



**CRUDE OIL SPILLAGE AND ILLEGAL BUNKERING IN TAYLOR CREEK:
IMPLICATIONS FOR SUSTAINABLE BLUE ECONOMY DEVELOPMENT IN THE
NIGER DELTA**

By

Ofurumazi, Righteousness Pereowei

Email: righteousnessofurumazip@gmail.com

Department of Transport and Nautical Science

Nigeria Maritime University, Okerenkoko, Delta State, Nigeria

Famous Denhinbofa Egelu

Email: egeluf@gmail.com

Department of Transport and Nautical Science

Nigeria Maritime University, Okerenkoko, Delta State, Nigeria

Okonkwo, Ifiokobong Ibanga

Email: ifiokonko@gmail.com

Department of Transport Management Technology

Federal University of Technology Ikot Abasi, Akwa Ibom, Nigeria

Uwakwe, Chinecherem Miracle

Email: chinecheremmi97@gmail.com

Department of Maritime Transport and Business Studies

Global Maritime Academy, Delta State, Nigeria

ABSTRACT

Crude oil spillage and illegal bunkering pose significant threats to the sustainable development of the Blue Economy in the Niger Delta, particularly in Taylor Creek. This study examines the key environmental, economic, social, and governance factors influencing marine-based economic activities (fishing, aquaculture, and tourism), assesses the direct and indirect impact of oil pollution using Structural Equation Modeling (SEM), and evaluates the economic decline's effect on public health and livelihoods. Data were collected through structured surveys and analyzed using SEM to identify latent relationships among key variables. Findings reveal that environmental degradation (oil spills, water pollution), weak governance (poor enforcement of regulations), and economic decline (loss of fishing income, reduced tourism) significantly affect the Blue Economy's productivity. SEM results show that oil spillage has a direct negative effect on marine productivity ($-0.72, p < 0.05$), while illegal bunkering indirectly contributes to economic decline and livelihood deterioration. The study highlights the urgent need for policy interventions, stricter environmental regulations, and investment in marine ecosystem restoration to mitigate the adverse effects of crude oil pollution. Addressing governance failures and promoting sustainable economic alternatives are critical for preserving the Blue Economy and ensuring the well-being of affected communities.

Keywords: Crude Oil Spillage, Illegal Bunkering, Blue Economy, Structural Equation Modeling, Marine-Based Activities

INTRODUCTION

Oil spills have been described as major environmental threats that have a devastating inimical impact on vast marine habitats. The incidents indicate a prolonged and extensive impact, disrupting both ecological systems and the financial stability of communities residing in the affected regions. Nigeria is widely acknowledged globally for its considerable oil reserves (Osunmuyiwa and Kalfagianni, 2017; Olayungbo, 2019). The large oil resources are concentrated in the Niger Delta region of the Nigerian State. There is a total of 36 billion barrels and about 150 trillion cubic feet of natural gas reserve (EIA, 2006). The Niger Delta region accommodates over twenty million people from over twenty ethnic groups, with over 1,600 autonomous communities distributed in 9 of the 36 States of Nigeria, Delta, Bayelsa, Rivers, Akwa Ibom, Ondo, Abia and Imo States. This region can be described as the engine room that propels the economic growth and development of the Nigerian State which is a mono-cultural nation with sole reliance on crude oil and gas.

A large number of these autonomous communities host both local and multinational oil companies. Crude oil production in this region dominated largely by Transnational oil companies including Chevron, Texaco, Royal Dutch Shell, Exxon Mobil, Total and Oando. These Transnational oil companies operate a joint venture with the Federal Government of Nigeria, represented by the Nigerian National Petroleum Corporation (NNPC) and its subsidiaries in which the Federal

Government of Nigeria hold an average of 60 percent equity shares. The Nigerian State has experienced a number of booms in alternation between several natural resources. There was the boom period associated with exploitation of agricultural cash crops such as palm oil, timber, rubber etc. (Olatubosun, 1975). The emergence of an oil dependent economy by the Nigerian State in the 1970s led to the systematic neglect of other sectors of the economy particularly the agricultural sector which was the major contributor to Nigeria's National Income. In spite of the country's vast oil resources, the world estimates that over 80 percent of the revenue accruing from oil benefit about 1 percent of the population. (EIA, 2005).

This study area is characterized by a vast network of channels of creeks specifically the Taylor Creek, which are inlets of the sea and extensive mangrove swamps (Green, 2022; Ikeke, 2020). Situated in the south-south region of Nigeria, the Niger Delta, which is the largest basin in Africa, provides a central area of Nigeria's oil and gas production, contributing well over 80 % of Nigeria's oil production (Akpan and Akpabio, 2003). Despite the economic benefits of the oil sector, Nigeria has experienced numerous oil spills, which have had significant repercussions on the marine ecosystem, public health, and the welfare of indigenous communities. On the negative side, the impacts of oil have been articulated in different facets of literature, especially the effects on the marine environment (Arnber *et al.*, 2018). Some of the various cases of oil spills that have occurred, which can be attributed to the operational factors and the sabotaging features, have raised many questions about the impacts of such disasters on environmental destruction, whereby the sensitive marine life in the area of focus is affected. The occurrence of oil spills, whether of large quantity or consistently over time, presents complex and diverse conducive threats to the marine environment in the area affected in the Niger Delta. This is not just limited to water pollution due to undesirable sedimentation but also affects the health of aquatic life, including fish, birds, and mammals in the water body. This would make it rather easy to conclude that in order to achieve proper protection and management for the exceptionally fragile ecosystem of the region, greater effort has to be put into comprehending the impacts and the details of these impacts to define the best strategy that should be employed to mitigate and eradicate these impacts effectively.

