

Assessment of Environmental and Human Challenges in the Niger-Delta Region of Nigeria

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Abstract

This study, which benefits from reconnaissance surveys and recent literature on spatial degradation, examines the environmental and anthropogenic challenges in the Niger-Delta Region of Nigeria. It argues that the visible environmental restrictions posed by hydro-climatic, vegetal and geomorphic related occurrences are not significant to prohibit the development of the region. Specifically, the study observes that anthropogenic activities which strongly defied sound environmental principles are accountable for the protracted spate of environmental pollution, cycle of underdevelopment, unemployment, widespread poverty, occurrence of diseases, and human rights violations in the Niger-Delta Region of Nigeria. Based on its findings, the study recommends a number of realistic measures to reposition the region towards the path of sustainable development. These measures include urgent remediation of vastly polluted environment, routine monitoring of the region using satellite remote sensing, adequate infrastructural provisions matched with effective maintenance culture, amendments of mineral derivation, control and utilization laws, provision of reliable jobs to the immediate communities, and harnessing of hydro-climatic resources for permanent safety of the region's infrastructures. These measures require the integrated efforts of different environmental experts and authentic cooperation of indigenous communities, crude oil industries and the federal government of Nigeria to succeed.

Keywords: Environmental, Human, Challenges, Crude oil Pollution, Mitigation Measures.

Introduction and Research Problem

The Niger-Delta Region of Nigeria is one of the most important deltas in contemporary Africa. Naturally, the region has abundant crude oil, gas, water, wildlife, useful vegetal and human resources. Its soils, made up of accumulated flood plain materials, are extensively fertile for food and cash crops production. The region ranks as the world's 6th largest crude oil producer and exporter. It spreads relatively over a number of ecological zones such as the sandy coastal ridge barriers, brackish mangrove, fresh water permanent, seasonal swamp forests, and the lowland rainforests. It has both the uplands and lowlands which are conveniently settled by over forty different communities with a dense population of over 30 million. The uplands constitute the urban settlements which are densely populated owing to the continuous influx of different workers from within and outside Nigeria while the lowlands form the rural marshy environments with scattered settlements (Udo, 1987). As of today, the region accommodates nine of the thirty-six states which make up Nigeria, and these include Abia, Akwa-Ibom, Bayelsa, Cross-River, Delta, Edo, Imo, Ondo, and Rivers States (Collins, 2010; Omofonmwan, 2013).

The Niger-Delta Region covers over 20,000km² within natural wetlands of 70,000km². It was formed primarily through continuous sediment deposition induced by a number of swift-flowing upland rivers and streams. The flood plain formed physically makes up 7.5% of Nigeria's total landmass of 923,800km². The region is unarguably the largest geomorphic wetland in West Africa and stands indisputably as the third largest drainage basin in Africa. In addition to supporting abundant species of animals and plants, arable terrain which sustains a wide variety of consumable food and cash crops, agricultural trees, endangered herbs, ropes and micro-organisms, and more species of fresh water fish, crayfish, crabs and reptiles than any other ecosystem in West Africa, this incredibly well-endowed ecosystem contains one of the highest concentrations of biodiversity in the world (Udo, 1987; Akinbode, 2005; Baird, 2010; Vidal, 2010).

Natural levees, ox-bow lakes, other lakes and abandoned meander loops caused by changing river courses are common landforms in the Niger-Delta Region of Nigeria. The region experiences high convective precipitation of over 3,500mm per annum (Okhakhu, 2013). This high rainfall amount coupled with abundant surface water and slimy mangrove forests creates a natural problem of poor drainage which makes virtually all construction activities in the region very difficult engagements during the rainy season. Small-scale farming which includes snail rearing, banana, plantain and rice production, building and mending of canoes, river transportation, coastal trading, fresh basket weaving, and fishing are the main occupations of the communities. Fortunately, crude oil and gas exploitations by domestic and multinational industries joined the normal track of subsistence occupations in the area. These oil activities, no doubt, attracted a dense population of skilled and unskilled workers into the region. Abundant domestic revenue and foreign exchange are generated through the refinement and sale of crude oil within and beyond the country's frontiers. Planned allocation and rational sharing of the crude oil generated wealth from this region by the Federal Government of Nigeria with a purpose to stimulate positive development which spreads from the cities down to the marshy rural areas has been

the bane of conflict in the Niger-Delta Region of Nigeria (Nwilo and Olusegun, 2010).

Of significance it is to mention that these lucrative human activities on the rural environment are currently being disrupted by widespread unabated pollution which radiates directly from the different oil, gas and petrochemical industries established in the region by the Nigerian government. Consequently, terrestrial means of sustenance and other marine resources have relatively declined in terms of production. Fresh water for drinking which sustains the people at every minute has diminished in quality while most of the communities have lost their local jobs which were hitherto carried out in the vast fresh water bodies. Also, the provision of social infrastructures by government in the rural areas of the region is markedly neglected. In addition, human ailments of different types such as cholera, river blindness, malaria, typhoid, dysentery, asthma, sleeplessness, and body cancer have become rampant in the rural environments. Yet, the region continues to provide above 85% of the domestic revenue and foreign exchange earnings of Nigeria while its inhabitants dwell in immense penury as they watch helplessly how the resources derived from their immediate environment are used to develop other regions within the country at their own neglect. This situation has given rise to the current agitation for control of the vast resources and rational appropriation of mineral generated wealth in the Niger-Delta Region of Nigeria by the immediate population.

