

Article

Mainstreaming Climate Change into the EIA Process in Nigeria: Perspectives from Projects in the Niger Delta Region

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Abstract: Climate change incorporation in environmental assessment is a growing research area, particularly following the Paris agreement. Environmental Impact Assessment (EIA) is considered in many quarters to be an important tool in factoring climate-related components in the planning and design of a project. However, many recent researches have shown that EIA has, so far, struggled in the attempt to incorporate climate change into its procedures. This study is an attempt to evaluate the level of consideration of climate change in the EIA process in Nigeria, with particular focus on the Niger Delta region. The result of this quantitative research shows that there is a poor political will to address climate change, as reflected in the absence of climate change requirements in the EIA guidelines of Nigeria. Although, there is a growing trend in the pattern of consideration of climate change in the EIA procedures, the overall level of consideration is still a far cry from the requirements if EIA is to be considered to be an important tool in addressing challenges of climate change in Nigeria.

Keywords: climate change; global warming; EIA; Paris agreement; Niger Delta; greenhouse gases

1. Introduction

The universality of the threat of climate change today cannot be over-emphasized [1]; however, the resulting impact will be felt differently across the world [2]. The severity and pattern of the impact, as well as the rate of occurrence, will differ across the various regions of the world. Overall, the extent to which climate change will affect a region or a community will depend a lot on their capacity to adapt to the impacts [3]. Studies have shown that there will be a notable increment in the number of summer days in the tropic region of the earth. Incidentally, many of the poor developing countries of the world are domiciled in the tropical latitudes, while the developed nation is mostly located in the temperate regions [2,4]. Additionally, basic needs, like food security, water availability, health, and shelter will be threatened by climate change. The implication is that it is mostly the poorer countries from the global south that often lack the mechanisms to cope with these impacts that will suffer the worst effects of climate change [3]. This underscores the urgency of carrying out the actions and interventions that are needed to address the challenges of vulnerable communities.

Intergovernmental Panel on Climate Change (IPCC) regards climate as the statistical description in terms of the mean and variability of the relevant atmospheric quantities, such as temperature and precipitation over a long period of time, which could range from months to thousands or millions of years [5]. In this respect, climate change is considered to be a change in the climatic conditions over a period due to anthropogenic or natural causes. Most climate scientists are unanimous on the fact that anthropogenic factors are the primary factors stimulating the trend in global warming [6]. Global warming results from the accumulation of greenhouse gases in the atmosphere [7,8]. Indeed, many of the greenhouse gases exist naturally, but the emissions mostly from fossil fuel burning, livestock farming, and deforestation are significantly increasing the concentration of carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄), and fluorinated gases in the atmosphere. These gases form a screen around the earth through which ultraviolet radiations from the sun easily penetrate to be utilized by plants, but the weaker reflected infra-red radiations are trapped by the screen that is formed by these greenhouse gases, thereby causing the average temperature of the earth to increase [7]. Provisional projection of the World Meteorological Organization (WMO) as of November 2017 submitted that the average temperature of the world between January to September 2017 was about 1.1 °C more than the pre-industrial average, which likely makes 2017 the second warmest year ever after 2016. Many countries thus experienced unprecedented devastation from sea level rise, excessive precipitation, flooding, tropical cyclone drought, heatwaves, and wildfire, while the glaciers continue to melt away and ocean acidification and temperature is on the rise [9].

To avert the trend in climate change pattern, the twenty-first Conference of Party of the United Nations Framework Convention on Climate Change (UNFCCC) that was held in Paris on the 12th December 2015 reached a phenomenal milestone with the adoption of the historic Paris (climate) agreement [10]. Built upon the UNFCCC's principle of Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC), the Paris Agreement has three goals vis; limiting global mean temperature growth to well below 2 °C above pre-industrial levels while pursuing efforts to keep increment to within 1.5 °C above pre-industrial levels, fostering adaptive capacities and climate resilience, and to promote clean development without threatening food security [11].

Thus, on the backdrop of the Paris climate change agreement, new policies, plans, and other instruments aimed at limiting the contribution of human activities to climate change and ecosystem vulnerability must be developed while existing ones must be evaluated for effectiveness [12,13]. Environmental Impact Assessment (EIA) is one of such regulatory tools that are used for mainstreaming environmental considerations into decision making for a proposed project or development. Most of the developments that were subjected to the process of EIA have bearing on climate change, thus underlining the significant role of EIA in achieving the goals of the Paris Agreement [12]. However, massive projects being carried out without properly considering their implications on the environment are still common to see in developing countries. Even though most nations have legislated EIA, it is often not efficiently implemented in developing nations as practiced in most developed countries (see Table 1) [3]. Effective and strategic planning and management can help to avoid significant financial costs and reduce societal impact and vulnerability [14].

Many studies including [1,13–18], as well as IEMA and European Commission guidance documents, have all emphasized the importance of EIA as a tool for climate change mitigation and adaptation. EIA is a planning tool for the analysis, prediction, and evaluation of potential environmental implications of a proposed development project, so that effective measures to prevent or at least mitigate such implications could be identified [16]. A good EIA should focus on the impacts that matter most, and, as a result, EIA systems involve systematic steps to determine whether the likely adverse impacts of proposed projects are significant [19]. The efficacy of the EIA system, however, relies heavily on the requirements and the extent to which the EIA guideline documents are followed, as well as the quality of the EIA reports produced thereof [20]. There is already a growing interest in the extent of integration of climate change concerns into the EIA process in the EIA community [17].

Table 1. An overview of climate change integration in Environmental Impact Assessment (EIA) in selected countries and organizations.

	Level 1: Intention	Level 2: Guidance	Level 3: Implementation
Developed nations	United Kingdom	Canada	Australia
	Australia	USA	Canada
	New Zealand	United Kingdom	The Netherlands
	European Union	European Union	New Zealand
	USA	Australia	
Developing nations	Canada	New Zealand	
	Dominican Rep.	Caribbean community	
	Saint Lucia	Trinidad and Tobago	
	Kiribati	Kiribati	
	Bangladesh	Grenada	
	Samoa		
	Solomon Islands		
Multilateral Organizations	Caribbean Community		
	The World Bank		
	Inter-American Development Bank		
	Asian Dev. bank		

Source: Adapted from Agrawala et al. [15], Enríquez-de-Salamanca et al. [21] and Modak & Ginoya [17].