The concept of "Blue Economy" has been defined by various organizations to mean the same thing from different perspectives. The World Bank defines the blue economy as the "Sustainable use of ocean resources for economic growth, improve livelihoods and jobs and ocean ecosystem health." The commonwealth defines the BE as "an emerging concept which encourages better stewardship of our ocean or 'blue' resources." Essentially, the blue economy concept focuses on the sustainability of the ocean economy by addressing the human drivers of change in marine ecosystems, e.g. increasing fishing capacity and effort, coastal development, and pollution. By definition of BE is, the sustainable identification and management of ocean resources for its Littoral state's primary security and growth while ensuring global economic growth, sustainability, and peace. Essentially, it is the economy of a state driven by its sea potential. This definition stresses the importance of identifying the economic potentials of a given part of the ocean and the priorities of its littoral state while ensuring that global interest is preserved without hindering the states from maximizing the benefit of their seas. Overall, this definition recognizes that the benefit

of the BE must lead to improved global peace. Depending on how it is managed, the sea is a catalyst for both global peace and crisis.

Objectives

- i. To identify the key environmental, economic, social, and governance factors influencing the productivity of marine-based economic activities (fishing, aquaculture, and tourism) in Taylor Creek using survey data.
- ii. To analyze the direct and indirect impact of crude oil spillage and illegal bunkering on marine-based economic activities.

LITERATURE REVIEW

2.1 Concept of the Blue Economy in Nigeria and Global Perspective

According to Rammads (2024), throughout history, the creeks, rivers, seas and oceans have always been present in the economic lives of mankind; as source of food, means and mode of transport, commercial exchange transactions and military campaigns. They have done so through the ages in supporting barely agrarian primitive tribal communities and all the way to the sophisticated autocracies of feudalist tyrants, principalities, kingdoms and empires. Apart from pre-historic times, they have also supported the emergence of industrial and post-industrial societies through maritime transportation. Marine Transport as a mode depends on deep seas and oceans for optimum performance. It is that part of transport activity that aims at increasing human satisfaction by changing the geographical location of goods and services. Projecting shipping and port activities as key performance indicator (KPI), this transport mode exerts so much gravitational pull on distribution and redistribution of global resources across spatio-temporal frontiers of the earth. As countries become more prosperous with the advent of science and automation, technological frontiers expanded. Larger ships began to emerge. This evolution influenced the direction of commercial pattern and trade flows and further reinforced the advantages of specialization. Time went by. Containerization appeared as the new generation entrant; quickening the amalgamation of global trade and delivering door-to-door services to excited end-users. Thus, the young female staff of PTI wearing hair attachments is unaware that she is enjoying the finished product of coconut fiber shipped in containers from Port of Manila in the Philippines to Warri port. Here, we see that the young female staff is happy and so is everyone else in the distribution value chain, thanks to maritime support.

The import of this scenario is an endless stream of opportunities for marine, ocean business, blue economy, ports and shipping, ship building and repairs, aquaculture, finger jetties and dry docks, fisheries, deep sea mining, tourism, research, energy, hydro carbon logistics, renewable energy, transportation, maritime institutions and more. Consequently, this presentation focuses on shipping services as one of the key drivers of marine and blue economy. The blue economy is a recent field of study associated with economic activities that depend on the sea with other economic sectors such as tourism, marine transport, energy and fishing. This first appearance of the term 'Blue Economy' dated back to 2009 at the Congress of the Senate Committee on

commerce, science and transportation of the United States. America's attraction to the blue economy was at the time based on the excellent opportunities it provided for new jobs in renewable energy, the concern for climate change and the overall economy. The symposium held in South Korea that same year on Blue Economy initiative for Green Growth argued that the concept of using ocean resources in a way that respect the environment can evaluate how both business activity models and new technologies satisfy economic and environmental conditions, contributing to the sustainability of ocean resources.

In 2012 at Rio de Janeiro Brazil, the UN Conference on Sustainable Development argued that the oceans were to be regarded as priority areas with initial objectives being proposed such as sustainable consumption and production, food security, sustainable energy for all and disaster risk reduction. These schools of thought agree that ocean resources generate benefits of gargantuan proportions to the world economy and offer essential opportunities for transportation, food production, energy, mineral extraction and biotechnology, human settlement in coastal areas, tourism, recreation and scientific research. Although circular economy rests on an economic model oriented towards elimination of generated waste, efficient use of resources, recycling and recovery; the blue economy runs on the wheels of economic growth, improve livelihoods and social inclusion without compromising the oceans' environmental sustainability and their physical conditions. To all intent and purposes, the blue economy has to support the sustainable growth of the maritime and marine sectors as long as the ocean and seas remain the engine growth of global economy with great potentials for prosperity.

Global Position

The United Nations and associated international bodies hold common grounds in defining the blue economy as the *"sustainable use of ocean resources for economic growth, improved livelihoods, addressing ecological and environmental imbalances and as a growth opportunity for developed and developing countries"*.

The blue economy from this definition can be viewed as part of the ocean family and hence thrives in oceans, coastal waters, inland waterways, lakes, islands peninsulas, estuaries, dry ports and rivers through granting access to human exploration and exploitation for socio-economic benefits.