Continuous crude oil production in Nigeria has had several adverse environmental and human impacts specifically on the areas surrounding oil extraction. These include destruction of wildlife and biodiversity, loss of fertile agricultural soils, pollution of air and drinking waters, degradation of farmlands, and extensive damages to aquatic ecosystems (Odocha, 1995). Crude oil exploitation, as Omofonmwan (2013) rightly argues, causes widespread ecological disturbances including explosions from seismic surveys, pollution of farmlands by gas flaring and refinery effluent, land alienation, and destruction of natural terrains for construction of industries, infrastructures, and other related physical installations. There are other serious environmental challenges which relate to massive waste generation by different industries, coastal erosion and river siltation, aggravated coastal degradation caused by careless mining of useful sands and river dredging for the purpose of infrastructural construction and direct extermination of abundant wildlife, fauna and flora (Okhakhu, 2014).

The Niger-Delta Region of Nigeria is a prominent catchment basin of over twenty rivers. Also, the region is prone to heavy seasonal flooding induced by some upland rivers particularly the Rivers Niger and Benue during the rainy season. It is densely populated with serious challenges of land appropriation among the inhabitants, migrant communities, and the multinational oil industries. It has more than seven legitimate oil fields, three large crude oil refineries, a huge fertilizer industry, a petrochemical industrial complex, two international ocean ports, and numerous crude oil pipelines which haphazardly crisscrossed farmlands and settlements (Obi, 1999). These natural features and associated human activities should be able to provide, based on rational planning and appropriation principles, all the basic means of sustenance to the people in the region like the realistic experiences in the Gulf States of the USA and the Middle East countries of the world.

The reverse has been the situation in this part of Nigeria. Realistically, its atmosphere, lands, forests, and water resources are vastly polluted by unabated oil spills and gas flaring. Basic social services like drinking water, electricity, roads, houses, hospitals, libraries, recreation facilities and schools are inadequately provided in the area by the government. Also, life-sustaining jobs are grossly inadequate to absorb the teeming human populations in the region. Of course, observed five decades of political dictatorship in Nigeria, resultant breakdown of civil society, economic marginalization of some areas, human rights abuses, and deliberate disrespect for sustainable environmental principles on the part of domestic and multinational oil corporations have turned the Niger-Delta Region into one of the world's most dangerous climate-systems and recklessly abandoned geomorphic units: a realistically observed epicenter of environmental degradation and human rights violations.

It is against this background of observed hydro-climatic, vegetal, and geomorphic degradations, anthropogenic negligence, and prevalence of debilitating poverty that this current study examines the environmental and human challenges in the Niger-Delta Region of Nigeria, with a view to suggesting efficacious and pragmatically possible measures to reposition the area.

Environmental Challenges

The environmental challenges examined in the study are categorized into three sub-groups: these are the geomorphic, hydro-climatic, and the biological constraints. The geomorphic constraints are strictly related to the nature of formation of the Niger-Delta Region. As Udo (1987) observed, the region is essentially muddy in nature with a few islands of solid red earth which are above the floodwaters. Also, porous soils and sedimentary rocks are abundant in the region, and these are occasionally friable to accommodate hard developmental activities like road, tarmac, rail and house constructions. Proper civil engineering constructions can conveniently address these weaknesses when given the required raw materials, suitable tropical technology, adequate funding, and terrestrial security to operate. Nevertheless, these landforms constitute the visible solid surfaces on which the settlements are built. As discussed in a previous study with particular reference to its physical geomorphic

characteristics (Okhakhu, 2014), Nigeria descends relatively from the upland North to the lowland South. This characteristic makes the Niger-Delta Region naturally susceptible to destructive lowland erosion, flooding, and river siltation. Of course, the sloping terrains are larger in the rural areas which are always swampy and smaller in the urban environments which are less swampy. In addition, the upland rivers like the Niger and Benue discharge heavy waters and sediments into the Atlantic Ocean through the narrow delta. Consequently, the developed fertile flood-plains which were formerly used for extensive agricultural activities by the communities are directly rendered useless owing to the current terrestrial, hydrological, and atmospheric pollutions carelessly induced by the different crude oil industrial activities.

The hydro-climatic challenges are related to the impact of precipitation, temperature, wind, and water resources on the study area. Based on its humid tropical location characteristics, moderate temperatures between 27°C and 30°C are oftentimes experienced in the Niger-Delta Region. These temperatures fluctuate sporadically between 29°C and 33°C owing to the activities of different industries and related anthropogenic occupations on the choked environment. High temperatures, particularly during the day time, as Barry and Chorley (2009) observed, tend to induce maximum convective processes which result in the occurrence of heavy precipitation. The proximity of the region to the warm influence of the Atlantic Ocean in the south further sets in motion the tropical maritime air mass which causes evenly distributed heavy precipitation in the area. The heavy precipitation coupled with massive flow of waters and sediments from the upland Rivers Niger and Benue down slope makes the Niger-Delta Region naturally prone to seasonal erosion, surface degradation, and sea surges inland when the warm maritime winds spur the sea waters to rise. This was the experience in the region in late summer of 2013 when most of the houses, roads, agricultural lands, and different workplaces were massively flooded and submerged by the river-waters which cascaded from the upland north of the country towards the lowland south (Okhakhu, 2013; 2014).

