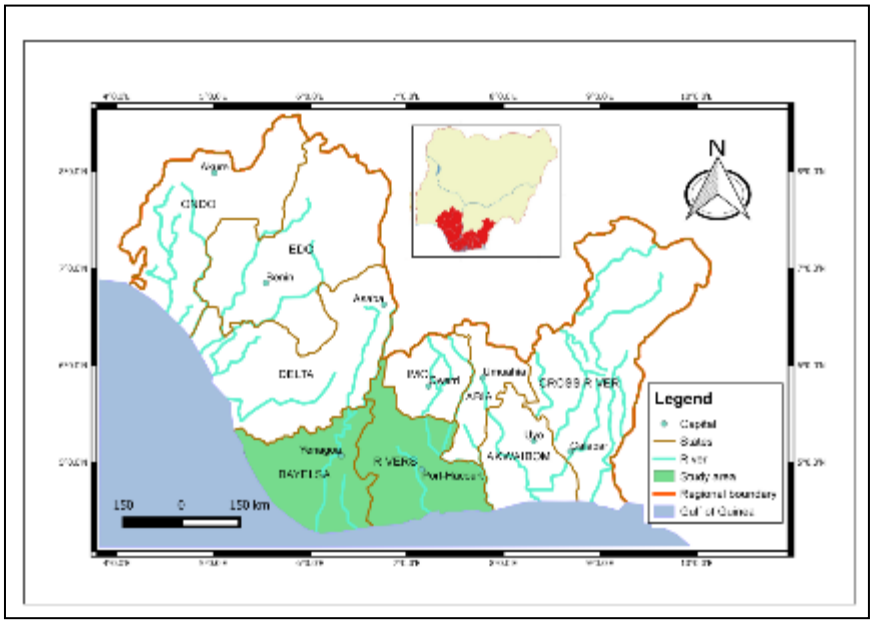

Figure 1 Niger Delta indicating Bayelsa and Rivers States; Map of Nigeria insert

2. Material and Methods

This study combines secondary analysis and Key Informant Interview (KII) for its investigation. It builds upon findings from a previous investigation conducted by [11] which examined the implementation of EMP of 12 oil and gas projects in Rivers and Bayelsa states (Table 1). The published performance (score) of the oil and gas projects were adopted and used as primary data for this study (Table 2). Two distinctive environments based on the location of the projects were considered for the study which are the state of location of projects represented as the geo-political environment of the projects and the ecological environment comprising the riverine and upland locations of the projects. The states of the projects as mentioned earlier are Bayelsa and Rivers States (Table 4). The case study projects' geographic location were

identified and the projects were clustered according to the ecological environment of location between upland and riverine areas (Table 3 and Figure 2). The areas considered as riverine are generally low lying with a relief range of between 2m and 5m above sea level. Such areas have been reported to account for about 39% of Rivers state's land mass (www.nigerdeltabudget.org). The riverine areas are generally considered as difficult terrain with poorly developed transportation system, poor living conditions, high levels of insecurity and poorly developed in commercial activities [12, 13, 14]. Higher areas above 5m (above sea level) were considered as uplands. The reported EIA Follow up performance scores of all the projects in a particular location were summed and the average considered as the score for the location. Consequently, the average was calculated for Bayelsa state, Rivers state, riverine and upland locations. To determine the impact of the environment on the implementation of EIA follow-up of the projects, the average scores between two opposite locations (between upland and riverine and between Bayelsa and Rivers states) were compared, and the Mann-Whitney U Test was performed to test if their difference was statistically significant. Mann-Whitney U Test was chosen because of the size of the data and distribution of the scores. In addition, key informants comprising two each from the Directorate for EIA of the Federal Ministry of Environment, HSE units of oil and gas company and community leaders were interviewed to acquire additional information to aid the interpretation of the result of the analysis. The information from KII was analyzed using thematic analysis.