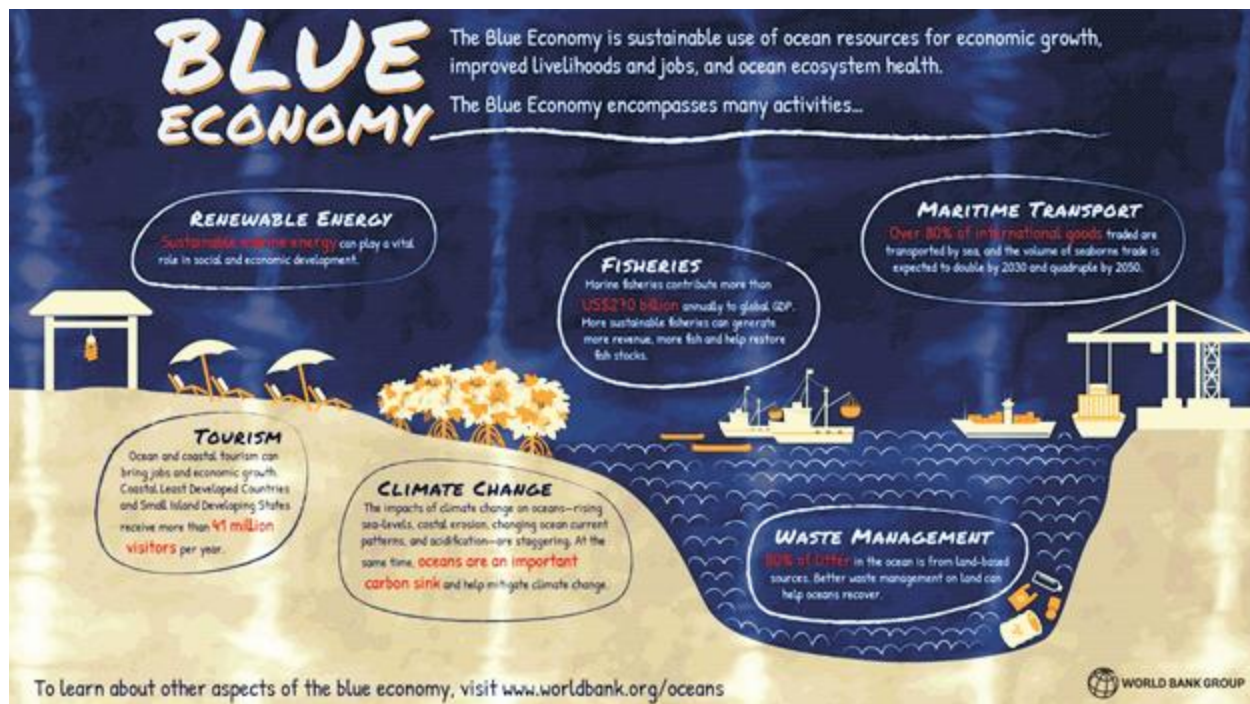


Figure 2.1: World Bank’s view of the Blue Economy

Source: Emmanuel Maiguwa’s Public Lecture on the Relevance of the Blue Economy.

Stakeholders

Fisheries, tourism, maritime transport and shipping, aquaculture, renewable energy, deep-sea mining are some of the stake holders in marine and blue energy. Shipping is one of the many stakeholders competing for right of use of the oceans in an environment where blue economy of ocean-related businesses and activities are expanding with increasing regularity.

Leading the pack are maritime transport and shipping; accounting for over 80% in global movement of world trade and contributing to resolving equilibria disputations on **balance of payment** profiles of trading nations. The advent of containerization has further accentuated the apogee of modern commercial relations amongst independent and supranational regions; hence the design and introduction of new generation container vessels with optimum capacities in excess of 24,000 TEUs have led to the emergence of mega hubs to carter for supra national regions like the BRICS (Brazil, Russia, India, China, South Africa) which accounts for 36% of the world population and 40% of global economy. Africa Continental Free Trade Area (AfCFTA) has 1.3 billion people across 55 countries with a combined GDP value of 3.4 trillion US dollars.

Besides, small islands developing states (SIDS) in the Caribbean and Pacific region whose entire economy of imports and exports solely on shipping services are queuing to join the BRICS and hence maximize the advantages of marine ad blue economy among trading nations.

Opportunities

BRICS- an association of five emerging economies that are Brazil, Russia, India, China and South Africa with headquarters in Shanghai China seeking to expand world trade through multilateral cooperation in areas of tariff similar to the “most favored nations” clause of the old GATT. Many countries outside BRICS are either members or waiting to be admitted. Although Nigeria is not a member, there is hope that when she joins, she will enjoy the benefits of an expanded market in trade and investment, financial cooperation and assistance amongst member nations, exponential growth in the manufacturing sector and a boost in competitive advantages as well as economies of scope.

Next is the Africa Continental Free Trade Area (AfCFTA), comprising of 55 African nations with a population in excess of 1.3 billion people. This is a huge market and Nigeria is a member. This mega market provides indigenous ship owners and carriers opportunity to participate in the windfall revenue harvest of freight hauls which had been hitherto hijacked by cross traders.

Coming home; Nigeria with a coastline of over 850 kilometers; national records indicate potential revenue earnings in excess of 1.5 trillion US dollars annually from marine and blue economy. Shipping and port services, terminal operators, service boat and bunker operators, dry dock and finger jetty entrepreneurs will have enough room to exploit the market. Consolidators, third party/fourth party (3PL/4PL) logistics providers; SMEs like chandlers, marine welders, marine painters, dumb barge and outboard engines boat operators will operate in a large economic space alongside channel management companies and FPSOs (Rammads, 2023).