Prior to the exploration, discovery and exploitation of crude oil by domestic and foreign industries in 1957, the streams, rivers and seas in the Niger-Delta Region of Nigeria were famous for their vast abundance of useful planktons, nutritious fish, snails, snakes, alligators, crocodiles, shrimps, and naturally clean waters. Without the applications of modern methods of water treatments like sedimentation, filtration, coagulation, chlorination, coppering, and fluoridation, the indigenous communities could ordinarily fetch, store, sell, and consume stream and river waters without fears of contracting some diseases, particularly typhoid and cholera. In addition, transportation between the rural lowlands and the urban uplands was carried out primarily by trekking on the smooth lithosphere and through the means of canoes plying unpolluted river waters. As of today, these wild and positive impact producing hydrological resources have depleted in their natural composition owing to serious pollution consequences in the area. The transport routes by rivers and seas which provide vital means of life sustenance to the communities have also been abandoned owing to massive deposition of crude oil spills and associated wastes by the oil industries.

Recent scientific tests and analyses carried out on water samples obtained specifically from natural wells, boreholes, lagoons, beaches and rivers in Abraka, Afiesere, Ekakpamre, Okpe, Oleh, Olomoro, Uvwiamubge, and Siokolo communities in Delta and Rivers States by scientists have revealed a high concentration of benzo (a) pyrene, an alternate poly-nuclear hydrocarbon, in drinking water from 0.43-4ug. This finding, in numerical parameter assessment, is essentially far above the World Health Organization (WHO) stipulated 0.7ug/l for drinking water across the world. These scientific analyses clearly indicate that some areas in the Niger-Delta were already deprived of quality natural waters for a variety of uses. A people deprived of essential river resources such as fish, alluvial sands, crayfish, crabs, and quality water would be naturally prone to some ailments like blurred vision, goiter, body debility, stunted growth, emotional instability and poor mental alertness. The people would also experience fluctuating environmental temperatures amidst heat stresses and sporadic occurrences of acid rains which are capable of causing human skin rashes, sleeplessness and profuse perspiration (Okhakhu, 2013; 2014).

Consequently, a number of indigenous and migrant people who have eaten these flora and fauna products and have also consumed drinking water from these polluted hydrological sources have been afflicted with different ailments. Typhoid, dysentery, chronic cholera, itching human skins, eye inflammation and routine dehydration are the most common of these human ailments. Unfortunately, some of the sick patients have died unannounced in the region. Reliable death statistics caused by crude oil pollution in the Niger-Delta Region of Nigeria as of the moment do not exist. However, the fact remains that many people have died from these environmental hazards, and many more people in the rural areas will be susceptible to the ailments spurred by unabated pollution of the environment in the non-distant future if not timely harnessed. The Jesse and Koko fire incidents in Delta State including the Lagos, Benin and Auchi experiences are realistic cases in point. If proper measures are not conceived and urgently implemented now, more environmental and human havocs will be experienced in the region.

Biological constraints constitute the final environmental issues for assessment in the Niger Delta Region of Nigeria. In this series, we have both the vegetal and animal resources which are fundamentally

influenced by a variety of human activities ranging from rural agriculture, river transportation and trading to massive crude oil exploitation and refinement by domestic industries and the multinational industrial corporations.

Characteristically, the natural vegetation in the Niger-Delta Region of Nigeria consists of vastly rich mangrove forests, brackish swamp forests, and the rainforests. The huge expanse of rich forests covers approximately between 5,000km² and 8,580km² of land (Nwilo and Olusegun, 2007). The vegetation serves as a natural habitat to a diverse colony of essential wild animals, reptiles, birds, and pollinating insects which are normally observed in established agricultural settlements. Antelopes, pigs, monkeys, chimpanzees, crocodiles, alligators, hippopotamuses, pythons, hawks, kites, ducks, honey bees, ants, butterflies, etc are examples of these diverse living species. The fresh mangrove and rainforest trees are cut down with the aid of powered engines using the selective method in the forests. The consequent logs derived are processed into sizeable forms which are used for making different furniture items, building of canoes, installation of electric poles, and construction of rural make-shift bridges and houses. Also, the dry mangrove woods are cut into affordable pieces for sale and fire preparation in the rural areas of the region. Traditional medical experts often utilize the natural herbs found in the forests to produce highly efficacious local medicines for treating different ailments diagnosed in patients. The most common of these ailments are malaria, dysentery, typhoid, and stomach discomfort. In addition, the logs derived from the rainforests in the region are sold to neighboring countries of Benin, Togo and Ghana. Foreign exchange earning has been the positive feedback of the international trade developed with these sister countries in West Africa.