Table 1 Case study Oil and Gas Projects

1	**Case 1: Diebu Creek Exploratory Drilling Project- SPDC in Bayelsa State:** The project was planned to improve hydrocarbon production with an expectation of over 250 Million Barrels of Oil Equivalent (MMBOE). The project scope included the drilling of one vertical or slightly deviated well within the Diebu Creek.
2	**Case 2: Nimbe Field Development Project. By NAOC in Bayelsa State** The Nimbe Field development project involved drilling development wells with its associated activities. The development drilling comprised the drilling of two wells on an existing well location. In addition, three wells were drilled at three other locations at Obiama, another at Etima and the third one at Amapogu.
3	**Case 3: Exploratory drilling in Ekedei Field in Oil Mining Lease (OML) 63 Project by NAOC in Bayelsa State** The project was the drilling of exploratory wells at the Ekedei oil field in Oil Mining Lease (OML) 63 in Bayelsa State). The project involved the drilling of a vertical well to a Total Vertical Depth (TVD) of 5113m with an impact target of all the area of interest.
4	**CASE 4: Nembe Creek Trunk Line (NCTL) Replacement Project by SPDC Bayelsa State**. The lines were built in 1981 and had reached end of its design life. The project involved additional land acquisition along existing Right Of Way (ROW) to accommodate a new line.
5	**CASE 5: Ekeremor Field Development Project by Excel Exploration and Production in Bayelsa State** The project involved the work over of existing wells, drilling of new wells and hook up of these wells to oth facilities at Ogbotobo through flow lines and pipelines. The field is located within OML 46.
6	**Case 6: Tebidaba East- A Exploratory Well Drilling Project By NAOC in Bayelsa State**. It is situated in the Oil Mining Lease (OML) 63; The project was designed as a field development project to increase the productivity of wells. It involved drilling activities for the re-entry and development of Tebidaba 11ST from the existing Tabidaba 11.
7	**CASE 7: 20" x 37 Km Kolo Creek Trunk Line Replacement Project by SDPC in Rivers State.** Kolo Creek and Rumuekpe are located about 42Km -68Km North West of Port-Harcourt, the project transverses five Local government Area; Ogbia in Bayelsa, Abua/Odual, Ahoada west, Ahoada East and Emohua in Rivers state. A 20" x 37 Km Kolo Creek – Rumueke TL which was commissioned in 1994 was to be replaced with a carbon steel pipeline due to corrosion. The pipeline itself is a replacement of an earlier one which was commissioned in 1974.
8	**Case 8: Agbada Non Associated Gas (Nag) Project by SPDC in Rivers State** The project involved the drilling of 2 Non Associated Gas (NAG) wells and laying of a bulk line. The project is located at the Dodo-North Field which is about 12km Northwest of Porthacourt. The Non Associated Gas project involved side tracking from existing appraisal wells for the two new (DN 001 and DN 002) NAG wells.
9	**CASE 9: Asaramatoru Oil and gas Field Project by SPDC in Rivers State** The project involved the re –entry of two suspended wells (ASRA 01 & 02), the construction of flow lines and pipelines for the evacuation of the produced oil and gas from the field to Bonny Flow Station for processing and transmission to Bonny Terminal for export. Also, establishment of 25m by 10km long pipeline Right Of Way (ROW) from the field to the SPDC Bonny flow station and Bathymetric survey of the Opobo Channel from Bonny River to Andoni River for transport of equipment in and out of field.

10	**CASE 10: Bonny Terminal Integrated Project by SPDC in Rivers State** The expansion was planned to improve on the quality and capacity of the existing facilities which comprised 23 storage tanks arranged into six tanks groups. Smaller tanks were removed and replaced with larger tanks. New tank internals were installed on the remaining old tanks. Among other upgrades the works included modification to the pipe works. Also, new earthen tank bunds and impermeable floors were provided.
11	**CASE 11: Produced Water Re-Injection In Ebocha Field in OML 61 by NAOC in Rivers State** Produced water Re-injection in the petroleum industry is generally recognized as an environmentally responsible method of disposing produced water. The re-injection project was designed to dispose the produced water from the Ebocha oil centre in an environmentally safe way by treating and re-injecting the water from Akri, Kwale, Irri, Mbde, Ebocha and Obiafu and Obrikom fields that are collected at Ebocha Oil Centre through dedicated wells within underground formations.
12	**Case 12: Swamp Area Gas Gathering Project by NAOC in Rivers State** The project was conceived with a goal to increase and supply additional gas of 312MMscfd to the NLNG's 4th and 5th train. The project involved: The installation of compressors, pumps, generators and separators at Ogbainbiri and Tebidaba flow stations and OB/OB Gas Plant. Pipeline networks were laid as follows: 12''x 35Km pipeline from Tebidaba to Ogbainbiri Flow-station on existing Right-Of-Way (ROW) and 24"x 121Km pipeline from Ogbainbiri to OB/OB Gas plant on partly existing and partly new Right-Of-Way (ROW).

