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Ocean and Coastal Resources Components and their Contributions to Sustainable Development of Nigeria

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ABSTRACT: The blue economy, which encompasses the sustainable use of ocean resources for economic growth, has the potential to revolutionize Nigeria's maritime industry and provide a significant boost to the country's economy. The subject has been taken seriously in recent time in many parts of the world basically due to the sustainability it implies to the use of ocean in boosting national and therefore well-being of the people. Hence, the objectives of this paper were to examine ten important blue economic components and evaluate their contributions to the sustainable development of Nigeria using various secondary data acquisition. Data obtained reveals that out of the ten (10) blue economic components studied, oil/gas exploration, maritime transport/shipping and fisheries dominate the blue economic contributions with the oil/gas exploration contributing 90% of the blue economic value in Nigeria. This work has shown that efforts are required both from the government and private sectors to pursue the huge opportunities available especially in the non-oil/gas exploration components to sustainably improve the economic base of the nation and generate huge employment opportunities for the large growing Nigerian population.

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According to the World Bank, the blue economy is the "sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem (Oyedele 2023). The most important source of human sustenance is the earth's water body which makes up around 70% of the earth's surface, including the ocean, seas, rivers, streams, and lakes (Allison *et al*., 2020). According to Sandifer and Sutton-Grier (2014), the ocean contributes to global wealth by supplying food, clean water, jobs, and clean air, regulating climate, treating waste, supporting biodiversity, and keeping coastal and marine ecosystems healthy. The ocean food industry can provide protein for over 3 billion people and create over 260 million jobs globally Teh and Sumaila (2011). Globally, the maritime environment's annual worth is $2.5 trillion Hoegh-Guldberg *et al*., (2015), with the world economy dependent on the ocean for a 25% contribution to $94 trillion which by 2023 will further increase by $3 trillion from enhanced conservation of important marine ecosystems (Brito 2021). The conservation of the ocean for the sustainability of the world economy gave way to the blue economy. Quirici (2023), refers to the blue economy as the effective and sustainable use of ocean resources as well as activities pertaining to the sustainable use of seas, oceans, and coastlines. The Gulf of Guinea, one of Sub-Saharan Africa's most economically vibrant nations, has several obstacles in its transition to the blue economy, which is essential for the continent's sustainable growth. Nigeria as one of the countries in the Gulf of Guinea has approximately an ocean space of 290 square kilometers which is one-third of Nigeria's land area (924 square kilometers) Agha (2023b). The activities pertaining to the sustainable use of the ocean, sea, and

coastal water can be grouped into Maritime transport and shipping, Cruise tourism, Fisheries and offshore aquaculture, Renewable energy, Oil and gas exploration, Mineral resources, Recreation and sporting, Biotechnology and pharmaceuticals, Coastal protection and infrastructure, Ocean governance and management. These activities are referred to in this paper as components of the blue economy. The ten (10) components of the blue economy are briefly described: a). Maritime transport, shipping, and trade: Maritime transport involves the process whereby ships and vessels are used to move goods and people around the world. b). Cruise tourism: Tourism on the ocean is a big business. The revenue is such that small Island of developing countries can host more 41 million visitors per year, generating millions of dollars annually in revenue. c). Fisheries, offshore aquaculture and seafood processing: Fisheries and offshore Aquaculture include the sustainable harvesting of marine resources such as fish, shellfish, and other aquatic organisms, as well as the cultivation of fish in controlled environments. At least 50% of fish for human consumption is provided by aquaculture. And of course, the total sales of fish globally are estimated at USD 406 billion, according to Food and Agriculture Organization or FAO report of 2020 (https://www.fao.org/newsroom/detail/record-fisheries-aquaculture-production-contributes-food-security-290622/en.). d). Renewable energy: Blue economy also encompasses renewable energy, meaning the ocean's energy can be utilized to generate power, offshore wind, tidal, and wave energy can generate electricity for companies and individuals. e). Oil and gas exploration: Beneath the seabed are oil and natural gas resources. f). Mineral resources: Polymetallic nodules and minerals found in hydrothermal vents can be explored as mineral resources. g). Recreation and sporting: There are more than 10 recreational and sporting activities such as sailing, wind-surfing, diving, rowing, surfing, wake-boarding, canoeing, skim-boarding, underwater hockey etc. h). Biotechnology and pharmaceuticals: Research in science and technology has advanced such that marine organisms are identified and extracted and used for applications in the production of pharmaceutical products. i). Coastal protection and infrastructure: Developing and maintaining structures that protect coastlines from erosion and storms, as well as building ports, harbors, and other coastal infrastructure. j). Ocean governance, waste management and pollution control. This is where the sustainability of the ocean comes in. Policies are important to drive the safe use of the Ocean ecosystem without damaging the ocean and society.