Challenges

a. Externalities

Externalities can produce positive or negative impacts on human and other socio-economic sectors. The latter is considered here. Marine pollution from ships-oil spills, greenhouse gas emissions, ballast water, ship-generated litter such as plastic wastes and more. Moves to cut greenhouse gas emissions, to reduce the Sulphur content of ship's fuel oil from 3.5% to 0.5% or 50% by 2050 and to require strict ballast water management are some of the headaches of the International Maritime Organization (IMO) – the regulatory body on international seaborne transport. These pollutants threaten marine and blue economy lives as the latter depends on sustainable support of the oceans and marine ecosystem. The same is true of oil thieves in the oil rich regions of Nigeria. These *‘rogue business men’*, through illegal petroleum refining leave behind trails of environmental degradation, destruction of aquatic lives, fresh water, fishing settlements and egregious dislocation of the fragile balance of nature's ecosystem.

b. International Hostilities.

Hostilities in the Middle-East have escalated and extended to the Red Sea; a major transport corridor in global shipping connecting the Suez Canal from Asia to Europe. Geo-political cleavages have emerged. While the US and the UK are keen on protecting this international shipping route; Yemen a country sitting on the gulf of Eden is attacking western commercial vessels plying the route in sympathy with their ‘cousins’ fighting in Israel. International commercial vessels have thus become vulnerable to attacks by Houthi rebels of Yemen. The Gulf of Eden is strategic to global shipping because it cuts ship’s transit time by 20 days if the Cape of Good Hope route is avoided.

For their safety, ships have taken to the Cape of Good Hope route and that has increased the unit cost of one 40ft. container from USD 1,400 to USD 4,000. In 8 weeks from 17 Nov 2023 to 12 Jan 2024; Shanghai to Europe route, rates are up 338.9% and Shanghai to Mediterranean route, rates are up 252%. French shipping group CMA CGM has hiked rates between Asia and Mediterranean by up to 100%. The import of this phenomenon is high distress level in costs associated with insurance premiums, lead time, ships’ port call variations, and longer transit times, disruption of logistics and supply chain connections, growing incidences of litigations and claims of indemnity, arbitrations and importation failures. It is an existential threat to global economy. The blue economy is no exception to these asymmetrical shocks, hence poor nations will **‘bleed’**.

Speaking to British Broadcasting Corporation (BBC) at the World Economic Forum 2024 in Davos Switzerland, the WTO Director-General Dr. Okonjo Iweala and the IMO Secretary-General Arsenio Dominguez agreed to the Red Sea crisis as an existential threat to global shipping and World economy. Their concern: tariffs could go up by as much as 23%. Poor nations will be hit while scheduling and routing disruptions will undermine relationships between suppliers and clients whose legal relationships had been sealed in financial and transport documents. The OECD, IMF and Non Aligned Movement (G77) hold the same position on the Red Sea crisis. They also believe insurance costs, claims and arbitration costs will increase.

A. P. Moller-Maersk Chief Executive, Vincent Clerc and the US Secretary of state, Anthony Blinken corroborated the positions of IMO and WTO while speaking to British Broadcasting Corporation (Jan, 2024). A. P. Moller-Maersk boss believes the lives of their sea farers are at risk in the face of the crisis hence the company has no choice other than let their vessels take the Cape of Good Hope route. He says the crisis has triggered anticipation and fear of congestion, inflation and a drop in capacity utilization. The Panama Canal is contending with geopolitics and climate change as decreasing water level restricts the number of vessel access. This is bad news for marine and blue economy. Besides, Malacca-Strait and South China Sea have their own **‘demons’** tormenting shipping services in the bulk, oil and grain trades. The marine and blue economy will be at the mercy of all this as the World Bank president Ajay Banga says 60 countries in emerging markets are in debt distress and will be further hit by the crisis, Nigeria inclusive.

c. Trends.

There is time for everything under the sun. The pre-historic times ended long ago. The Stone Age did not end due to lack of stones either. ***Time and chance happeneth to them all.*** That is **why GOD created time to prevent everything from happening at once.** This is the age of knowledge – digitalization, artificial intelligence (AI), robotics, automation, cyber security, ICT and the internet. Marine Autonomous Surface Ships (MASS) have started making their ways into sea-borne trade and so are autonomous vehicles on land mode. These technologies operate with little or no human interference.

According to recent documentary on CNN, January 2024, the International Monetary Fund (IMF) says AI is already pushing to take 40% of human jobs globally. The implication of this is the emergence of new generation of illiterates in global unemployment markets. The languages and values of these new technologies must be learnt in order to be relevant and productive in the labour market. It is a challenge to marine and blue economy.

d. Education and Training.

Shipping is **sui generis**. It is not for jesters and nobody comes to it by accident. The industry depends on specialized managers to perform optimally. The marine and blue economy sector must look up to institutions like Global Maritime Academy to supply first line managers and supervisors in marine engineering, marine welding, electricians, marine painters, finger jetty managers, dockyard supervisors, marine security officers, cargo brokers and protective agents.

It is regrettable that many Nigerians with highly specialized education in shipping and maritime transport cannot find jobs in which to apply their knowledge because few indigenous ship owners (if any) have ships classed by Lloyds or Bureau Veritas for the needs of these advanced specialists. From here, a paradox can be observed in the sector: a high rate of existing unemployment followed by a critical shortage of employable workers. This problem can be traceable to institutional failures to look at industry needs and tailor their educational programmes to meet them.

e. Development.

Shipping is dynamic and evolving in nature; because of this, developmental efforts cannot be taken for granted. Different trading ships will make demands on different ports and so are the buyers of shipping services and importers.

Example 1: Road, rail inland water ways and inland dry ports are attractive to importers of general cargo. These infrastructure provisions extend the frontiers of marine and blue economy, increase the nation's revenue base and attract more players into the system. It follows that sea ports, inland water ways and inland dry port must be closely linked to land transport modes to engender an active economy.