Source: Adopted from [11]

Table 2 EMP Implementation score of case study projects

S/N	Project title	State	Performance (%)
1	Diebu Creek Exploratory Drilling Project	Bayelsa	55.5
2	Nimbe Field Development Project.	Bayelsa	50
3	Exploratory drilling in Ekedei Field in Oil Mining Lease (OML) 63	Bayelsa	33.3
4	Nembe Creek Trunk Line (NCTL) Replacement Project	Bayelsa	66.6
5	Eremor Field Development Project	Bayelsa	55.5
6	Tebidaba East- A Exploratory Well Drilling Project	Bayelsa	27.7
7	20" x 37 KM kolo creek Trunk line replacement Project (**Rivers state stretch**)	Rivers	27.7
8	Agbada Non Associated Gas (Nag) Project In Obio Akpor Lga, Rivers State	Rivers	27.7
9	Asaramatoru Oil and Gas Field Project Rivers State	Rivers	27.7
10	Bonny Terminal Integrated Project	Rivers	77.7
11	Produced water re-injection project in Ebocha field in NAOC OML 61 in Ogba Egbema	Rivers	27.7
12	Swamp Area Gas Gathering Project.	Rivers	77.7

Source: Adopted from [11]

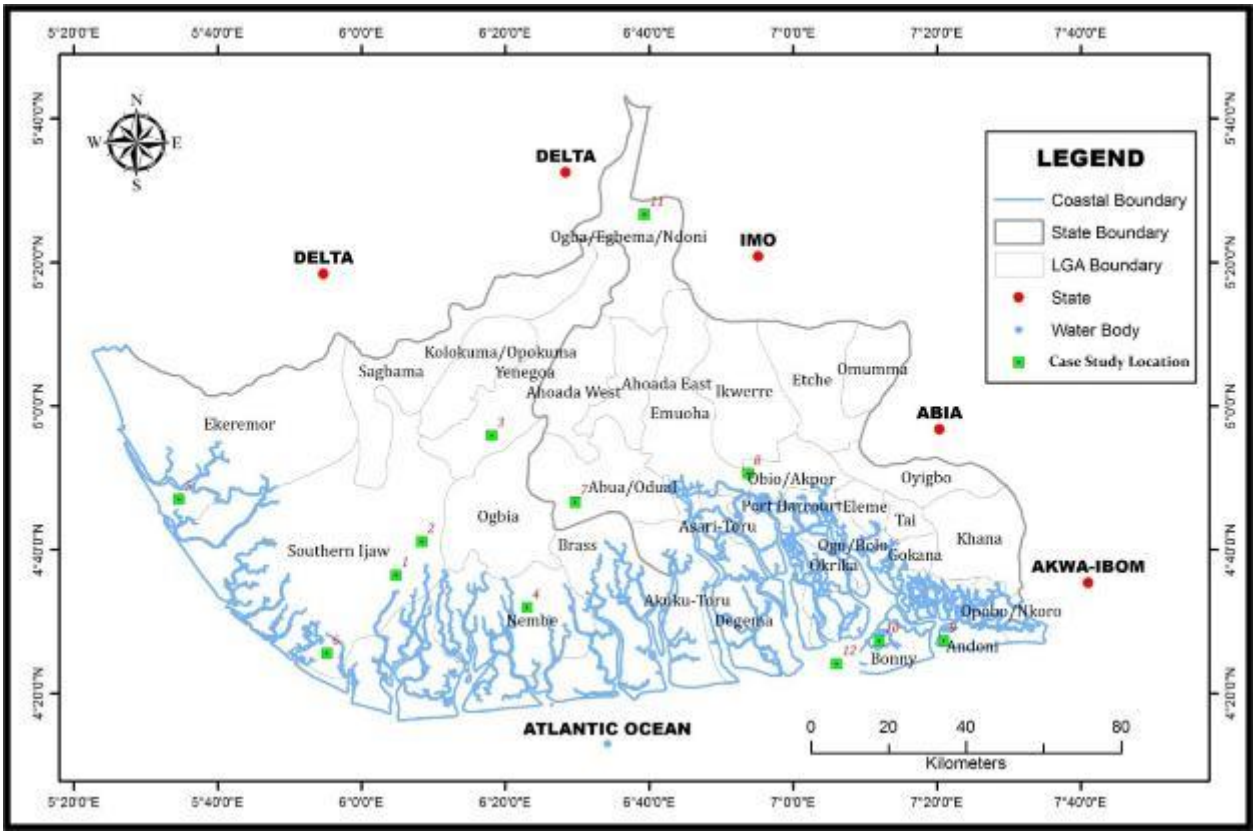

Figure 2 Spatial distribution of case study projects.

3. Results and Discussion

It was found that, although the performances of the projects were generally low (Table 3), the average performance of the projects in Bayelsa state was higher than the average performance of the projects in Rivers state.

Table 3 Performance according to states

	Bayelsa State		**Rivers State**	
S/N	Project	Score (%)	Project	Score (%)
1	Diebu Creek Exploratory Drilling Project	55.5	20" x 37 KM kolo creek Trunk line replacement Project	27.7
2	Nimbe Field Development Project.	50	Agbada Non Associated Gas (Nag) Project In Obio Akpor LGA, Rivers State	27.7
3	Exploratory drilling in Ekedei Field in Oil Mining Lease (OML) 63	33.3	Asaramatoru Oil and gas Field Project Rivers State	27.7
4	Nembe Creek Trunk Line (NCTL) Replacement Project	66.6	Bonny Terminal Integrated Project	77.7
5	Ekremor Field Development Project	55.5	PRODUCED water re-injection in Ebocha field in NAOC OML 61 in Ogba Egbema	27.7
6	Tebidaba East- A Exploratory Well Drilling Project	27.7	Swamp Area Gas Gathering Project.	77.7
Average Score (state performance)		**48.1**	**Average Score (State Performance)**	**44.36**

As shown in Table 3, Rivers state projects scored 44.36% while Bayelsa state projects scored 48.1%, this indicates that the projects in Bayelsa State performed higher in EMP implementation than the projects in Rivers State (Figure 3).