The aim of the paper is to quantify the present contribution of each of the ten components of blue economic activities to Nigeria's economy considering the enormous ocean space in Nigeria. In discussing related literatures to the paper's objectives, Mmom and Chukwu-Okeah (2011), concentrated on the potential of Nigeria's blue economy and related activities, with a focus on the country's oil and gas industry in particular putting into consideration Nigeria's oil and gas potentials in relation to the blue economy. Ebeh (2017), investigated the possibilities of marine biotechnology in addressing societal issues and promoting economic expansion and recovery in an increasingly significant way. Increasing the interest in sustainable practices, technological innovation, renewable energy, circular economy concepts, sustainable tourism, and blue finance, the future of the blue economy appears bright and certain (Marwan 2023). Akomolafe *et al*., (2022), identified resources, challenges preventing deployment, proffered efficient ways of implementing and prospects of blue economy in coastal state of Ondo state. Alubeze and Samuel (2018), analysed that Nigeria's dry bulk and general cargo demand for transport (shipping tonnages) along Nigeria's trading regions/routes is positive. This shows that the Nigerian Maritime and shipping industry is economically viable. Jacob and Umoh (2022), proposed regional involvement in the economic transition of the Niger Delta area from oil hub to growth and expansion of the blue economy for regional prosperity and sustenance. Popoola and Olajuyigbe (2023), identified poor institutional framework, unsustainable anthropogenic activities, climate change, piracy, urbanization, and population growth as challenges militating the blue economy transition in the Gulf of Guinea. Gbadegesin and Akintola (2021), argues that given Nigeria's current legal framework on the protection of the marine environment, it is possible to derive sustainable profit from ocean-based businesses in the nation. In order to meet the Sustainable Development Goals (SDGs) and achieve decent, sustainable, and equitable economic growth, it is imperative that Nigeria diversify its economy away from oil and its coastal, marine, and maritime sectors to a sustainable economy (Elisha 2019). Giwa (2018), advocated for the inclusion of public private partnership in blue economy through executive order or policy. The existing literatures have not documented the contributions of each of the ten (10) key components of blue economy to the Nigeria economy to enable a base knowledge and the need to improve. Hence, the objective of this paper was to examine ten important blue economic components and evaluate their contributions to the sustainable development of Nigeria.

MATERIALS AND METHOD

The materials are secondary data acquired from the Nigerian Maritime Administration and Safety Agency (NIMASA), MARPOL convention compliance review records and publications, and Nigerian Port Authority (NPA), other data sources include published (Journals, Newspapers e.t.c.)

RESULTS AND DISCUSSION

This work presents 10 components of blue economy that can be developed and utilized, not only to generate revenue for government but to reduce unemployment rate through job creation. They include: *Maritime Transport and Shipping***:** Maritime transport and shipping involve the process whereby ships and vessels are used to move goods and people in and around the world The global economy revolves around the shipping industry, with a total value of US$14 trillion in 2019 according to (International Chambers of Shipping 2020). The origin of maritime trade particularly in Nigeria which has a coastline of around 850km may be traced from the middle of the 1800s until her independence in 1960 with the arrival of colonial control on the African West coast (Osadume and Uzoma 2020). Table 1.0 shows that maritime and shipping operations' component of blue economy generated a total of ₦1,873,173,000,000.00 and remitted ₦277,227,000,000.00 into the Federation account with a total of 27,301 vessels received at various ports in Nigeria.