Example 2: The box (container) trader will require deep channels, long berths with sufficient draught, terminal hubs, advanced technology in container handling and documentation. Dredging,

sweeping and channel management are crucial in this regard if we are to witness “**happily ever after**” in marine and blue economy.

Besides, port and terminal capacities to handle cargo mix and awkward cargos such as locomotive heads and cranes for multi storey constructions must be provided to prevent trade moving away to better and more friendly locations.

Multiple port access route will knock down port congestion and improve delivery times.

Example 3: The car (RORO) trader. Traders here will be attracted to ramps and slipways, underground drive ways, segregated car, bus and truck terminals, lightings and security posts including ingress and egress to transport networks.

Empowering women in marine and blue economy will be a welcome development. In order for shipping to be sustainable, there is need to draw talents from every sub sector of the economy including women that account for about 40% of our population. Policy makers of marine and blue economy envisage decent jobs and gender equality for all in the industry.

Finally.

Shipping remains one of the last vestiges of trans-boundary transaction where personal relationship counts. One wrong move from any side of shipping services can attract trade away and precipitate losses both in revenue and market share. Terminal operators know this globally. It is one of the many reasons why some ports are more competitive than others even when they are located along the same coast line. Granted that no two ports are the same, the market remains the front line where battles are won and lost. The world economy relies on shipping services. It is the organic appendage that supplies the bargaining tools of bilateral and multilateral trade relations between our government and the rest of the world. Should the marine and blue economy get it right, such will be a statement of bold and audacious economic feat at the very edge of modern history.



Figure 2.2: The Nigerian Blue Economy

Source: Author's Research

2.2 Environmental Impact of Crude oil Spillage on Marine Ecosystem

Nigeria as a nation has faced recurring oil spills in the Niger Delta area, resulting in significant consequences. The Niger Delta, which functions as the central hub for oil production in Nigeria, has witnessed a notably more significant occurrence of oil spill incidents than other African regions (Ordinioha and Brisibe, 2013; Chinedu and Chukwuemeka, 2018). Hence, one cannot fail to conclude that this region is among the most affected in the whole of the continent. Oil spills are one of the most well-known and widespread forms of marine pollution, significantly harming the marine environment globally (Martínez-Gómez *et al.*, 2010; Nordborg *et al.*, 2018). One of them is the pollution of the world's oceans, which is extensive and well-known, and this problem significantly affects all aquatic habitats. Oil extraction has significant and persistent implications for the environment, economy, and long-term outcomes. The repercussions of oil spills encompass

the degradation of ecosystems, such as coral reefs, and the impoverishment of biodiversity (Johannes *et al.*, 1972; Johansson *et al.*, 2016).

From the discovery of the first commercially viable oil wells in Oloibiri, in the Niger Delta, Nigeria, in 1956 to the present day, the issue of oil production and its effect on the environment has been the source of constant friction between oil companies and their host communities. According to Shell Petroleum Development Company (SPDC), most environmental problems related to the oil industry are due to oil spills, gas flaring, dredging of canals and land take for construction of facilities (Raji and Abejide, 2013). Large oil spills, depending on their location, may go undetected for many days or even months with untold damage to the fragile ecology of the Niger Delta. These oil-related activities have affected fishing activities in the host communities; the major economic preoccupation in these areas.

The main occupations of the people in the coastal areas of the Niger Delta are fishing and farming; and according to a report by United Nation Development Programme (UNDP) (2006), more than 70 % of the people of this area depend on the natural environment for their livelihood (Ebegbulem *et al.*, 2013). According to Niger Delta Environmental Survey (NDES) (1996), oil production and other industrial activities are just some of the factors that have greatly impacted on the evolution of the Niger Delta, however public attention has tended to focus on the appropriation of oil from the region. The operations of the oil industries have introduced pollutants as liquid discharges and oil spills into the air, land, and water components of the environment (Omajemite, 2011). Akpofure *et al.*, (2000) noted that when there is an oil spill on water, spreading takes place immediately. The gaseous and liquid components evaporate while some get dissolved in water and even oxidize and some undergo bacterial changes and eventually sink to the bottom by gravitational action. The soil is then contaminated with gross effect upon the terrestrial life. As the evaporation of the volatile lower molecular weight components affect aerial life, so the dissolution of the less volatile components, with the resulting emulsified water affects aquatic life. Aquatic life has also been destroyed with the pollution of traditional fishing grounds, exacerbating hunger and poverty in fishing communities (Inoni *et al.*, 2006). All these could force affected communities to aggress. Clark *et al.*, (1999) sums up the experience of local fishermen and farmers as follows: “having lost their traditional subsistence lifestyle to pollution and other drastic changes in their immediate environment, many oil producing communities are now forced to buy their food. In Eket, Akwa Ibom State, where Mobil’s operations have reportedly led to the loss of fish populations.