It is imperative that the potential impact of a planned developmental project is considered based on its projected GHG emission estimate as well as climate change implications of the environmental effect of the planned development. Here, the kind of effect to be analysed and extent of analysis will vary by the nature of proposed development, the significance of effect, the attending uncertainties, and public interest [18]. However, owing to the complexity of the interactions between climate change uncertainties, GHG emission estimation, and its impact, effective integration of climate change into EIA has been challenging [1]. Though it differs across different countries, some degree of success has been achieved in the attempt to integrate climate change into the EIA process. Table 1 reflects the fact that there is still a wide gap between the interest to integrate climate change into the EIA process and actually doing so. Level 1 includes countries that have indicated high-level interest to incorporate climate change considerations in the EIA procedures; Level 2 includes countries that have taken steps to developed operational guidance and have incorporated climate change in their legal and regulatory frameworks; and, Level 3 looks at countries that have used EIA to address climate change impacts of projects. While a few multilateral organizations and developed and developing nations have shown the desire to deploy EIA as a tool for climate change mitigation and adaptation, only Australia, Canada, the Netherlands, and New Zealand have actually taken steps to implement it [15].

The Niger Delta region of Nigeria has been primed as being highly vulnerable to the impact of climate variability due to its low adaptive capacity and the fragility of the ecosystem [22], and unfortunately extensive oil exploration activities in the region have tremendously affected the natural ecosystem of the once pristine and undisturbed ecosystem [23]. If properly implemented, EIA can be a veritable mechanism to mitigate likely future consequences of climate change impact [24] by potentially minimising GHG emission and fostering adaptive capacity [20]. To achieve this objective, guidance documents have been developed in most parts of the developed regions of the world (such as the USA, Canada, the United Kingdom (UK), and the European Union) to facilitate the adequate consideration of climate change in both EIA and Strategic Environmental Assessment

(SEA) [21]. Unfortunately, not much has been done to promote climate change integration in the Environmental Assessment process in most developing nations.

The goal of this study is to evaluate the adequacy of the consideration of climate change concerns in the EIA process in the Niger Delta region of Nigeria using adapted criteria framework from existing studies. Climate change integration in the EIA process is a recent and growing area of knowledge that has generated much interest, particularly in the industrialised nations. However, it is pertinent for the developing nation to begin to channel effort in similar directions, as recent studies, such as [25], have shown that rapid industrialization in the emerging economies, such as Nigeria, is causing more emissions than ever.

2. The Climate Pattern in the Niger Delta

The Nigerian coastline lies on the latitude $4^{\circ} 10'$ to $6^{\circ} 20'$ N and longitude $2^{\circ} 45'$ to $8^{\circ} 35'$ E is about 853 km long and it overlooks the Atlantic Ocean [26]. The coastline is generally classified into four geomorphological units viz: The Strand coast, the Mud coast, the Barrier Lagoon coast and the Niger Delta [27]. The Niger Delta region is a wetland ecosystem that is in the Atlantic coast of southern Nigeria spanning over an area of about 70,000 km² (see Figure 1) [22] and hosting a population of about 30 million (based on 2009 National Population Census) [28].

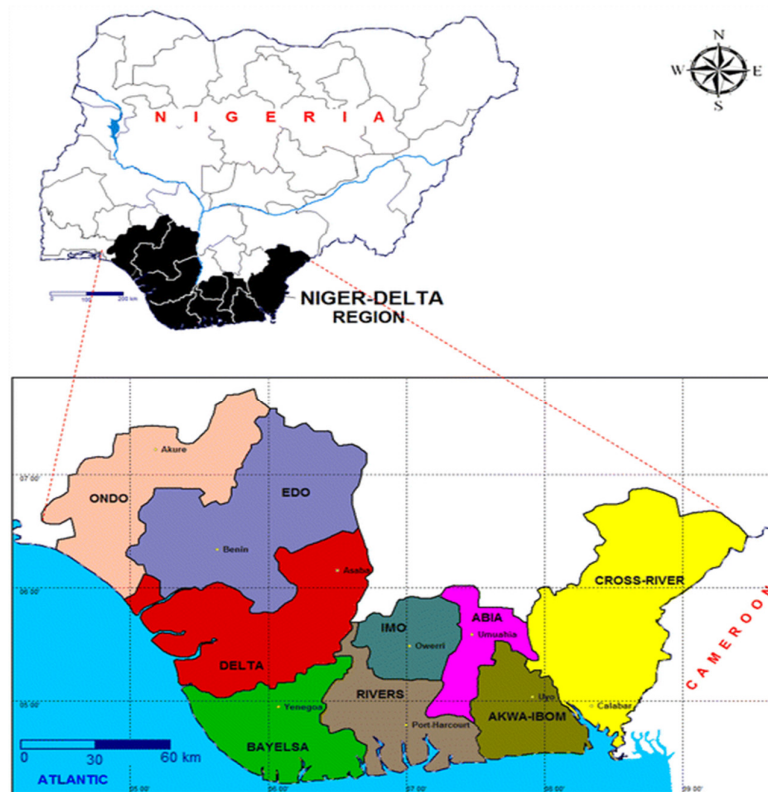


Figure 1. The Niger Delta region of Nigeria. Source: Nzeadibe et al. [22].

Creeks, estuaries, and rivers cover an estimated 2370 km² of the Niger Delta land; stagnant swamps cover approximately 8600 km², while the mangrove swamp with about 1900 km² is considered Africa's largest [29]. World Bank report estimated that one-third of the Niger Delta is covered by fragile mangrove forest, which makes it the second largest in the world. This delta is highly rich in both aquatic and terrestrial biodiversity [22,29]. The Niger Delta comprises nine states of the Nigerian federation viz; Rivers, Bayelsa, Delta, Cross River, Edo, Akwa Ibom, Ondo, Abia and Imo states (see Figure 1) [27].