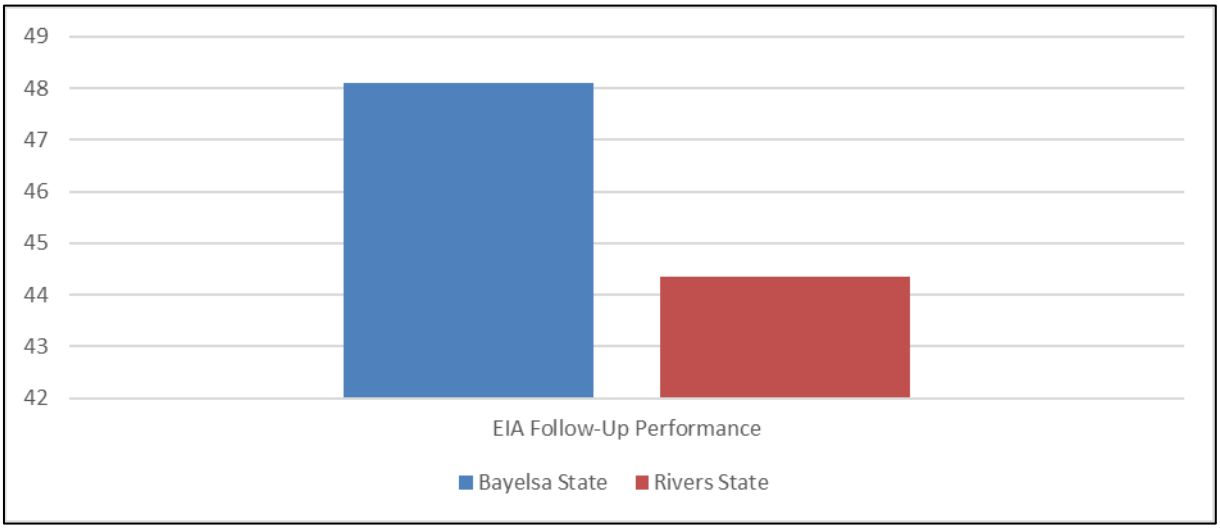

Figure 3 Follow-up implementation score of project in Bayelsa and Rivers State

On the other hand, the ecological environments of the projects considered as riverine and uplands were compared. The average performance of all case study projects located in the riverine areas (in Bayelsa and Rivers states) was taken and compared with the average score of all projects located in the upland areas. The result is shown in Table 4.

Table 4 Implementation score of Upland and Riverine case projects

	Upland		**Riverine**	
S/N	Project	Score (%)	Project	Score (%)
1	Diebu Creek Exploratory Drilling Project	55.5	Ekremor Field Development Project	55.5
2	Nimbe Field Development Project.	50	Tebidaba East- A Exploratory Well Drilling Project	27.7
3	Exploratory drilling in Ekedei Field in Oil Mining Lease (OML) 63	33.3	Asaramatoru Oil and gas Field Project Rivers State	27.7
4	20" x 37 KM kolo creek Trunk line replacement Project	27.7	Bonny Terminal Integrated Project	77.7
5	Agbada Non Associated Gas (Nag) Project	27.7	Nembe Creek Trunk Line (NCTL) Replacement Project	66.6
6	PRODUCED water re-injection in Ebocha field in NAOC OML 61 in Ogba Egbema	27.7	Swamp Area Gas Gathering Project.	77.7