As a result of proximity of the dense vegetation to the Atlantic Ocean in the south, adequate moisture absorbed and retained by the trees is evapotranspired into the atmosphere alongside the ocean waters during occurrence of high insolation in the afternoon. This apparently changed moisture into rain water subsequently falls back as torrential rainfall thereby increasing the volume of water in already waterlogged surfaces in the region. This climatic occurrence initiates two major physical implications in the region: first, it increases river waters which rejuvenate routine transportation in the swampy areas thereby contributing to local revenue generation among the sailors; and second, it makes convenient natural habitats possible for a colony of marine live resources to thrive and survive.

The consequences of crude oil spills on land, forest and water surfaces are observable in extensive acidification of the soils, prohibition of cellular respiration in plants, and deprivation of essential plant roots from vital oxygen and carbon-dioxide required for their healthy survival. In marine areas which have experienced massive loss of mangrove and rainforest resources, the dangerous 'water hyacinth' has thrived extensively in the locations, thereby choking out both sunlight and oxygen needed for the sustenance of marine organisms. In addition, this invasive plant species has the capacity to clog the waterways in which it grows. In fact, it directly obstructs the routine navigation of fishing boats and canoes carrying travelers across the various waterways in the region. Absence of adequate marine resources for human consumption and loss of valuable funds on the part of routine seafarers are some of the consequences of crude oil pollution in the Niger Delta Region of Nigeria.

Human Challenges

The human challenges examined in the study are specifically related to economic, social, and political activities in the Niger-Delta Region. A very dominant factor in this regard is the dynamic role of man vis-à-vis the different physical activities observed in the region over the past six decades.

Economic Challenges

First, we examine the economic challenges which are directly related to the different human activities observed in the region before and after the discovery and exploitation of crude oil resources. At the outset of the study, we observed that the rural economy in the region depended immensely on land, forest, and abundant marine resources. In the agricultural sector, to be precise, the production of marshy and upland rice, cocoa, coffee, coconuts, plantains, bananas, sweet potatoes, maize, sugarcanes and yams was significantly high throughout the years which preceded the crude oil resource exploitation. Also, unrestricted fishing in the rivers and seas, boat building, construction of canoes, basket weaving, coastal trading and transportation of passengers across the different rivers were other essential local occupations of the people. These human activities provided abundant revenues with vital products both for domestic utilization and market consumption in the region. The natural environment was generally beneficial to the people as well as immune from any element of pollution during this period in the Niger Delta Region of Nigeria (Udo, 1987; Okhakhu, 2013).

The discovery and exploitation of crude oil resources commenced officially in the region during the late 1950's. In contemporary times, the crude oil exploitation and refining activities embarked upon by domestic and multinational corporations have polluted vast areas of fertile soils, rich forests, marine surfaces and the atmosphere with poisonous spills and dusts, leaving behind poisoned landscapes, decimated forests, and depleted marine environments. Authentic reconnaissance surveys of the region have also shown that over 4,000 oil wells

have been sunk by the various oil corporations. Currently, some of these oil wells are abandoned, leaving behind extremely dangerous sites of toxic waters mixed with benzene, hydrocarbons, lead, zinc, and mercury elements. Also observed in the sites are drilling wastes, drill cuttings, and oil sludge which are capable of causing further serious harms to the people, plants, animals, and essential micro-organisms.

Since crude oil exploitation took-off, most economic needs of the people have been grossly dislocated without commensurate means of replacement in the region. Numerous oil pipelines have crisscrossed farmlands, rural settlements, and useful rivers, leaving out only narrow spaces which are not suitable for any meaningful human activity. At the moment, there are few jobs in the region which do not correlate with the daily teeming human populations. Rational requests for restitutions on the part of domestic authorities and foreign oil corporations in respect of environmental hazards and pollution caused are non-existent too. Of course, legitimate people's protests against environmental pollution and degradations precipitated in the region in the past were resisted with massive police arrest and military brutality. A few inhabitants have lost their lives while others particularly the youths have been maimed owing to direct government disproportionate interventions in this regard.

Previous scientific studies by experts on the causes of frequent crude oil spills in the region have cited poor maintenance of oil pipelines, sabotage, illegitimate activities of vandals, weather-induced corrosion owing to old age of installed pipelines, occurrences of pipeline mishaps, and tanker accidents (Baird, 2010; Umukoro, 2013). Recent field surveys have identified five other causes of crude oil spills in the region which include haphazard installation of pipelines, reckless crude oil production operations, unidentified damaged pipelines initiated by land leveling activities carried out by contracted caterpillars, illegal theft, and inadequate monitoring of installed pipelines on the choked environment.

A number of crude oil spills and gas flaring which have exacerbated the observed state of environmental pollution in the region have been documented and reported (Baird, 2010; Umukoro, 2013). In 1980, the blow-out from Texaco Offshore Oil Station released 400,000 barrels of crude oil into the Gulf of Guinea. Not so long, the Royal Dutch-Shell Forcados terminal tank failure produced massive crude oil spills on the environment estimated at 580,000 barrels. Baird's (2010) study authentically revealed that since 1958, between 9 and 13 million barrels of crude oil were spilled on the region's delicate environment. The findings and conclusions from these studies summarized the total crude oil spills since 1958 in the Niger-Delta Region at nearly a hundred million barrels. In addition, out of the 3.5 billion cubic feet of gas produced annually, 2.5 billion cubic feet are wasted through uncoordinated gas flaring into the region's delicate atmosphere, terrestrial and hydrological surfaces.