Table 1: NPA Generated Revenue, Remittances and Operations (2015 – 2022)

S/N	Year	Total Revenue Generated	Amount Remitted to the (CRF)	Vessel Traffic	Gross Registered Tonnage (GRT)	Cargo Throughput	Container Traffic
1.	2015	180,050,000,000.00	18,043,000,000.00	4,254	104,446,052	77,387,638	1,567,898
2.	2016	162,020,000,000.00	23,087,000,000.00	3,897	101,685,820	70,365,036	810,000
3.	2017	299,056,000,000.00	30,031,000,000.00	3,878	95,190,097	71,535,636	1,289,576
4.	2018	282,042,000,000.00	33,000,000,000.00	3,859	126,683,956	74,677,507	1,000,976
5.	2019	300,000,000,000.00	31,000,000,000.00	3,259	108,923,118	81,264,169	1,032,253
6.	2020	317,000,000,000.00	80,000,000,000.00	4,054	127,923,118	80,826,672	1,073,807
7.	2021	333,005,000,000.00	62,066,000,000.00	4,100	127,562,514	79,915,877	2,029,823
Total		**1,873,173,000,000.00**	**277,227,000,000.00**	**27,301**	**792,414,675**	**535,972,535**	**8,804,333**

Source: Table by authors adopted from (https://www.ceicdata.com/en/indicator/nigeria/container-port-throughput); (https://www.thisdaylive.com/index.php/2020/10/23/how-npa-generated-n1-02trn-revenue); (Agha Eugene 2023a);(https://nigerianports.gov.ng/ports-statistics/)

The generated revenue from NPA have the possiblilty of increasing with the coming onstream of the Lekki deep seaport. Furthermore minimizing vessel turn-around- time from 5.16 days to 2 days will certainly see the maritime and shipping component of the blue economy leading in the revenue generation for Nigeria economic growth.

Note that this excludes the inter- and intra state transport system in Nigeria that has largely created huge employement for the local Nigerian populace especially the riverine communities of Bayelsa, Delta, Rivers, Akwa-Ibom, Cross-River and vasts of other states. *Cruise Tourism***:**Nigeria as a coastal state in West Africa, is endowed with an abundance of varied water resources, encompassing both freshwater and marine environments Oladele *et al*., (2018), with approximately 708 km of 853 km long coastline stretching from 16 to 90 km inland are made up of mangrove swamp forest and coastal vegetation (Isebor & Awosika 1993). cited by (Osuji and Agbakwuru 2022). The Nigeria coastal regions is a composition of tidal channels, beach ridges, sandbars, lagoons, marshes, and freshwater and mangrove swamps (Osuji and Agbakwuru 2022). Figure 1 identifies Coastal tourism potential in Nigeria. The Niger Delta coastal line, the Coastal line of Lagos and Ondo states are the most potential for coastal and tourism components that can contribute immensely to Nigeria economy if properly harnessed. Also, the inland coastal waters in the Niger Delta are not left out as they are capable to boast the economy when properly harnessed. Oladele *et al*., (2018), highlighted that Nigeria coastal tourism potentials are underutilized notwithstanding that beaches in Lagos state are presently in use and open to tourists. However, the Niger delta area with much tourism potentials are yet to be tapped and opened to tourist in contribution to blue economy. The States within the Niger Delta coastline identified as potential contributors to tourism components of blue economy that have the capacity for Nigeria economic growth are:

1. Akwa Ibom State: Ibeno Beach, Iko Beach in Eastern Obolo (Cashew Beach)
2. Bayelsa State: Okpoama Beach, Twon-Brass Beach, Olodiama Beach, Koluama Beach, Sangana Beach, Odi Beach, Kaiama Beach, Nembe Beach and the evergreen expanse of mangrove creeks
3. Cross River State: Coconut Beaches
4. Delta State: Asaba beach, Eku Beach, Otuogo beach, Abraka beach and Ogulagha beach.
5. Edo State: Aghenebode Sand beach
6. Rivers State: Ikofo beach, Yowiks beach and Port Harcourt beach.