Mean Score		**36.98**	**Average Score**	**55.48**

It was found that, the riverine projects had average score of 55.48% while the upland projects had an average score of 36.98 (Table 4 and Figure 4). According to the classification by [11] the score of 55.45% stands for good performance and the score of 36.98% stands for inadequate performance, this applies to the riverine and upland locations respectively.

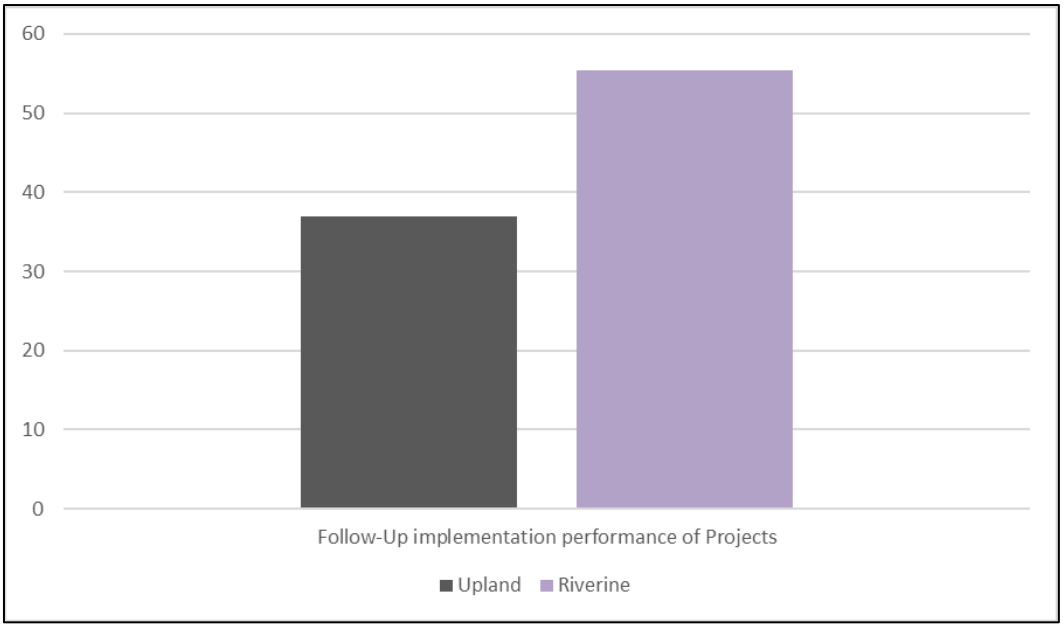

Figure 4 Follow-up implementation score of Projects in Upland and Riverine locations

Further, results of the Mann-Whitney U test showed that the difference was not statistically significant, *U* = 9.500, *P*= .157 (Table 5). Median performance score was higher for Riverine (Mdn = 61.1) than for Upland projects (Mdn = 31), but this difference was not statistically significant. The effect size was moderate (r= .41). While the difference in performance was not statistically significant, the moderate effect size (r= .41) suggest that the Riverine projects performed noticeably better than the upland projects. This difference may have practical implications, especially in environmental protection or with a larger sample.