The Niger Delta ecosystem is of immeasurable economic importance to the local communities as fishing, farming, livestock agriculture, and trading constitute important occupations for them

[28]. A few of the population are also employed in various government institutions and other corporate organization. The local GNP of the Niger Delta is less than the national average of 280 USD while education, especially for women, is also below national average [29]. A study by Ebegbulem et al. [30] showed that the inhabitants of the Niger Delta region form a significant fraction of the poorest groups in Nigeria, with about 70% of the population still living in rural settlements with inadequate access to electricity, clean water, health care, and access roads.

The Nigerian coastal zones are low lying mostly less than 3m above sea level. They have a tropical climate with rainy and dry seasons [26]. The Niger Delta generally have an equatorial climate on its southern coast and subequatorial climate in the north (based on Koppen's Af classification). The monthly mean temperature ranges between 25 °C and 29 °C, while the annual precipitation ranges between 2000 mm and 4000 mm, with relative humidity being above 70%. The rainy season in the Niger Delta lasts from March to October, with a little dry spell experience during the August break due to monsoon winds from the southwest that carries moisture from the ocean into the hinterland. The dry season lasts from November to February with harmattan experienced between December and February that is caused by tropical continental air mass from the north [31].

Due to the peculiar nature of the Niger Delta region of Nigeria, many studies have identified it as being highly vulnerable to impacts from climate change. Studies, such as [27,29,32], have identified sea level rise, increased precipitation, intensive industrial activities from oil exploration, poverty, and its coastal location as some key features that make the region highly susceptible to climatic variability. Already, there has been an observed rise in the mean sea level that has resulted in flooding and coastal erosion that has caused the displacement of many settlements in some regions of the Niger Delta [29] while torrential rainstorms have further exposed the low-lying regions to impacts from flood [27]. A study that was conducted by Uyigüe and Agho [29] on 'Coping with Climate Change and Environmental Degradation in the Niger Delta of Southern Nigeria' suggested that the World Bank ranked flooding as requiring high priority attention while coastal erosion requires moderate attention to ease the impacts on the local communities. The study further reports that other than coastal erosion in the Niger Delta, rising sea level, and frequent ocean surge will aggravate problems of flooding and seawater intrusion into fresh water and could affect food security and shelter of the community. If the trend in sea level rise is not averted, about 15,000 km² of the Niger Delta land could be lost to a 1 m rise in sea level by the year 2100 [29]. According to The Nigeria Post-Disaster Needs Assessment report on one of the most devastating flood event in the Niger Delta region in recent years, the 2012 flood episode led to the loss of 363 lives, with over 5851 receiving various degrees of injuries and over 3871,530 being displaced [31]. Another change in the pattern of the climate is that of decline in rainfall in the last three decades. The raining season is also changing and has become more difficult to predict, a phenomenon that is affecting farmers productivity, and hence threatening food security even further [33].

Despite the present trends of impacts occasioned by climatic variability, various studies have projected alarming future impacts. For instance, Uyigüe & Ogbeibu [34] in their study projected that more than 15,000 km² of the Niger Delta coastland could be inundated with a 1m rise in sea level by the year 2100, while a 0.2 m rise could inundate almost 3000 km² of the land (see Table 2). The projection also suggests that up to 100,000 inhabitants of the Niger Delta region could be displaced by a 0.2 m rise in the sea level.

Table 2. Projection of land loss (km²) and population displacement (millions) due to different scenarios of sea level rise in the Niger Delta region.

Events	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Sea level rise (m)	0.3	0.5	1.0	2.0
Land loss (km ²)	2865	7500	15,332	18,803
Population displacement (millions)	0.10	0.25	0.47	0.21

Source: adapted from Uyigüe & Ogbeibu [34].

Also, in a projection study of the changes in the temperature (ΔT) and precipitation (ΔP) in the Niger Delta region by Agumagu & Agumagu [32], using seven Global Climate Models (GCMs) from IPCC Fourth and Fifth Assessment Reports (AR4 and AR5) for the simulation for two-time periods of 2020–2050 and 2050–2080, the results shows an overall increasing trend in temperature and precipitation in the Niger Delta region. Though the study indicates disparities in the magnitude of changes amongst the GCMs, most of the models demonstrate overall increasing trends in the annual temperature and precipitation (see Table 3). The maximum change in mean annual precipitation of 27.42 mm/year is recorded by FGOALS AR5, with a 3.06 °C increase in temperature during 2050–2080 period. Such a projection in temperature and precipitation represents a warning of for the Niger Delta.

Table 3. Summary of projected mean annual temperature (ΔT) and precipitation (ΔP) in the Niger Delta by seven Global Climate Models (GCMs).

AR5 Models	2020–2050		2050–2080	
	ΔT	ΔP	ΔT	ΔP
CNRM	0.97	3.93	2.02	6.27
IPSL	1.65	0.17	3.53	−5.73
INMCM4	0.79	−74.66	1.80	−75.94
MPI	1.27	2.59	2.67	7.10
FGOALS	1.50	9.60	3.06	27.42
AR4 Models	2020–2050		2050–2080	
	ΔT	ΔP	ΔT	ΔP
CSIRO	0.89	−0.44	1.68	−1.81
INGV_ECHAM	1.15	7.42	2.09	6.68

Source: adapted from Agumagu & Agumagu [32].

These projections will accelerate sea level rise, increase storm period and intensity, and exacerbate flooding risks in the region, thereby threatening the survival of the people and further impacting agricultural production. This represents significant consequences for the Niger Delta region [35].

When considering these recent events and trends in the climate change impacts in the Niger Delta region, it is imperative for decision makers to take proactive measures to mitigate future implications of the various projection. Measures must be put in place to control activities that have the potentials for promoting climate change. One important tool would be the EIA, which is very useful for helping decision makers reach informed decision on activities that have potentials of compromising the environment. The Niger Delta region is home to enormous oil prospecting and other industrial activities, thus it is imperative to investigate how adequate are climate change concerns integrated into the EIA process of projects in the region.