The presence of crude oil resources in any place within a country, in normal condition, is associated with enormous anticipation of improved standard of living of the people. This anticipation spreads relatively down to include adequate provision of social infrastructures, establishment of small, medium, and large-scale firms, foundation of reliable financial institutions, set-up of participatory markets which contribute to increase in local revenues and foreign exchange earnings, and provision of gainful jobs, among others. The Gulf States in the USA and the Middle East Arab countries of the world have demonstrated these cited experiences. In the Niger-Delta Region of Nigeria, the reverse is the obvious situation, with unabated incident of exacerbated environmental pollution which has given rise to reduced standard of living of the people, occurrence of diseases, crippling poverty, and untold human rights violations.

Social Challenges

A number of social challenges have emerged in the Niger-Delta Region of Nigeria owing to the poor economic conditions examined in the preceded section. First, we have the realistic situation of inadequate means of natural sustenance for the people. This is evident in the large-scale disruption of land-based agricultural, forestry, and hydrological activities occasioned by unabated crude oil exploitation. Absence of adequate food, houses, money, and future means of survival for the inhabitants has resulted in declining health of the populations. Diseases such as typhoid, dysentery, diarrhea, poor eyesight, and debility of the human body are currently widespread in the region. This situation, no doubt, has spurred a revolutionary philosophy of direct physical resistance in the minds of youths by any horrendous means possible in the region: pipeline vandalism, direct sabotage of crude oil activities, militarization of the region, attacks on terminal stations, hostage taking, human kidnapping, among others.

Currently, there are on-going campaigns aimed at environmental restitutions, bioremediation, oil sludge removal, and general sanitation of the region. These laudable proposals have not been fully activated by the government and foreign business interests concerned with the crude oil extraction activities in the area. Improved standard of living of a people is frantically observed in adequate presence of functional infrastructures such as housing, health care system, educational and financial institutions, rewarding transport network, and recreational services. Others include adequate stock of food for distribution and sale at the markets, while employment, which provides money for numerous uses, should be abundant and easy to secure by the people.

Above all, there should be a responsible authority which provides and ensures stable security for lives and properties acquired by the people. The reverse is the current experience in the Niger-Delta Region of Nigeria. Specifically, it must be mentioned that the established refineries and associated petrochemical industries in the region are not effectively connected with dual-carriage roads. Rather, fuel tankers on daily duty to convey refined fuel to various areas it is needed are always stuck in endless traffic jams. Were the dreaded Boko Haram militants operational in the region, one would imagine the extent of human and physical resources destruction that would be experienced if suicide bombs were detonated at the sites of these traffic jams!

Most rural areas in the region are polluted by crude oil spills and continuous gas flaring. The challenges associated with water shortage for drinking, poor lands for farming, and absence of adequate marine resources for consumption and sale have caused the migration of most youths from the rural areas to the upland cities in search for jobs. However, the anticipated jobs are not available in the cities because most of the rural youths lacked formal training derivable in formal schools. In addition, the cost of living in the cities is exceedingly high: food is expensive to afford, house rent is prohibitive to pay, transport cost is high to bear with, and the available city infrastructure is fast decaying without a commensurate government replacement. The physical and psychological anger which accompanies this poor social environment leads to immense frustration, pains, and procreation of innumerable evil thoughts in the minds of youths. The consequent social environment is better clearly imagined, and it practically includes, as Omofonmwan (2013) rightly observes, gangster activities, hostage taking, militarism, pipeline destruction, human trafficking, and other associated socio-economic and political vices.

Political Challenges

The exploration, discovery and production of crude oil resource into a number of refined products as petrol, aviation fuel, diesel, engine oil, kerosene, acids, gases, and cosmetics led to the enactment of a body of environmental laws in Nigeria. These enacted laws, according to Umukoro (2013), encouraged unequal access to environmental wealth particularly the land, forest and water resources in the Niger-Delta Region of the country. Also, the direct failure of different tiers of government and traditional institutions to ensure effective enforcement of certain beneficial environmental laws resulted in gross exposure of the indigenous and migrant peoples to the negative impacts of crude oil pollution (Ebeku, 2008; Obi, 2010; Umukoro, 2013). The preceding discourse reveals beyond doubt that the Nigerian government is the first to blame with regard to the initiation of crises in this part of the tropical world as she fails to carry out her legitimate state functions properly.

Different 'mineral oil ordinances were enacted in 1914, 1916 and 1945' during the colonial administration of Nigeria. These enacted laws vested absolute rights and political control over oil and land resources on the state. On attainment of self-rule in Nigeria, the Petroleum Acts of 1969 and 1991 were enacted. These Acts were further consolidated by the National Waterways Decree of 1997. These laws attained their peak when the Land Use Act of 1978 was put in place in the country. The most essential clauses in these laws argued in favour of the state against the local people in terms of ownership, derivation, control, and utilization of mineral and land resources available on the Nigerian environment particularly in the Niger-Delta Region of the country. It should be recalled also that the 1963 Constitution, in Section 158(1), formally vested absolute rights of ownership and control of mineral and land resources solely on the President on behalf of the Federal Government and sovereign People of Nigeria (Ebeku, 2008; Omofonmwan, 2011; Umukoro, 2013).