Table 5 Mann-Whitney test results for Upland and Riverine Locations

	Project Score
Mann-Whitney U	9.500
Wilcoxon W	30.500
Z	-1.417
Asymp. Sig. (2-tailed)	0.157
Exact Sig. [2*(1-tailed Sig.)]	0.180[b]

Whereas, difficult terrains like riverine locations are considered challenging in terms of access and expected to affect implementation process leading to poor implementation, poor access may make social issues of security complex affecting monitoring and may impact the performance of EMP. In such situation, the implementation could be expected to be better in areas with relatively better access and security. However, findings show otherwise with the projects in the riverine area performing even better. This suggests that the challenges associated with riverine terrain do not have effect on EMP implementation in the region. Risk perception may have influenced the high performance of implementation in the riverine location. The delicate nature of the riverine environment in terms of its ecological vulnerability may influence risk perception that could raise social pressure and influence implementation performance. The fear that poor environmental management may aggravate the security challenges in the riverine area could be a source of social pressure that may lead to a better EMP implemented in the area.

Similarly, Mann-Whitney U Test was conducted to test if the difference between projects located in Bayelsa state and Rivers state was significant (Table 6). Results showed that the difference was not statistically significant (*U* = 14, *P*= .505). Median performance score was higher for projects located in Bayelsa state (Mdn = 53) than for projects located in Rivers state (Mdn = 28), but this difference did not reach statistical significance. The effect size was small (r = .19) indicating a slight tendency for Bayelsa state to outperform Rivers state, though the difference was not meaningful in practical terms.

Table 6 Mann-Whitney U test result for case projects in Bayelsa and Rivers States**.**

	ProjectScore
Mann-Whitney U	14.000
Wilcoxon W	35.000
Z	-0.667
Asymp. Sig. (2-tailed)	0.505
Exact Sig. [2*(1-tailed Sig.)]	0.589[b]

It is already known that EMP in specific location in the region may be influenced by local factors. Some of these factors may include, public participation, ease with which to carry out impact mitigation monitoring and the availability of funds. These factors have been reported by [15] in commercial projects in Kenya and found to have positive correlation with implementation of recommendations of EIA which are essentially contained in the EMP. Public participation in EMP happens in many very important ways which can support the process and provide the context within which the implementation of EMP may differ across geopolitical location. However, this study could not find significant difference in the implementation across the different states of location of the projects. The implication of this finding is that, EMP implementation in the Niger Delta is likely the same regardless of the location of the project.

4. Conclusion

The findings of the study have led to the conclusion that the location of oil and gas project site within the Niger Delta region has no impact on the EIA follow up of the projects. EIA follow-up in the Niger Delta is not significantly affected by the terrain and geopolitical environment of the region. The implementation of EMP in the Niger-Delta apply largely uniform and occur in much the same way across projects' geopolitical and ecological environment. The observed higher scores in some project locations is likely due to chance. Although it was indicated by both regulator and proponent's key informants that logistic arrangements and frequency of inspection of projects in riverine locations was more challenging, the general performance of the EMP did not indicate significant difference between the two locations. Also, this research is unable to establish that the difficult terrain associated with riverine areas as well as differences in geopolitical environment affect the implementation of EMP in the region. While it is important to recommend the expansion of this investigation to cover more projects and states, it is believed that the insights gained from this analysis are essential for policymakers, environmental consultants, project developers, and community stakeholders who aim to improve environmental governance and sustainable development in the Niger Delta.

Compliance with ethical standards

Disclosure of conflict of interest

There is no conflict of interest to be disclosed.

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