3. Methodology

This quantitative research is largely explorative and pragmatic in design. The research explores the degree of consideration of climate change factors in the EIA procedure in Nigeria through the case of the Niger Delta region. To establish a concrete academic background, this research employs an in-depth study and an analysis of literature. The output of the review of existing literature provides the primary concepts upon which the research is built. These concepts include that of EIA and climate change and the nexus that exists between them. This approach provides the opportunity to explore different criteria frameworks that have been deployed in previous studies for mainstreaming climate change into environmental assessment processes. Thus, streamlining the conceptual framework down to an analytical framework. This forms the descriptive property of the research.

The principal method that is employed for the assessment is the analytical review of documents and frameworks. A wide range of criteria has been applied to different studies relating to the

integration of climate change into EIA and SEA. Based on the emphasis from existing criteria framework, it will be safe to describe climate change mitigation and adaptation as the two most important criteria. Perhaps some of the most detailed and recent studies on this subject include those of [1,12,13,20]. A detailed analytical review of the existing frameworks and guidance documents for incorporating climate change into EIAs was conducted from which a set of nine review criteria was developed in order to assess climate change treatment in the EIA reports in the case study area (see Table 4).

To investigate the consideration of each of the nine review criteria, it must be stated that it was not realistic to completely read each of the reports of hundreds or sometimes over a thousand pages, thus the selected EIA reports were strategically reviewed, as shown in Table 4. The study therefore identified relevant chapter(s) and paragraphs to be reviewed for each of the criteria. Based on this partitioning, a content analysis is conducted to determine whether a particular criterion has been considered in the report. For example, in investigating the consideration of climate baselines, the focus will be on chapter 4, which contains the description of the project environment to evaluate whether a description of present and future climate patterns were included. The limitation here is that, in the theoretical framework, the concept of climate change is limited to the three key aspects of water issues, greenhouse gases, and CO₂. Clearly, climate change encompasses far more than these aspects but these three aspects have been emphasised in much of the literature as being the most relevant in the context of environmental assessment. Furthermore, this approach has been applied in previous studies such as [13, 36].

Table 4. Criteria framework for climate change mainstreaming.

Assessment criteria	Source	Section of Report Review
The EIA report must develop objectives that are climate change related	Yi & Hacking [1], Posas [13]	The review was focused on chapter 1, that gives background to the EIA study and its objectives; and chapter 3 which describe the project and its objectives
The report must take account of existing and projected future climate baseline scenarios	Yi & Hacking [1], Posas [13], IEMA [37], European Commission [38]	Review was focused on chapter 4 that describes the project environment
The report must review relevant climate change targets, policy statements, regulations and agreements	Yi & Hacking [1], Posas [13], IEMA [37], Wende, et al. [39]	The review was focused on chapter 1 provides background information on the EIA study including a section detailing the legal and regulatory frameworks consulted in the process
The report must identify climate change impacts on the project and project impact on climate change as well as their synergistic implications	IEMA [37], Yi & Hacking [1], Posas [13], Byer et al., [35]	Review was focused on chapter 5 which details the existing, potential and associated impacts of the proposed project
The report must consider the implications of the alternative's projects with respect to climate change	European Commission [38], Wende, et al. [39], Posas [13]	The review was focused on chapter 2 which provides justification for the project and details the alternative development and analysis
The report must address climate change mitigation strategies or planned actions for GHG emission reduction and/or increasing carbon sink	Yi & Hacking [1], Posas, [13], IEMA [37], Wende, et al. [39], Byer et al.[35]	The review was focused on chapter 6 which discusses the mitigation measures and chapter 7 that provides the Environmental Management Plans (EMP)
The report must address climate change adaptation or risk reduction strategies	Yi & Hacking [1], Posas, [13], IEMA [37], Wende, et al. [39], Byer et al.[35]	The review was focused on Chapter 7 which discusses the EMP for the project
The report must include climate change related monitoring measures for the causes and impacts of climate change	Yi & Hacking [1], Posas, [13], IEMA [37], Wende, et al. [39], Byer et al.[35], European Commission [38]	The review was focused on chapter 7 that details the project EMP with a section that details the monitoring plans and objectives
The conducts public and stakeholders' consultations must make provisions for climate change-related discussions	Posas [13]	The review was focused on the survey questionnaires that were used for the EIA study which is often provided in the appendices

The number of EIA reports that were selected for the review study is limited to within the years 2011 to 2016. This is because the reports are difficult to access online, as most of them are only available in hard copies in the Federal and States' ministries of environment, especially those that

were approved before 2011. Although a limited number of reports are available on websites of World Bank and ADB as well as some multinational organisations, most of them were still accessed from the Federal Ministry of Environment (FMOE). This setback means that almost 60% of the reports were scanned copies, which made it impossible to conduct a search for specific terms during content analysis of the reports. Despite the challenge of inadequate access, the reviewed reports were selected in a manner that ensures all nine states of the Niger Delta and the five key sectors of the economy are represented. The total number of EIA certificates that have been issued in the study area within the years under review is 142. The goal here is to review about 50% of the total number of EIA reports that are available in the national base. Thus, exactly 70 EIA reports were reviewed for this study.

Table 5 shows the distribution of the selected EIA report by states that compose the Niger Delta. The amount of the reports selected for review is determined by the total number available in the national database and the number that is accessible for each of the nine states. Thus, Rivers and Cross River states have the largest percentage of the reports reviewed, because there are many reports to select from. However, in the other case, due to the challenge of accessibility, seven out of 12 and six out of 16 EIA reports that are available in the national database were selected for review in Bayelsa and Delta states, respectively.

Table 5. State distribution of reviewed Niger Delta EIA reports.