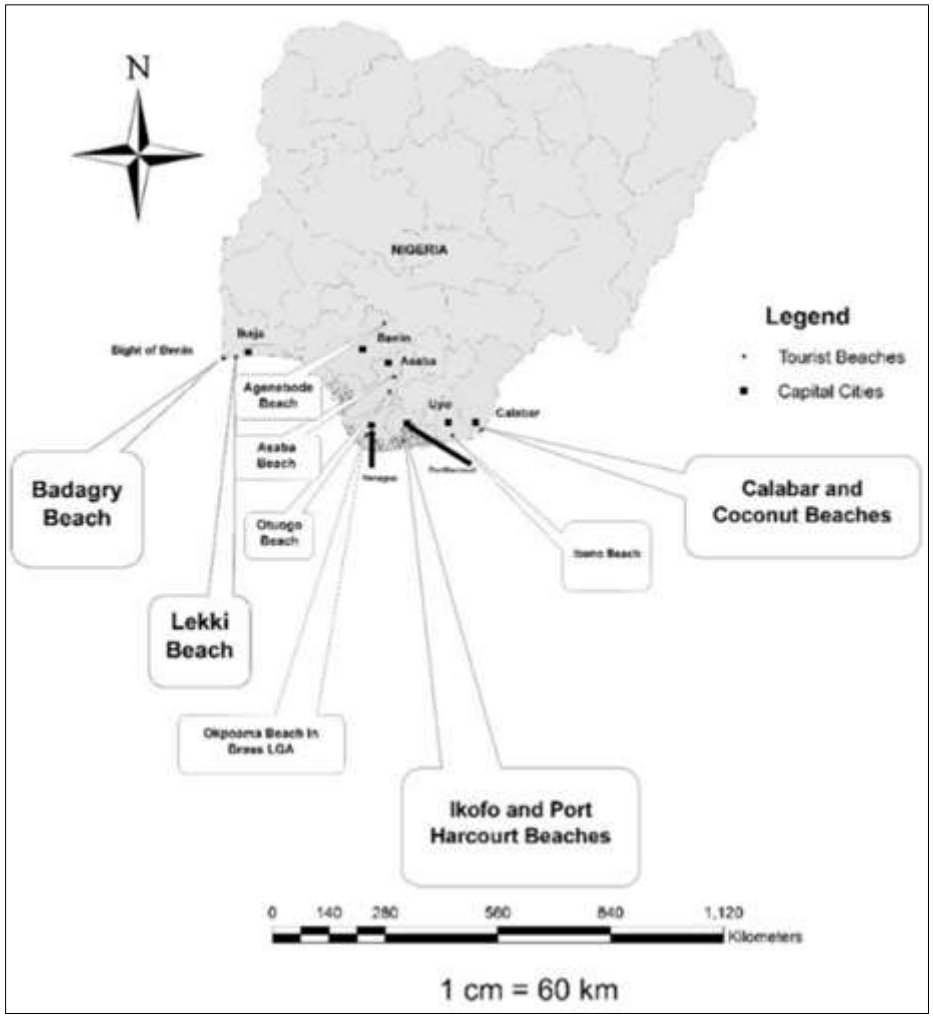

Fig 1: Map of Nigeria showing various coastal and marine tourism destinations
Source: Adopted from (Oladele et al., 2018)

A boat cruise-site seeing of oil production facilities along the coastline of Niger Delta is another area of tourism potential. Apart from revenue generation, the coastline tourism in Nigeria has the potentials of stimulating recreational and educational values, developing infrastructures, creating jobs, preserving and sustaining our rich cultural heritage and diversity, coastal and marine tourism environment conservation. Unfortunately, it is sad to report that there is no documented evidence of contribution of this component of blue economy into the country's economic growth.

*Fisheries and Offshore Aquaculture***:** Nigeria is one of the developing nations, where fishing industry continues to be a key source of foreign exchange and the primary source of sustenance for millions of people, with over 1,477,651 persons exploring the fishing industry (Odioko and Becer 2022). The primary source of protein in Nigeria is fish. With Nigeria's enormous coastline and inland water and domestic fish output estimated at around 800,000 metric tonnes per annum, fish shortage is still experienced (Akinsorotan 2019). Generally speaking, despite the fishing industry's significance, governments and policy-makers in developing nations do not give the fisheries sector the attention it deserves (Odioko and Becer 2022). Presently, Nigeria's fish production industry is yet to meet up the expected demand based on the projected fish demand and supply analysis in Table 2. As shown in Table 2 the percentage fish deficit is directly proportional to the increase in population. The deficit could be overturned through the application of offshore aquaculture considering the enormous coastline in Nigeria. Fishery contributed 2,978.6 (trillion) to the GDP between 2015 – 2022. Apart from 2016 drop in GDP contribution, fishery have contribution to GDP have increased geometrically each year as shown in Figure 2.

Table 2: Projected population and fish demand/supply from 2000 to 2025 in Nigeria.