Figure 2.3: Polluted Taylor Creek

Source: Author's Research

2.3 Socio-Economic Consequences of Illegal Bunkering

Any activity that involves extraction and exploitation and damages to oil installations outside legal framework, is considered illegal and is termed oil bunkering under the Nigerian constitution. Equally, illegal oil bunkering may also refer to activities involving oil theft, smuggling and diversion of petroleum products (Campbell, 2015). Oil bunkering in Nigeria usually start from attacking of oil pipelines or flow stations and attacking legitimate oil cargo (Asuni, 2009; Boris, 2015). Most illegal oil refineries in the Niger Delta region of Nigeria are found in the cricks, forests, or villages. Equally, criminals burst oil pipelines that transport oil to various locations, tap and move the crude oil to tanks or containers where they are refined (Adishi, 2017). As pointed out by Asuni, (2009), Katsouris and Sayne, (2013), there are four ways to engage in illegal oil theft and bunkering. First, Condensate and petroleum products and sold in the neighborhood market. Second, hacking into pipelines or tap the oil from a wellhead with a hose. Here more sophisticated and technical tools were used. The money realized is used to buy weapons used to sustain militancy. While of the remaining are loaded onto ocean going ships for export. Third, may include

unauthorized lifting of extra crude oil than legally permitted using fraudulent bills of lading for onward delivery to the international market. Forth, the use of explosives to blast the crude oil pipeline to divert the flow of crude oil illegal storage facilities. This category is responsible for major spills and environmental devastation in the Niger Delta region. After refinement, the petroleum products such as petrol (PMS, diesel, and kerosene, is sold to dealers. (Ozogul, Olabimtan. Chukwurah, Ukpong, and Daniel, 2023)



Figure 2.4: Illegal Oil Refining I

Source: Ahmed Tukur Umar



Figure 2.5: Illegal oil Refining II

Source: Ahmed Tukur Umar

It has been pointed out that crude oil bunkering will continue due to underdeveloped nature of the region. Equally it has observed that the involvement of powerful people in the act also makes difficult to stop the illegal activities. Also the involvement of security agencies in the illegal activities makes it difficult to bring to an end to oil bunkering. Also the government lacks the willpower to stop such activities. It has been found that, in 2024 alone, NNPC deactivated 7,973 illegal refineries; disconnected 5,690 illegal connections; 2640 vandalism cases reported. It has been revealed that, NNPC private security has recovered 2.3 million barrels of crude oil; 194.4 liters of AGO; 66.7 thousand liters of PMS and 1.2 million liters of PMS. equally, arrested 2274 suspects.

While illegal activities of oil bunkering are ongoing, the environment continued to suffer degradation this can be seen in figure 2.6 below. It has been argued that, the destruction of illegal refining sites by the security officials is seriously contributing to environmental degradation and

pollution in the Niger Delta region of Nigeria. Although it is the alternative available for now but, it's hope that, a better way of dealing with the illegal refineries can be found.

According to Ahmed (2024), Crude oil illegal bunkering has become a lucrative business in Nigeria. It involves stealing of crude oil through pipeline vandalism, processing and finally selling the refined products in the ever available illegal markets. Blasts at the illegal processing or refining sides and spillages are common occurrences in Niger Delta region. This have led to significant environmental degradation and economic loses to region. Despite consistent government and multinational oil companies' efforts to bring an end to this illegal and lucrative business, the activities of oil bunkering seem to be on the increase. His work examines the causes and effects of illegal crude oil bunkering and refining in Niger Delta region, which becomes a major source of environmental degradation over the years. He adopted a qualitative/content research approach using secondary sources such as government publications, journals, newspapers, and the internet. The findings from the study revealed that; militancy in the region is a major sources of oil bunkering in the Niger delta region; illegal refining and destruction of illegal refining sites are major sources of environmental degradation. The paper suggests the need to improve security of oil pipeline in the region and in the long run replace the old cold pipelines with modern ones.

Illegal crude oil refining is very common in the Niger delta region of Nigeria. it is a common practice by militant's groups and other oil thief's. For decades', communities close to refining areas in the region were affected especially farmers and fishermen who lost their sources of livelihood as a result of pollution (Global Citizen, 2024). It has been found out that, Niger delta is one of the environmentally impacted regions of the world mainly as a result of poor regulations and illegal refining.

Igbani, Ronald, and Weapngong, (2024) the researchers observed that, illegal refineries have significantly damaged the biodiversity of the Niger delta region killing fishes, and aquatic wildlife. They further pointed out that, illegal refineries pollute the ecosystem; air, water and land resulting to health problems, food shortages due to land damaged. They equally, pointed out that, the strategy of destruction of the illegal refining sites by the security agencies have worsen the environmental situation in the region.

Egboboh (2024) reported that, in 2024 alone NNPCCL deactivated 6,409 illegal refineries; disconnected 4,845 illegal connections out of 5,543 connections. However, it has been reported that, as the company disconnect one illegal connection another one comes up. It has been observed that this does not happen anywhere in the world except in Nigeria. the illegal pipes are not invisible rather they very much visible big pipes that require some level of expertise to be put in place. That has lowered the production of crude oil in the region and promotes environmental pollution (Business day, 2024).

Emodi, Okereke and Diemuodeke (2022) equally observe that, about 10% of the 200,000 barrels per day of crude production is lost to illegal activities worth an average of \$21 million per day. In

2019 it has been estimated that, Nigeria lost up to \$2.8 billion annually. The activities of illegal refineries contribute to air borne diseases.



Figure 2.6: Fishermen fishing in polluted water in Taylor creek

Source: Author's Research



Figure 2.7: Okordia Manifold, Major Source of Illegal Bunkering in Taylor Creek
Source: Author's Field Survey

METHODOLOGY

3.1 Study Area

Taylor Creek is a significant waterway located in the Niger Delta region of Nigeria, specifically within Bayelsa State. Geographically, it lies between latitudes 5°01'N and 5°02'N, and longitude 6°17'E and 6°18'E. The creek serve as tributary to the Orashi River and eventually empties into the Nun River. The area surrounding the Taylor creek encompasses several communities including Ikarama, Biseni, Joinkarama, Okordia, Zarama, Polaku, Okolobiri and Agbia, which are part of the Okordia, Biseni, Joinkarama, Zarama, Gbaran clan of the Ijaw people. These communities rely heavily on the creek for their livelihoods, engaging in activities such as fishing, farming, and palm oil production.