Niger Delta States	Number of Reports	Number of Reviewed Reports	% of the Total Reviewed
Abia	9	3	4.29
Akwa Ibom	16	7	10
Bayelsa	12	7	10
Cross River	30	15	21.43
Delta	16	6	8.57
Edo	15	7	10
Imo	9	4	5.71
Ondo	12	7	10
Rivers	23	14	20
Total	142	70	100

Table 6 reveals the annual distribution of the reports within the years under review. Like the state's distribution, the number of EIA reports reviewed for each year depends on the number accessible for the year. Thus, the year with the least number of EIA is 2011, with 8.57%, and the highest is 2015, with 25% of the reports.

Table 6. Annual distribution of reviewed Niger Delta EIA reports.

Year	Number of Reports	Number of Reviewed Reports	Percentage
2011	10	6	8.57
2012	14	8	11.43
2013	30	16	22.86
2014	21	12	17.14
2015	42	18	25.71
2016	25	10	14.29
Total	142	70	100

Table 7 shows the distribution of EIA reports on a sectoral basis. The infrastructure and the petroleum and petrochemicals sectors have a higher report of 83 and 40, respectively. This represents 51.43% and 31.43%, respectively, of the reviewed reports. While the mining, beneficiation, and metallurgy have the lowest number of reports, with 2.86% of the reviewed reports.

Table 7. Sectorial distribution of reviewed Niger Delta EIA reports.

Sectors	Number of Reports	Number of Reviewed Reports	Percentage
Agriculture and rural development	7	4	5.71
Infrastructure	83	36	51.43
Manufacturing	10	6	8.57
Mining, beneficiation and metallurgy	2	2	2.86
Petroleum and Petrochemicals	40	22	31.43
Total	142	70	100

4. Results

4.1. Climate Change Consideration in EIA by Year of Publication of the Reports

Figure 2 represents the pattern of the level of consideration of climate change criteria in the EIA report in the Niger Delta region by year of publication of the reports. At first glance, the chart reveals that some of the criteria appear to have a consistently growing trend in the level of consideration along the years, while others are either inconsistently addressed or completely neglected in the EIA reports.

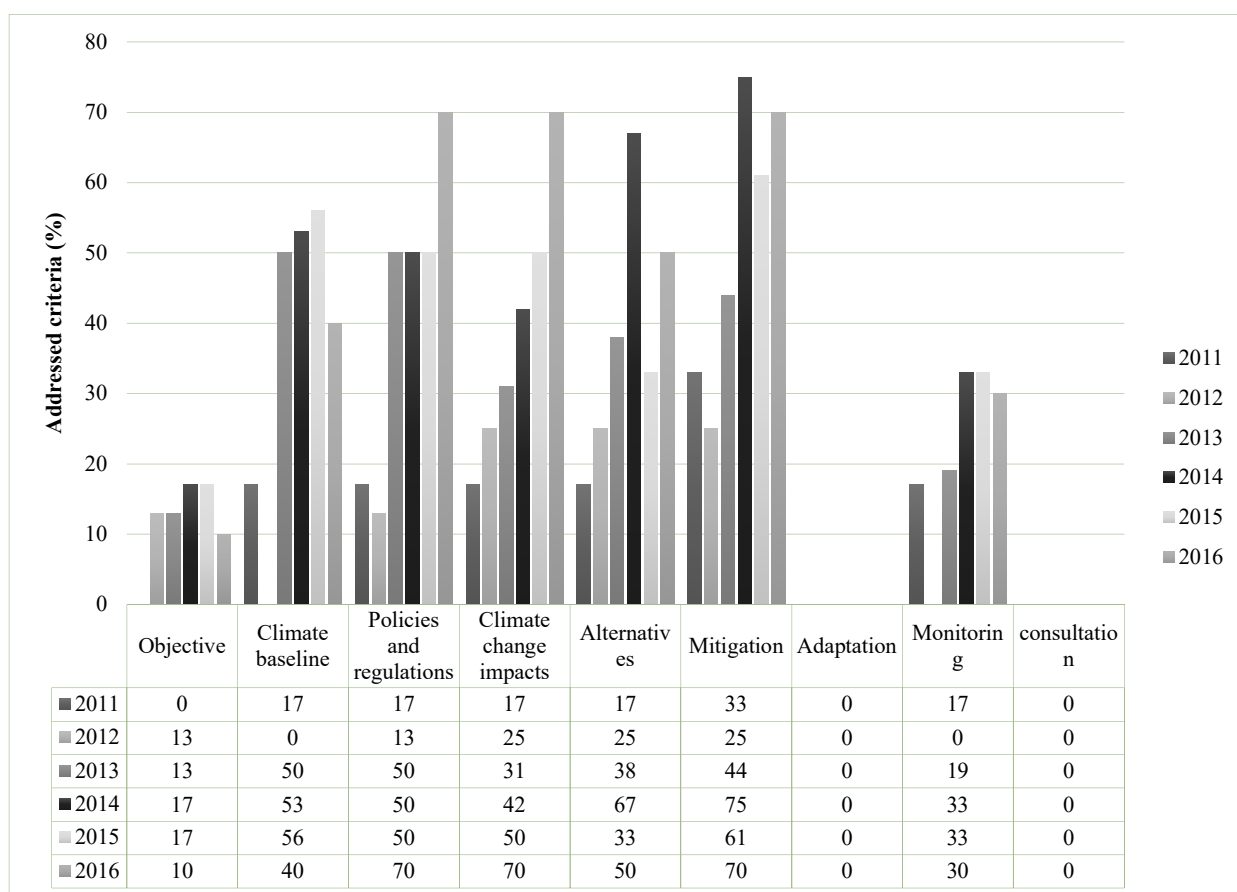


Figure 2. Percentage of criteria addressed (2011–2016).

Climate change adaptation and consultation with public and stockholders on discussions that have bearing on climate change are two criteria that received complete neglect in all 70 EIA reports that were reviewed in the Niger Delta.