Year	Projected Population (million)	Projected Fish Demand (mt)	Projected Domestic Production (mt)	Projected Fish Importation (mt)	Projected Total Fish Consumption (mt)	% Fish Supply Gap Deficit
2010	158,503,200	3,020,000	817,520	1,330,690	2,147,910	28.88
2011	162,805,080	3,110,000	856,610	1,589,400	2,423,600	22.07
2012	167,228,790	3,211,000	922,650	1,083,210	1,996,590	37.80
2013	171,765,820	3,320,000	1,000,060	868,040	1,804,530	45.65
2014	176,404,930	3,420,000	1,073,060	991.02	2,064,040	39.65
2015	181,137,450	3,280,000	1,027,060	866,980	1,890,980	42.35
2016	185,960,240	3,380,000	1,041,500	593,710	1,635,210	51.62
2017	190,873,240	3,490,000	1,212,470	466,930	1,679,400	51.47
2018	195,874,680	3,610,000	1,169,480	582,390	1,751,870	51.88
2019	201,042,520	3,730,000	1,199,410	484,280	1,683,680	54.86
2020	206,310,940	3,850,000	1,211,780	506,140	1,717,840	55.38
2021	211,705,770	3,970,000	1,264,390	478,720	1,742,840	56.10
2022	217,235,370	4,100,000	1,287,470	484,320	1,771,210	56.80
2023	222,902,500	4,230,000	1,323,190	472,190	1,794,750	57.57
2024	228,713,570	4,370,000	1,355,980	475,560	1,831,100	58.10
2025	234,671,680	4,510,000	1,399,840	472,530	1,872,110	58.49

Source: Adopted from (Odioko and Becer 2022).

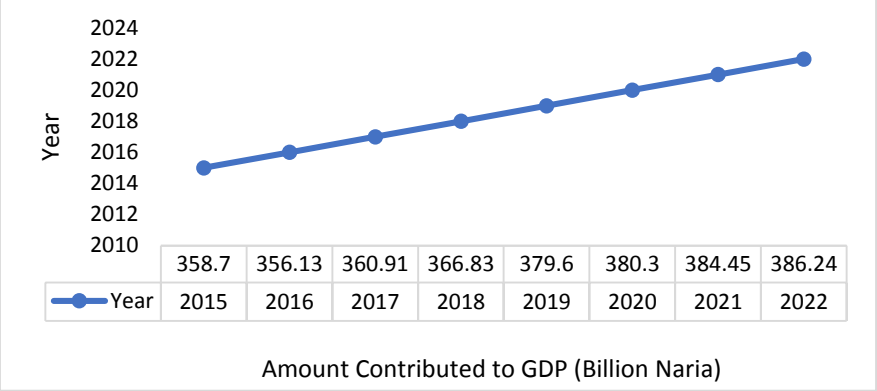

Figure 2: Fishery Contribution to Nigeria's GDP from 2015 – 2022

Source: Chat by authors adopted from (https://www.cbn.gov.ng/rates/RealGDP.asp). Central Bank of Nigeria Real Gross Domestic Product

Offshore aquaculture has the potential to significantly contribute to Nigeria's Blue Economy by promoting economic diversification, enhancing food security, creating jobs, supporting environmental conservation, and fostering technological innovation. However, it requires careful planning, investment, and regulation to ensure long-term sustainability and maximize its positive impact.

*Renewable Energy***:** Ocean energy, a renewable energy source could potentially meet a substantial portion of the world's energy needs (Thresher and Musial 2010). Presently, the production of oil and gas from the continental shelf of West Africa is the only use of the ocean as an energy source (Thresher and Musial 2010). Ocean energy when compared to sustainable energy sources like biomass, solar, wind, etc., provides several advantages with fewer negative effects on the environment than other renewable sources as it is easily accessible, abundant in nature, and forecastable (Thresher and Musial 2010). Sitoe *et al*., (2023), conclude in their findings that salt gradient power and small tidal power plants are the most suitable ocean energy sources best suitable for coastal development. Nigeria a developing country has a low average annual electricity use of 145 kWh despite having a high GDP per capita of US$ 3,099.00 (Sitoe *et al*., 2023). Potential sources of ocean renewable energies are ocean wave, Ocean thermal energy conversion (OTEC), Salinity gradient, Marine currents and Tidal energy.