Ecologically, Taylor Creek is characterized by freshwater swamp forests, which are interspersed with various creeks and flood channels. These waterways connect the Nun River and Taylor Creek at multiple points, forming extensive water bodies during high flood periods. The region is subject

to mild tidal influences, especially during the dry season, and is prone to seasonal flooding due to its proximity to the River Niger.

The Creek's rich biodiversity includes various species of fish, making it a vital resource for artisanal fisheries. However, environmental challenges such as gas flaring and oil production have adversely affected the aquatic ecosystem and the health of local communities. Studies have indicated that gas flaring in the area has led to a decline in fish catches and has posed health risks to residents.

3.2 Research Design

This study will adopt a mixed research design, combining quantitative and qualitative methods to provide a comprehensive analysis of the impact of crude oil spillage and illegal bunkering in Taylor Creek.

3.3 Methods of Data Collection

A mixed-method approach was deployed, combining structured surveys, key informant interviews (KIIs), and field observations. Data was collected from 300 respondents, including fishermen, aquaculture farmers, tourism operators, local traders, and community members.

3.4 Method of Data Analysis

Structural Equation Modeling (SEM) was employed to analyze the relationships between environmental degradation, economic impact, and public health in Taylor Creek. SEM is a robust statistical technique that integrates factor analysis and multiple regression to examine direct and indirect effects among latent constructs. The analysis was conducted using survey data from local fishermen, traders, and tourism operators. The study applied Confirmatory Factor Analysis (CFA) to validate the measurement model and assessed model fit using indices such as Chi-Square (χ^2), RMSEA, CFI, and TLI. Path analysis was used to estimate the causal relationships among oil pollution, economic decline, and health outcomes. This method ensures a comprehensive understanding of the systemic effects of crude oil spillage and illegal bunkering on marine-based economic activities and community well-being in Taylor Creek.

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This section presents an empirical analysis of the impact of crude oil spillage and illegal bunkering on marine-based economic activities in Taylor Creek, Niger Delta. Using Structural Equation Modeling (SEM), this study identifies key influencing factors and examines their relationships with economic productivity and public health within the Blue Economy framework.

4.2 Variable and Measurement

The study focuses on three latent constructs (Environmental Degradation, Economic Impact, and Health Impact), which were measured using nine observed variables from survey responses.

Table 4.1: Latent Construct of the variables used

Latent Construct	Observed Variables (Indicators)	Measurement Scale
Environmental Degradation (ED)	Oil Spill Frequency (OSF)	1 (Rare) - 5 (Very Frequent)
	Water Quality Decline (WQ)	1 (Very Clean) - 5 (Highly Polluted)
	Habitat Loss (HL)	% Decline in Mangroves, Breeding Grounds
Economic Impact (EI)	Decline in Fish Catch (DFC)	% Reduction in Annual Yield
	Reduced Tourism (RT)	% Drop in Tourist Visits
	Income Loss (IL)	% Decrease in Average Monthly Earnings
Health Impact (HI)	Respiratory Issues (RI)	% of Respondents Affected
	Waterborne Diseases (WD)	% of Reported Cases
	Skin Conditions (SC)	% of Respondents with Skin Reactions

4.3 Structural Equation Modeling (SEM) Results

Table 4.2: Descriptive Statistics of Key Variables

Variable	Mean (M)	Standard Deviation	Maximum	Minimum
Oil Spill Frequency (OSF)	4.2	0.8	2	5
Water Quality Decline (WQ)	3.9	0.7	2	5
Habitat Loss (HL)	38.5%	6.3	25%	50%
Decline in Fish Catch (DFC)	42%	7.2	28%	55%
Reduced Tourism (RT)	45%	8.1	30%	60%
Income Loss (IL)	39%	6.5	25%	50%
Respiratory Issues (RI)	55%	9.0	35%	70%
Waterborne Diseases (WD)	48%	7.6	30%	65%
Skin Conditions (SC)	50%	8.2	33%	67%

4.4 SEM Path Analysis and Hypothesis Testing

The hypothesized relationships between environmental degradation, economic impact, and health impact were tested using SEM path analysis. The regression weights and significance values are summarized below:

Table 4.3: Hypothesized relationship between variables

Path Hypothesis	Standardized Estimate (β)	p-value	Significance
ED → EI (Environmental Degradation → Economic Impact)	0.72	<0.0001	Significant
ED → HI (Environmental Degradation → Health Impact)	0.65	<0.0001	Significant
EI → HI (Economic Impact → Health Impact)	0.50	0.0002	Significant

ED → EI (0.72, $p < 0.001$): A strong positive impact, indicating that increased oil spills and habitat destruction directly reduce fishing, aquaculture, and tourism productivity.

ED → HI (0.65, $p < 0.001$): Shows that crude oil pollution and illegal bunkering significantly increase health risks, including respiratory issues and waterborne diseases.

EI → HI (0.50, $p = 0.002$): Suggests that economic decline further worsens public health due to reduced access to healthcare and nutritious food.

4.5 Model Fit Statistics

Table 4.4: Model Fit Statistics

Model Fit Index	Value	Acceptable range	Interpretation
Chi-Square X^2	15.34, $p = 0.04$	$p > 0.05$	Acceptable
RMSEA	0.04	<0.06	Good Fit
CFI	0.95	>0.90	Good Fit
TLI	0.93	>0.90	Good Fit

The model fit indices indicate an excellent fit, confirming that the hypothesized relationships are well supported by the data

CONCLUSION

5.1 summary of Key Findings

Environmental degradation significantly reduces economic productivity in Taylor Creek, leading to a 42% decline in fish catch and a 45% drop in tourism activities.