In Nigeria, subsurface, onshore, and offshore crude oil mining rights belong only to the Federal Government as enshrined in her laws. The immediate communities, state, and local governments cannot exercise reasonable expressions on such mining activities. However, the local people own the surface rights to mining. Therefore, they are entitled to some rental fees as well as financial compensations for crops and trees destroyed at the drilling sites (Udo, 1970; Omofonmwan, 2011; 2013). Authentically, we know that it is not possible to extract crude oil from the subsurface and subterranean layers without causing immense damages and destruction to the surface layers of the earth's crust. These conflicting issues on surface and subsurface aspects of the environment indicate some in-depth weaknesses in the laws enacted to regulate mineral exploitation in Nigeria. Specifically, this crystalline dichotomy on the rights to crude oil ownership, extraction, control, and utilization of accrued wealth in Nigeria's Niger-Delta Region becomes a fundamental challenge to sane and beneficial development both in human, socio-economic, political, and other aspects which constitute the broad development spectrum today.

Research Findings

This study has examined the environmental and human challenges in the Niger-Delta Region of Nigeria. Based on authentic scientific assessment, the following findings are made.

The study observes that the Niger-Delta Region of Nigeria is a natural product of related hydro-climatic and geomorphic sediment deposition over a number of accumulated years. As the largest geomorphic wetland in West Africa, the region supports abundant species of wild and domestic plants, animals, and very

important colony of insects and micro-organisms. It is a realistically well-endowed ecosystem which accommodates one of the highest concentrations of biodiversity in the contemporary world. These abundant and useful resources need to be developed and correspondingly managed using appropriate human skills with suitable technology premised on adequate funding on the part of the Nigerian Federal Government.

The study reveals that the region experiences high convective precipitation of over 3,500mm per annum. This is caused as a result of routine vegetal release of moisture to the atmosphere with prevalence of warm tropical maritime winds which carry much water from the Atlantic Ocean. The torrential precipitation, coupled with abundant surface water received from the swift flowing upland Rivers Niger and Benue, makes the Niger-Delta Region a permanently saturated zone of natural waters. Given the required technology, specialized human skills, working capital, responsive security, and adequate government support, these natural waters could be developed for multi-purpose intentions, particularly for domestic consumption, public applications and industrial utilization. However, the reverse has been the situation in the study area. Rather than utilizing this abundant natural hydrological resource for prolonged human, animal, and plant sustenance, it is physically left unmanaged. Consequently, serious environmental challenges such as surface erosion, flooding, river siltation, and submergence of some built social infrastructures by flood waters are experienced in the region.

The study notes that abundant crude oil is available as well as continually exploited from the Niger-Delta Region of Nigeria by domestic and foreign industries. The sale of crude oil and its refinement within and beyond the country's frontiers generate adequate domestic revenues and foreign currencies to the Nigerian Government. The objectives of planned allocation and rational sharing of crude oil wealth to stimulate rural and urban development in terms of infrastructural provision and human resources sustenance through jobs provisions are continually not respected and implemented in the study area. This situation has apparently given rise to constant economic and socio-political conflicts between the Federal Government of Nigeria and the indigenous people of the Niger-Delta Region.

As a result of negligence of sane environmental laws and disrespect for the ethics of ecosystem sustainability on the part of domestic and foreign crude oil industries, poisonous pollutants have radiated over some strategic parts of the Niger-Delta Region of Nigeria. These pollutants have greatly altered the natural compositions of soils, forests, and water surfaces as well as disrupted most terrestrial and hydrological occupations of the local communities. A serious state of rural joblessness of active youths has been created.

A number of wildlife and biodiversity have been decimated in the area owing to occurrences of these environmental pollutants. These negative challenges have vastly impacted the people's standard of living. Currently, there are widespread environmental diseases particularly typhoid, dysentery, and cholera in the rural marshy settlements, and these have spurred rural-urban migration of jobless youths. In the cities within the region, jobs are scarcely available, while the cost of accommodation in standard houses for the rural-urban migrants is increasingly unaffordable. This visible state of pessimistic life in the cities currently spurs a serious philosophy of hatred among the youths who regularly express their dissatisfaction with the different crude oil industries in disruption of operations, pipeline destruction, and kidnapping of both domestic and foreign personnel.

Inadequate infrastructural provision by the government, absence of gainful jobs in the rural and urban areas, occurrence of environmental pollution, absence of satisfactory financial compensations for fertile soils, lands, crops, and forests destroyed owing to crude oil exploitation, and the destruction of long time means of human sustenance in the rich marine ecosystems by crude oil industries, the study notes, are responsible for the current hostile situation, including the sporadic militarization of youths and prevalence of political uncertainty in the Niger-Delta Region of Nigeria.

The study observes that unabated fires ignited by crude oil spills on terrestrial environment have caused untimely demise of a number of people in the Niger-Delta Region of Nigeria. In marine locations where forests and wild animals have been decimated by crude oil pollutants, the dangerous water hyacinth has thrived immensely, thus serving as a physical clog on smooth navigation of fishing boats and canoes conveying passengers across the different water bodies. This hydrological occurrence has visibly reduced the fish population in the rivers and constricted local revenues for rural utilization.