Agbakwuru and Akaawase (2017), evaluated wind energy potential in the vast Nigerian onshore and offshore with respect to power and annual energy output and capacity factor for most common existing state-of-the-art industry turbines and finally submitted that combining wind power, deepwater wind power with ocean current energy technology will give an outstanding output. Agbakwuru and Arome (2023), presented a hybrid system that harvests electricity from both solar and underwater currents. Commercialization of these ocean renewable energies will further increase the electricity generation output in Nigeria and also help in developing Nigeria's

coastal communities thereby leading to industrialization of the Nigeria coastal communities. However, the Ocean renewable energy component of the blue economy is yet to contribute to Nigeria's GDP because no investments have been made to tap into that, which will in turn generate electricity for the general development of our country Nigeria.

*Oil and gas Exploration***:** According to estimates, Nigeria emerged as the top-ranked nation with the greatest remaining deepwater oil reserves, possessing an estimated 5,038 million barrels of economically recoverable oil in 2018 (https://www.offshore-technology.com/marketdata/oil-gas-field-profile). The first offshore petroleum discovery in Nigeria was on the Okan structure in Bendel State, which is now Delta State by the Gulf in 1964 (Abasi-Udosen *et al*., 2006). African oil firms began looking into offshore production as a potential alternative source of income in 2005 as a result of less vulnerability to civil and militia conflicts being experienced in most oil-producing countries at onshore operations (https://en.wikipedia.org/wiki/Petroleum_industry_in_Nigeria), though heaven for illegal crude oil trade and bunkering (Smith and Simon 2014). Nigerian offshore oil production was predicted to produce 1.27 million barrels of oil per day (202,000 m3/d) in 2010 compared to 15,000 barrels per day (2,400 m3/d) in 2003 (McLennan and Williams 2005). In 2005, 250,000 barrels (40,000 m3) of oil were produced daily at the Agbami oilfields as it reached full capacity. Nigerian deepwater offshore sector has the ability to develop and expand like Akpo, Bonga, and Erha (https://en.wikipedia.org/wiki/Petroleum_industry_in_Nigeria).

Table 3: Offshore Oil fields with both crude and gas production capacity in Nigeria.

S/N	Field	Operators	Crude Production(bpd)	Gas production
1	Agbami	Chevron Nigeria	250,000	450 mcf/D
2	Akpo	Total Upstream Nigeria	175,000	320 Mscf/D
3	Amenam	Elf Petroleum Nigeria	125,000	15 mmt/d
4	Bonga	Shell	200,000	150 mscf/D
5	Abana	Moni Pulo Petroleum	10,000	
6	Erha	EEPNL	140,000	-
7	Usan	Total E&P Nigeria	27,100	-
8	Sonam	Chevron Nig	-	215mcf

Source: Table by authors adopted from (*Smith and Simon 2014).*

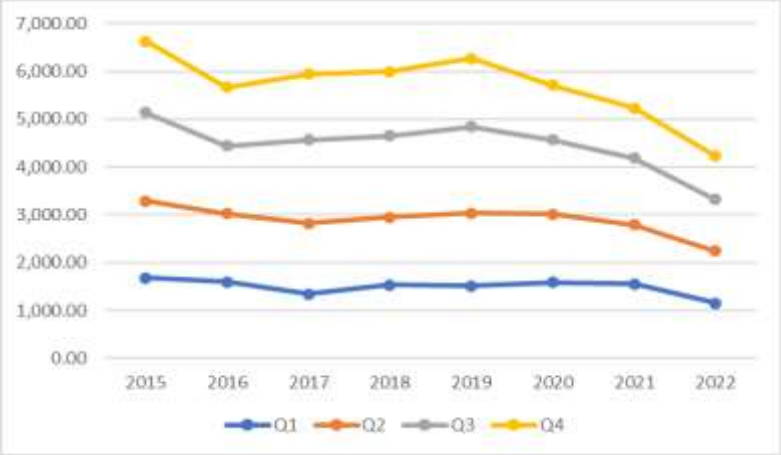

Figure 3: Crude Petroleum and Natural Gas Contribution to Nigeria's GDP from 2015 – 2022
Source: Chat by authors adopted from (*https://www.cbn.gov.ng/rates/RealGDP.asp) Central Bank of Nigeria Real Gross Domestic Product*