The health impacts of crude oil pollution are severe, with 55% of residents reporting respiratory illnesses and 50% suffering from skin conditions.

The decline in marine-based economic activities further exacerbates health conditions, as lower incomes reduce access to proper medical care.

5.2 Recommendations

- Stronger Regulatory Frameworks: Implement stricter monitoring of illegal bunkering activities and enforce stiffer penalties.
- Environmental Remediation Programs: Conduct oil spill clean-ups and restore aquatic habitats to boost fish stocks.
- Alternative Livelihood Programs: Develop eco-friendly tourism and aquaculture support schemes to provide alternative income sources.

REFERENCES

- Akpan, N., and Akpabio, E. (2003). Youth restiveness and violence in the Niger Delta Region of Nigeria: Implications and suggested solutions. *International Journal of Development Issues*, 2:37-58.
- Akpofure, EA., Efere, ML. and Ayawei, P. (2000). *The adverse effects of crude oil spills in the Niger Delta: Urhobo Historical Society*. Retrieved September 20, 2018, from http://www.waado.org/environment/petrolpollution/oilspills/OilSpills_AdverseEffects.html
- Arnber, M., Calosi, P., Spicer, J., Taban, I., Bamber, S., Westerlund, S., Vingen, S., Baussant, T., Bechmann, R., and Dupont, S. (2018). Effects of oil and global environmental drivers on two keystone marine invertebrates. *Scientific Reports*, 8: 17380.
- Chinedu, E., and Chukwuemeka, C. (2018). Oil Spillage and Heavy Metals Toxicity Risk in the Niger Delta, Nigeria. *Journal of Health and Pollution*, 8 (19): 180905.
- Ebegbulem, JC., Ekpe, D. and Adejumo, TO. (2013). Oil exploration and Poverty in the Niger Delta Region of Nigeria: A critical analysis. *International Journal of Business and Social Science*, 4(3): 279- 287.
- Egboboh C. (2024) “NNPC deactivates over 6,409 illegal refineries linked to pipeline in Niger delta”.
- EIA (2006, March). Nigeria Country analysis brief. Available online at <http://www.eia.doc.gov/emeu/cabs/Nigeria/Full.html>.
- Emodi N V, Okereke C, and Diemuodeke O E (2022) “three things that can go wrong at an illegal oil refinery in Nigeria. the conversation.com
- Igbani F, Ronald W I A, and Weapngong, (2024) effects of illegal refineries on aguatic life in Niger delta: a review international journal of environment and pollution research. 12(1).1-17.2024ISSN:2056-7545.<https://www.eajournals.org/> UK
- Ikeke, M. (2020). Deep Ecology Philosophy and Biodiversity Conservation in Nigeria’s Niger Delta. *European Journal of Sustainable Development*, 9 (2): 80-88.
- Inoni, OE., Douglasson, GO. and Adun, FN. (2006). The effect of oil spillage and crop yield and farm income in Delta State, Nigeria. *Journal of Central European Agriculture*, 7(1): 41-48.
- Johannes, R., Maragos, J., and Coles, S. (1972). Oil damages corals exposed to air. *Marine Pollution Bulletin*, 3: 29-30.
- Johansson, V., Felton, A., and Ranius, T. (2016). Long-term landscape-scale effects of bioenergy extraction on dead wood-dependent species. *Forest Ecology and Management*, 371: 103113.

- Martinez-Gomez, C., Vethaak, A., Hylland, K., Burgeot, T., Köhler, A., Lyons, B., Thain, J., Gubbins, M., and Davies, I. (2010). A guide to toxicity assessment and monitoring effects at lower levels of biological organization following marine oil spills in European waters. *ICES Journal of Marine Science*, 67, 1105–1118.
- Ordinioha, B., and Brisibe, S. (2013). The human health implications of crude oil spills in the Niger Delta, Nigeria: An interpretation of published studies. *Nigerian Medical Journal: Journal of the Nigeria Medical Association*, 54, 10-16.
- Omajemite, BU. (2011). The economic dimensions of the Niger Delta ethnic conflicts. *African Research Review*, 5(5): 46-55.
- Olatubosun, D (1975): Nigerian Neglected rural majority, Ibadan, Nigeria, Oxford University Press.
- Osunmuyiwa, O., and Kalfagianni, A. (2017). The Oil Climax: Can Nigeria's Fuel Subsidy Reforms Propel Energy Transitions? *Energy Research and Social Science*, 27: 96-105.
- Ozogu N A, O. H. Olabimtan OH, N. C. Chukwurah NC, M. K. Ukpong M K, D. S. Daniel D S (2023) Effects and Causes of Illegal Crude Oil Bunkering in Nigeria: Case Study Niger Delta. *American Journal of IR 4.0 and Beyond(AJIRB)*. Volume 2 Issue 1, Year 2023 ISSN: 2837-4738 (Online) DOI: <https://doi.org/10.54536/ajirb.v2i1.1450> <https://journals.e-palli.com/home/index.php/ajirb>
- Raji, AOY. and Abejide, TS. (2013). An assessment of environmental problems associated with oil pollution and gas flaring in the Niger Delta region Nigeria, C.1960s-2000. *Arabian Journal of Business and Management Review*, 3(3): 48-62.
- Rammads M.A. (2024). 15th Anniversary of Giant Strides in the Maritime Industry “GMA Sailing Towards the Future of the Maritime Industry”: A public lecture on Marine and Blue Economy.