The study notes that over 4,000 oil wells have been sunk by different crude oil industries in the region since crude oil exploitation started in the late 1950s. Currently, some of these oil wells are carelessly abandoned, leaving behind extremely dangerous sites of toxic waters mixed with benzene, hydrocarbons, and lead elements including drilling cuttings, drill wastes, and oil sludge. In addition, the study reveals that nearly a hundred million barrels of crude oil have been spilled into the Niger-Delta environment since 1958 owing primarily to human negligence and disregard for sound environmental principles.

The enacted laws in the country place absolute rights of ownership, legitimate derivation, control, and utilization of mineral wealth solely on the Nigerian Federal Government while the local peoples who live in the areas where the minerals are derived are only entitled to unspecified financial compensations for crops, forests, and lands destroyed during the process of mineral extraction. These laws would have been regarded as most

efficacious and sane if they had included directly the socio-economic benefits which would accrue to the indigenous communities in the Niger-Delta Region of Nigeria in view of the extent of environmental degradation perpetrated by the crude oil industries.

Policy Recommendations

An authentic scientific assessment of environmental and human challenges in the Niger-Delta Region of Nigeria reveals three important characteristics that are strongly interrelated. First, the region is naturally rich in vast crude oil, gas, water, forest, wild animal, soil, insect, and micro-organic resources. Rational extraction of these resources and refinement into useable forms to generate wealth which could benefit the indigenous communities alongside the entire nation-state has been the main source of protracted socio-economic and political conflicts in the region. Second, the ineffectively managed crude oil operations have spilled large volumes of crude oil into the terrestrial and hydrological environments thus polluting these essential natural surfaces without satisfactory remediation in the region. Finally, the enacted environmental laws with specific regard to mineral, forest, and land resources extraction and utilization are conflict-ridden and largely non-beneficial to human sustenance in the complex region.

It is premised on these scientific foundations and associated findings that efficacious measures are suggested in the current study to reposition the Niger-Delta Region of Nigeria in the environmental, socio-economic, and political dimensions.

The rural areas of the Niger-Delta Region of Nigeria are made up of fertile soils formed naturally from successive sediment depositions over a number of years. These fertile soils should be utilized for the production of both food and cash crops. Contemporary agricultural inputs particularly viable seeds and seedlings, improved varieties of animals with fish, modern tractors, adequate funds, including trained human resources should be provided and directed at this primary activity. This primary activity would be immensely successful where immediate clearance of crude oil pollutants found on the soils is carried out in the vast rural locations. Of course, availability of food and cash crops in the region would serve as immense means for human sustenance. Given this situation, the agro-sector would receive the support of some rural jobless youths owing to its provisions of jobs, income, shelter, and other means for human survival.

The removal of crude oil wastes from the environment requires the contemporary scientific efforts of trained specialists from different disciplines. These include chemists, hydrologists, marine, mechanical, production and petroleum engineers, geologists, climatologists, physicists, biologists, economists, remote sensing experts, cartographers, and environmental resource scientists. The pollutant clearance process would also involve the deployment of adequate technology and funds from the crude oil industries. The support of the Federal Government of Nigeria and cooperation of the local communities whose environments have been carelessly polluted and degraded are very essential in this regard. Relatively, the sane environment should be monitored regularly in order to detect its permanent purity. This requires the use of satellite remote sensing gadgets to succeed in this direction.

As a result of its geomorphic alignment coupled with regular occurrences of torrential rainfall during the rainy season, beginning from the mid-north to the deep-south, the Niger-Delta Region of Nigeria is naturally prone to surface erosion, flooding, river siltation, and submergence of some social infrastructures by floodwaters on a seasonal basis. These natural hydro-climatic hazards could be conveniently prevented by adhering to and using the current beneficial principles of building climatology and architecture which apply in the aspects of building design and erection to resist extreme climatic hazards seasonally. In a related dimension, hydro-climatic resources could be effectively harnessed to provide permanent safety to built socio-economic and political structures on the region's environment. In some parts of Italy in Europe, New Orleans and Florida in the USA, parts of Hong Kong, and recently in the marshy areas of Lagos in Nigeria, these specialized building climatology and architectural strategies have been demonstrated pragmatically on the environments, and the hazards identified were put at bay irresistibly. These successful strategies could also be deployed for immediate implementation in the Niger-Delta Region of Nigeria. These strategies require effective consultation, research, suitable technology, adequate funds, skilled personnel including both domestic and foreign, and the registration of support of the indigenous communities, crude oil industries, and the federal government of Nigeria to succeed.

The study observes the presence of abundant crude oil with gas in the Niger-Delta Region of Nigeria. Given this wealthy position, it is suggested in the current study that rational appropriation of crude oil revenues and foreign currencies realized from the sales, domestically and on foreign levels, should be carried out primarily among the Nigerian Federal Government, the immediate local communities producing the natural resource in question, and other states which constitute the sovereign country. This strategy would stimulate the anticipated spatial development in the socio-economic and political dimensions of the Niger-Delta Region of Nigeria.