Three criteria, developing 'objectives' that take climate change into account, 'climate baseline' scenarios, and 'monitoring' overall received a low and inconsistent degree of considerations over the years. With respect to objective, it is important to state that none of the six EIA reports reviewed for the year 2011 addressed climate change related objectives. There seems to be a slight upward trend in the level of consideration from 2012 to 2015, with 13% each for 2012 and 2013, and 17% each for 2014 and 2015 integrating climate change-related objectives. However, the level of integration of climate change related objectives dropped to 10% in 2016. Identifying existing climate vulnerabilities and critical thresholds (climate baseline) received a better level of consideration, but was still low and inconsistent overall. While 17% of the EIA reports reviewed for 2011 incorporated climate baselines, none of the 2012 reports incorporate it. There is, however, a sharp increase in 2013, with 50% of the reports incorporating climate baseline. There was a slight upward trend from 2013 to 2015, with 50, 53, and 56% of the reports for 2013, 2014, and 2015, respectively, incorporating climate baseline. This trend was broken in 2016 with 40% of the reports incorporating climate baseline. 'Monitoring' trends in causes and effects of climate change is another criterion that has very low consideration over the years. While none of the reports for 2012 addressed monitoring criteria, 2014 and 2015 jointly have the highest level of consideration with 33% each. 17, 19, and 30% of the reports that were reviewed for 2011, 2013, and 2016, respectively, incorporate monitoring.

Review of climate change-related policy references, identifying climate change impact of development, and that of alternatives as well as developing mitigation strategies are criteria that showed consistent progressive trends over the years. Although the review of climate change-related policies and regulations dipped from 17% in 2011 to 13% in 2012, it rose to the 50% consideration level in 2013 and it remained at this level until 2016, when it further increased to 70%. Climate change impact consideration is perhaps the most consistently progressive criteria in terms of trend. The level of integration of climate change impacts grew from 17 to 25, 31, 42, 50, and then 70%, respectively, from 2011, through 2016. Consideration of climate change impacts of alternative projects showed some degree of irregular pattern, but it is still regarded as consistent growth overall. Although it peaked in 2014 with 67% of the reports integrating the alternative criteria, the consideration level dropped to 33% in 2015 before picking up again in 2016 to 50%. Integration of alternatives showed increasing trends from 17 to 25, 38, and 67% for the years 2011, 2012, 2013, and 2014, respectively. Like alternatives, the consideration of climate change mitigation is another criterion that showed some inconsistencies but is overall deemed progressive. Mitigation consideration level dipped from 33 to 25% from 2011 to 2012, but it showed an upward turn from 2012 to 2014, growing from 25% to 44% and then 75%. There was a little dip again in 2015 to 61% before making growth to 70% in 2016.

Overall, there seems to be a progressive trend along the years in the level of climate change integration in the EIA reports that were reviewed in the Niger Delta. Figure 3 shows the percentage of the total number of climate change criteria addressed in the reviewed EIA reports with the trend line. The trend line (power) suggests an overall progressive pattern in climate change consideration.

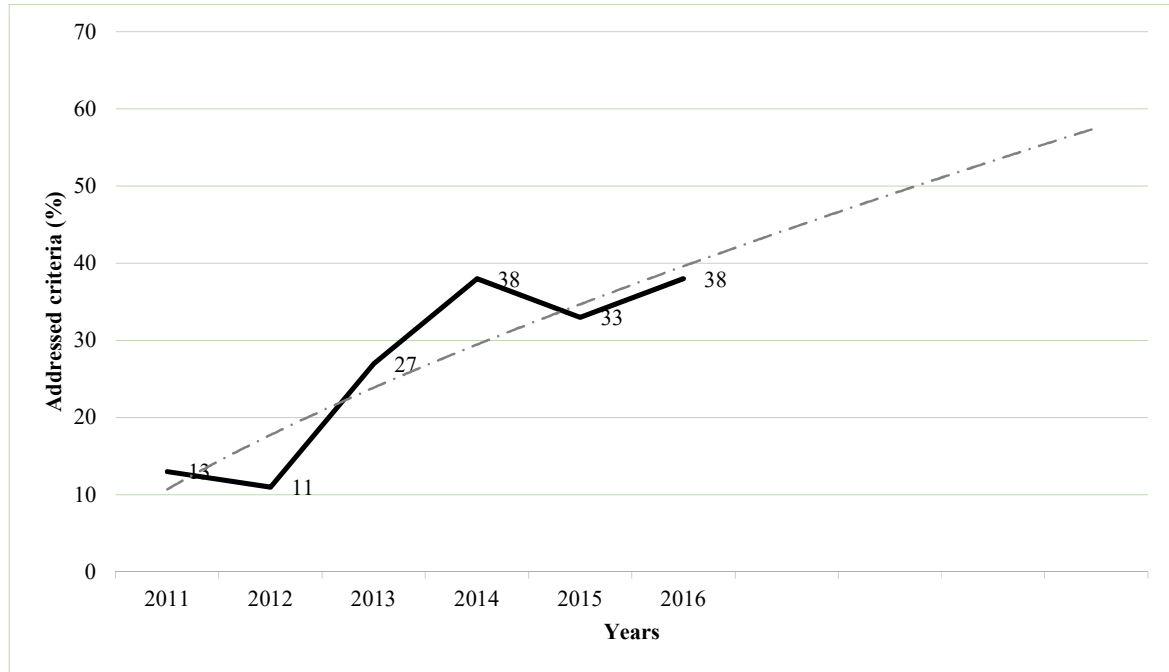


Figure 3. Percentage of criteria addressed with a trend line.

4.2. Climate Change Consideration in EIA by Sector for Which Report is Prepared

Figure 4 shows the pattern of consideration of climate change based on the sector for which the EIA reports are prepared. The chart suggests that some sectors have better performance in incorporating climate change criteria into their reports. Some criteria appear to receive fairly considerable attention from all sectors, while others only get attention from some sectors or do not even get any at all. Expectedly, climate change adaptation and consultation are not integrated into all of the EIA reports reviewed.