Agbami in Table 3 has the highest daily production capacity followed by Bonga, Akpo, Erha, and Amenam while Abana and Usan have the least daily production capacity for crude. However, the combined capacity of Abana and Usan oil fields is higher than Anambra, Imo, and Abia state daily crude production capacity. The crude and natural gas production contribution to Nigerian economy is dropping owing to a likely diversification of the economy from mono to multiple economy as shown in Figure 3. However, oil theft may not be left out as seen in recent discoveries. Community unrest and frequent disruptions of production by host communities could also contribute to the drop. During the Q4 of 2015 and 2019 the contribution of crude oil and natural gas was high. It could be as a result of Nigeria meeting up with the OPEC production quota. Deep sea crude oil and natural gas production which is one of the components

of the blue economy contributes immensely to GDP as it is a major source of foreign exchange in Nigeria. Nigeria's official oil corporation predicted that by 2022, "two-thirds of the nation's production will stem from deep-water deposits" as offshore production is expected to surpass onshore production (Bala-Gbogbo 2018).

*Mineral Resources***:** According to Sakellariadou *et al*., (2022), rare earth elements (REEs) and other rare metals, which are essential for adopting clean technologies, are required due to the anticipated expansion of the worldwide economy and the predicted rise in global population. The next frontier for mineral exploration and extraction is thought to be seafloor resources because land-based mineral deposits are being depleted and the growing demand for essential metals (Sakellariadou *et al*., 2022). Deep-sea mineral deposits such as polymetallic sulphides, polymetallic nodules, cobalt-rich crusts, phosphorites, and rare earth element-rich muds are among most marine mineral deposits that have a significant resource potential for transition, rare, and critical metals (Sakellariadou *et al*., 2022).

In Nigeria, the Nigerian Maritime Administration and Safety Agency (NIMASA) DG requested support from the International Seabed Authority (ISBA) to create a database of mineral resources that are accessible to all people and to conduct a deep-sea survey in order to increase capacity (Sulaimon Salau 2017). ISBA currently have exploration in the following areas:

a. Polymetalic Nodules Exploration Areas in the Clarion-Clipperton Fracture Zone

b. Polymetalic Nodules and Polymetallic Sulphides exploration areas in the Indian zone

c. Polymetallic Sulphides exploration areas in the Mid- Atlantic Ridge.

Nigeria seabed is blessed with the following minerals according to (https://www.statista.com/statistics/1276924/contribution-of-travel-and-tourism-to-gdp-in-nigeria/),

Titanum, Colbalt, Mikel, Iron, Copper, Zinc, Molybdenum, Stronitium and Lead with a possibility of Gold, Silver and Ferromagnesium. Presently, no seabed mineral mining has started in Nigeria Ocean and there is no contribution so far by mineral resources to the Nigerian economy. Hence, "there is the need to establish a Seabed Authority which would consist of identified and relevant MDA`s and also recruitment of candidates with technological and scientific expertise within the relevant fields in line with the activities of the Authority and formulation of national legislation in line with the activities of the Authority" as suggested by NIMASA. Furthermore, seabed sensitisation and personnel training are needed to tap into the abundant mineral resources embedded in the Nigerian Continental seabed.

*Recreation and Sporting***:** There are more than 10 recreational and sporting activities such as sailing, windsurfing, diving, rowing, surfing, wakeboarding, canoeing, skimboarding, underwater hockey etc.

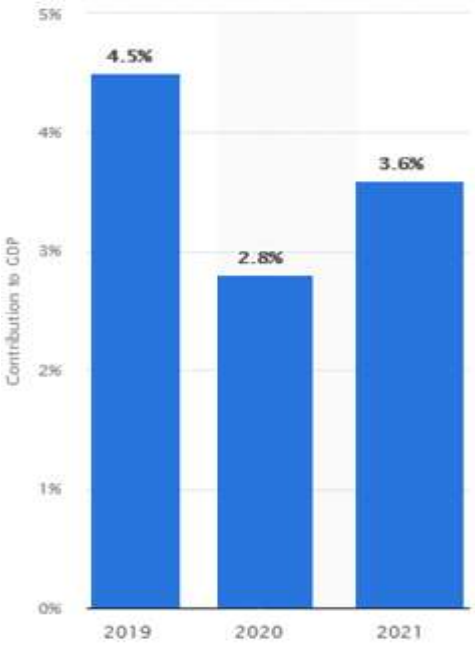

Figure 4: Contribution of travel and tourism to GDP in Nigeria from 2019 to 2021 (in million U.S. dollars)
Source: adapted from (https://www.statista.com/statistics/1276924/contribution-of-travel-and-tourism-to-gdp-in-nigeria/)