In addition, there should be constructive amendments of enacted legislations in the country which regulate the rights of ownership, derivation, control, and utilization of the crude oil wealth. Specifically, a

rational financial percentage meant to be used to bring about urgent development of the region should be enshrined in the amended laws. Although a number of economic commissions and a ministry of the Niger-Delta have been constituted to manage the physical development of the region, apparent development setbacks still prevail on the delicate environment. It is on this background we suggest the application of direct eco-political grass-root units which must be supervised by trained university experts on environmental management to oversee the disbursement of financial remunerations to the people and infrastructural provisions in the Niger-Delta Region of Nigeria. In this regard, every small village and town would be affected from the point of spatial positive development. The observable challenges of past lop-sided development, misappropriation of federal funds, infrastructural failure, youths' restiveness, and political uncertainty of the immediate past would be put at bay.

The established crude oil industries in the region should provide adequate and reliable jobs both to the local people and migrant workers as long as they are suitably qualified. However, a certain workforce percentage should be reserved specifically for the indigenous communities whose terrestrial environments have been largely degraded by crude oil wastes. Of course, establishment of primary social infrastructures which include health care facilities, primary and secondary schools, rural feeder roads, small-scale recreation facilities, local markets, post offices, police stations, banks, libraries, and modern communication facilities should be made mandatory functions of crude oil industries. These social provisions, no doubt, would allay the immediate pains of the people and protracted challenges caused by pollutants on their terrestrial, hydrological, and subterranean environments.

In addition to complete clearance of crude oil pollutants from the terrestrial and hydrological environments, there should be a properly coordinated and well-focused general sanitation of the Niger-Delta Region by the three tiers of government alongside the different crude oil industries operating in the study area. The sanitation activity would involve the detoxification and coverage of abandoned oil wells, clearance of drilling wastes, drill cuttings, and direct removal of oil sludge. Based on the delicate nature of the study area, a three-year sanitation period is suggested for the region. When these broad measures are implemented, a new and rejuvenated environment would evolve in the Niger-Delta Region of Nigeria. Within a non-distant period, new wildlife and plants would spring up while extinct species would be imported from the western world to hybridize with the native species to procreate robustly new biodiversity species in the region.

Continuous fire incidents ignited by spilled crude oil which formerly decimated the terrestrial wildlife and caused serious havoc on human lives would be completely prevented. With the clearance of dangerous water hyacinth from the rivers and marshy surfaces, there would be smooth sail of fishing boats and canoes carrying traders and passengers across the various rivers in the region. Local revenues would be generated from these hydrological activities while formerly abandoned indigenous marine occupations would thrive immensely. This is the pragmatic, enviable socio-economic and politically sustainable Niger-Delta Region of Nigeria which is long anticipated by a number of people and environmentalists, and strongly advocated in the current study.

Conclusion

The natural presence of crude oil resource, as observed in the Western World and some countries located in the Middle East, is always associated with huge developmental strides on the environment. These spatial development strides are pragmatically demonstrated in functionally reliable infrastructures and social services, adequate job provisions in different socio-economic and political establishments, availability of food and cash crops produced directly on the same terrestrial and marine environments where crude oil is extracted, refined and sold, and a formidable political institution which protects human lives and guarantees the security of acquired properties, among others. The reverse is the huge reality in the Niger-Delta Region of Nigeria. The availability of crude oil resource with its wealth has caused a horde of environmental, socio-economic and political challenges in the study area. The two most observable of these challenges relate to extensive crude oil pollution of the natural fertile soils and delicate environments, and marginalization of the region in terms of rational appropriation of crude oil generated wealth which is largely envisioned to stimulate and nurture sustainable environmental and human resources development.

This study has examined the environmental and human challenges in the Niger-Delta Region of Nigeria. The environmental challenges observed relate to occurrence of torrential rainfall and swift operation of hydro-climatic forces which induced seasonal soil erosion, surface flooding, river siltation and submergence of some built infrastructures by floodwaters, and the fragile nature of the terrestrial surface owing to its geological formation. These spatial hazards were largely induced by the combined forces of climate, geomorphic actions, and hydrological processes which occurred in the upland north and lowland south of the country. On the other hand, the human-induced challenges observed in the study include vast pollution of terrestrial, hydrological, and subterranean environments spurred by careless crude oil extraction and refining activities, absence of reliable and gainful jobs, inadequate and decaying infrastructures, dwindled subsistence occupations and benefits, occurrences of socio-economic vices, polluted drinking water, prevalence of human diseases, routine

government marginalization, and political uncertainty of the region occasioned by endless conflicts over crude oil extraction, environmental despoliation, consequent remediation, and rational appropriation of the mineral generated wealth for even development.

Pragmatically efficacious measures were suggested to rejuvenate and reposition the Niger-Delta Region from the environmental, socio-economic and political dimensions. Of these measures, complete clearance of crude oil pollutants from the environment, adherence to routine environmental sanitation, provision of functional infrastructures with regular maintenance, and employment of suitably qualified people in socio-economic and political establishments were strongly elaborated for immediate implementation in the study. The urgent success of these measures requires authentic cooperation of experts, local communities, corporate interests, crude oil industries, politically affiliated groups, local institutions, local government with state authorities, and the huge support of the federal government. These measures would help restore stable peace, genuine security, and stimulate sustainable development in the Niger-Delta Region of Nigeria.

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