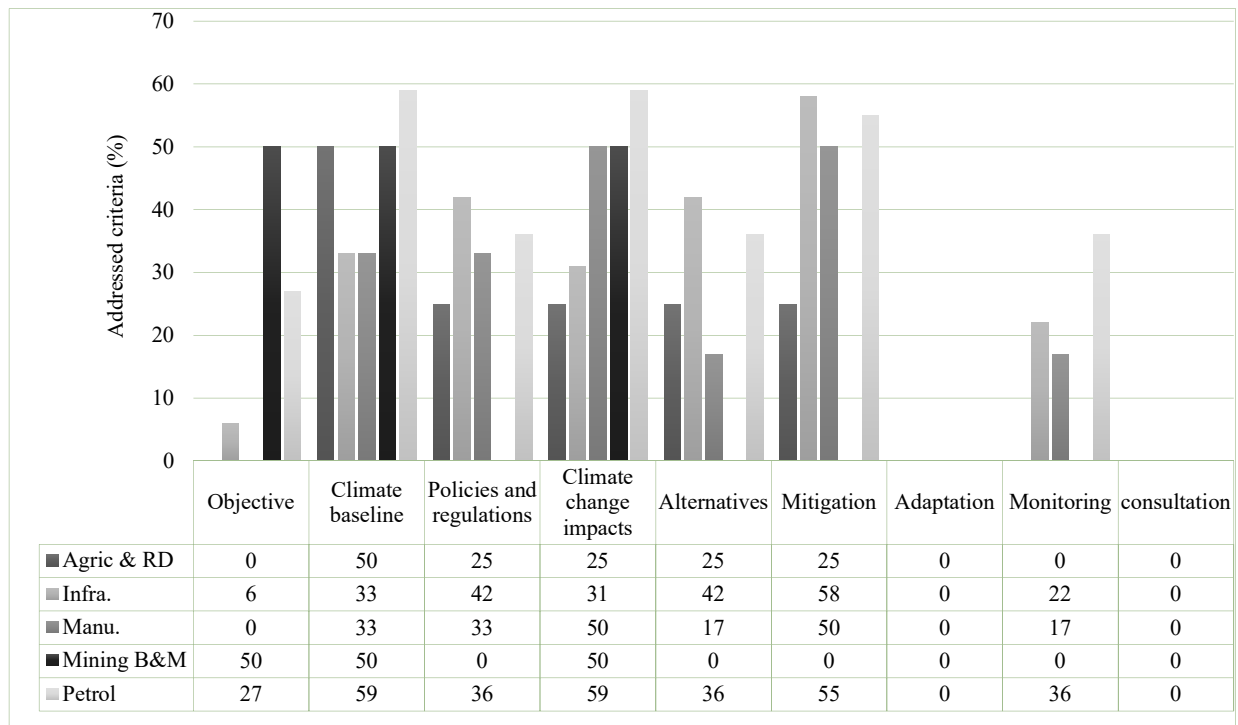
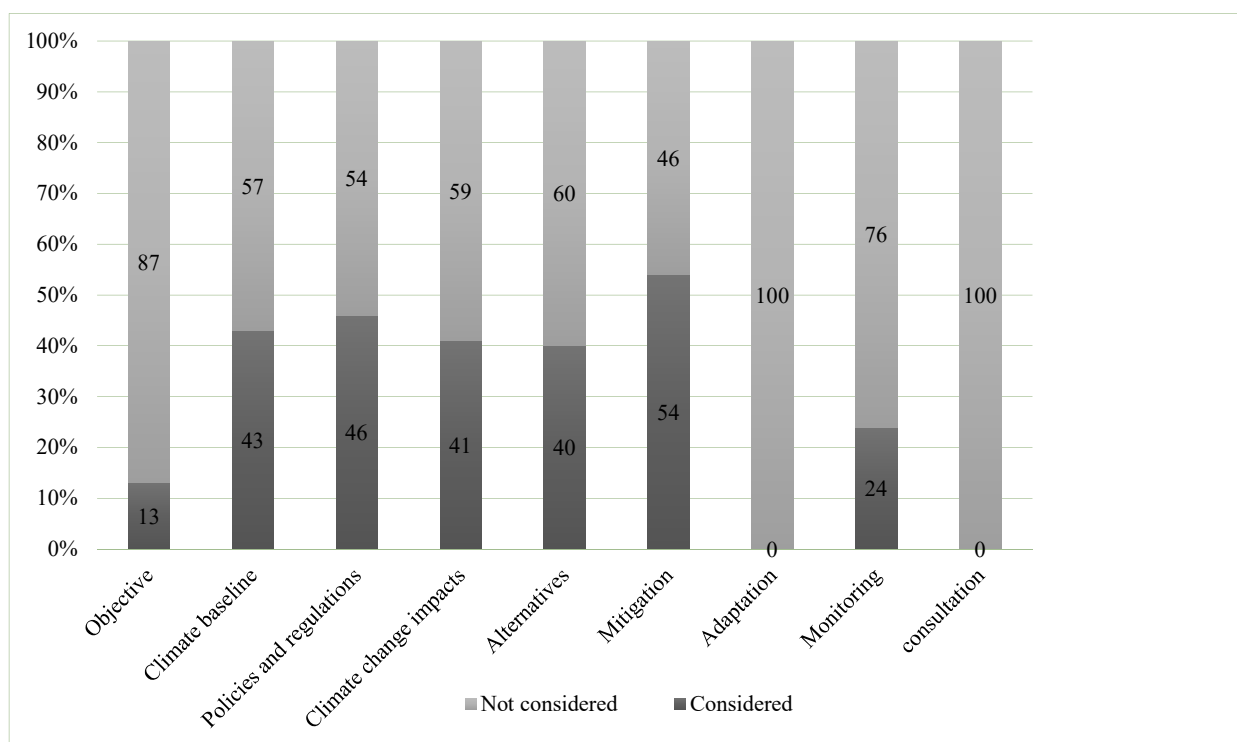


Figure 4. Percentage of criteria addressed per sector.

Besides adaptation and consultation criteria, the Petroleum and petrochemical and infrastructure sectors were the only two sectors that had some level of integration of all other seven climate change criteria. In the analysis of climate change consideration in the 22 EIA report from the Petroleum sector, the least integrated criteria are objective, with 27% being followed jointly by policy and regulation, alternatives, and monitoring, with 36% each. 55% of the reports integrated climate change mitigation, while the most integrated criteria are climate baseline and impacts with 59% each. With this data, the petroleum and petrochemical sector represents the most climate change-considerate sector in Nigeria. The infrastructure is the next climate change considerate sector. 36 EIA reports were reviewed for the infrastructure sector, of which objective received the lowest consideration, with only 6%, followed by monitoring with 22%, climate change impact with 31%, and climate baseline with 33%. 42% of the reports incorporated policies and regulations and alternatives each, while mitigation is the most considered criteria, with 58%.

Except for objectives that had some degree of incorporation in the petroleum and infrastructure sectors, the remaining six criteria were integrated to some extent in the manufacturing sector. Alternatives and monitoring were the joint least integrated criteria with 17% each, while climate baseline and policies and regulation were considered by 33% of the reports each. Climate change impact and mitigation were the most integrated, with 50% each. Agriculture and mining sectors were represented with only four and two EIA reports, respectively, which may not be enough to make a statistical conclusion.

Overall, as revealed in Figure 5, out of the 70 EIA reports reviewed, only climate change mitigation criteria were integrated into more than 50% of the reports. Climate change adaptation and consultation were completely neglected, while only 13 and 24% of all the reports developed objective relating to climate change and integrated monitoring, respectively. 40, 41, 43, and 46% of the reports incorporated alternatives, climate change impacts, climate baseline, and policy references, respectively.

**Figure 5.** Percentage of EIS that addressed the climate change criteria.

5. Discussion and Conclusion

The extent of coverage of climate change in the EIA process in the Niger Delta region was found to be limited, based on the reviewed EIS. The result of this study shows a lack of consideration of climate change adaptation strategies and consultation of stakeholders on climate change related issues are evident in all the EIA reports reviewed. None of the reviewed EIS with respect to adaptation, for example, attempt to relate an action plan to how it will help to cope with potential sea level rise or increased precipitation. This is an indication of how insignificant the challenge of climate change is considered, despite the enormous threat that is posed by climate change to Nigeria, and particularly the fragile ecosystem of the Niger Delta region. This already portends a big gap in the EIA studies that should have necessitated a rejection of the reports. It must be noted here that climate change adaptation is one of the two most important criteria identified and a complete lack of consideration undermines the whole EIA process as far as climate change incorporation is concerned. Though not a complete neglect, a similar case has been reported in Kenya in a study that was conducted on climate change adaptation in EIA by [24]. The study revealed that, although climate change adaptation constitutes the greatest threat to Kenya's Vision 2030, it has been poorly integrated into the EIA process. This has been posited in a survey that was conducted in 2009 and referenced in [40], 80% of EIA professionals believe that climate change adaptation has generally not been properly mainstreamed in the EIA process.

Developing objectives that have bearing on GHG emission and climate change as well as the monitoring of causes and effects of climate change were also very poorly incorporated, with only 13 and 24%, respectively, of the reviewed reports attempting them. This portends a great inadequacy, knowing that only when climate change considerations are incorporated from the formulation of objective can it be adequately addressed in the process. This can be an indication of the dire need for urgent attention to review the process for EIA in Nigeria.

Though, the level of consideration is still inadequate, overall, the categories of climate change information often addressed in most of the EIA report in the Niger Delta, as revealed in the results, relate to historical climate data (climate baselines), climate change-related policies and regulations, climate change impacts, climate change implications of alternative projects, and mitigation. This is in line with the result that was obtained for Germany and Austria by [40], which shows that climate change mitigation has received significantly more attention than even adaptation. [40] also established based on an interview with project proponents that climate change impacts on projects and its host environment are usually considered at the surface level.

Analysis of climate change incorporation on a sectoral basis shows that there is a high level of consideration in the petroleum and petrochemical relative to other sectors. This may not be unconnected with sector-specific GHG emission targets and control mechanisms, particularly as the petroleum sector represents the most important source of Nigeria's contribution to climate change. Agricultural development, for example, is not considered as a serious threat or GHG emission source, which is thus a reflection of its low consideration of climate change issues.

Although there has been an improvement in the performance of EIA with respect to climate change integration, the overall performance level is far below the requirement if EIA must be considered a tool for climate change mitigation and adaptation. This is like the outcome of many studies that have been conducted in the past on mainstreaming climate change in the EIA process. This also conforms to the findings of a study by [1], which reveals that climate change incorporation is still in its infancy stage in the UK, with a significant level of inconsistencies in the reviewed EIA reports considered for their study. Their results showed that climate change mainstreaming in EIA process lacks adequate scientific rigor and without proper projections and evaluation of GHG emissions and climate change impacts of projects.

One important obstacle to adequate mainstreaming of climate change into the EIA process in Nigeria is the lack of climate change consideration requirements in the EIA legal framework and EIA (Procedural and sectorial) guidelines. [41] identified a similar problem in the United States (US), while [24] resonate the same challenge in Kenya. This will be an important step toward re-engineering the EIA system to suit climate change incorporation in Nigeria. Lessons can be learnt from the European commission's 'Guidance on Integrating Climate Change and Biodiversity into

Environmental Impact Assessment' and other similar guidelines [38]. The provision of improved access to climate change modelling technology to enhance access to climate data is another very important step. There will also be the need for the government to facilitate capacity development of relevant institutions and officers to improve the efficiency of enforcement and implementation. Lastly, increase climate change awareness amongst the public will play a major role. Carlos Lopes, the eighth Executive Secretary of the United Nations Economic Commission for Africa (UNECA), stated that, in recognizing the multifaceted challenges of developing economies and transforming lives in a changing climate, and by adopting a positive and proactive approach to climate change, the solutions lie within our generation to keep climate change impacts in check and to translate these into business opportunities [42].

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