However, kayaking sports is an upcoming area of recreation and sport in Lagos as kayak tour operators in Lagos with years of experience and relationships with the natives take tourists around the lagoon at a cost and the kayaks are comfortable and safe. Furthermore, the beaches in Lagos are always filled with sporting activities like beach football, handball, and other beach sports.

In addition to the recreation aspect, there are canoe tours in places like Makoko in Lagos. The following waterfronts in Nigeria are presently potential locations for recreation and sporting activities and if well harnessed will generate income for Nigerian development; Elegushi Beach, Landmark Beach, Avista Beach, Gberefu Beach, Ibeno Beach, Port Harcourt Tourist Beach and McCarthy Beach. The beaches are in Lagos, Delta, Rivers, and Akwa Ibom States.

There was a drop in the contribution of the tourism industry in 2020 as in Figure 4 because of COVID-19 which kept the world economy at pause. However, 2021 saw an increase in rise which is a show that tourism and leisure activities have been activated and it is coming up.

Biotechnology and Pharmaceuticals: Around 70% of our planet's surface is made up of the oceans, which also include over 99 percent of the biosphere. Creatures may be found in the oceans representing an environment with biggest temperature, light, and pressure fluctuations that life has ever experienced (Day *et al*., 2016).

Nigeria is blessed with an abundance of natural resources to the extent that the country is referred to as a coastal state. According to Day *et al*., (2016), adapting to these challenging conditions, there is a wealth of marine biodiversity and genetic variation, with biotechnological uses in medication development, environmental cleanup, enhancing the supply and safety of seafood, and creating new resources and industrial processes.

The use and harvesting of living aquatic resources (seafood, plant marine organisms, and marine biotechnological products) for the production of pharmaceutical drugs and products which are for the sustainability of human life from the ocean is important and needs to be harnessed.

When these goods are developed and brought to market, they have the potential to generate significant amount of revenue for both individuals and the government which will advance national development and enhance people's quality of life (Ebeh, 2017). Globally, the marine biotechnology market is expected to increase based on a compound annual growth rate (CAGR) of 8.7% from 2021 to 2026, when it is expected to reach $7.3 billion (https://www.industryarc.com/Report/16110/marine-biotechnology-market.html).

However, Nigeria is yet to tap into this due to the following reasons by Ebeh (2017):
1. Lack of adequate manpower in the field,
2. Poor infrastructures,
3. State of the art equipment,
4. Research funding from government agencies, and
5. Adequate awareness and policy,

These are some of the challenges facing marine biotechnology. The government alone should not be the only party in this, rather the private sector should be in the lead while the government creates policies and an enabling environment for marine biotechnology and pharmaceuticals to strive.

Ocean Governance and Management: Globalization has given rise to human activity, which has also greatly increased the threat to ocean global space (Johnson 2023). Ocean noise, pollution from land-based and ship-based sources, unsustainable and harmful fishing methods, and illegal and unreported fishing are just a few of the threats that exist in the maritime environment while other threats include the mining of minerals, the production of gas and oil, and collisions between ships and marine life (Johnson 2023).

According to Johnson (2023), ocean acidification, heat, and a drop in oxygen levels are all caused by the maritime environmental threat. Consequently, all of these have an adverse effect on marine life which gave way to the need for ocean governance and management.

Globally, the United Nations Convention on the Law of the Sea of 1982 adopted guidelines for all uses of the oceans and their resources, it establishes a comprehensive system of law and order in the world's oceans and seas. Nigeria benefits from UNCLOS, which went into effect on November 16, 1994. On December 10, 1982, and August 14, 1986, respectively, the Federal Republic of Nigeria approved and signed the convention (DOALOS 2012).

In Nigeria numerous Ministries, Departments and Agencies (MDAs) oversee ocean governance which include laws enforcement, policies and regulations that are pertinent to their respective responsibilities.
The six basic domesticated ocean governance management in Nigeria as in Table 4 are being handled and managed by Ministries, Departments, and Agencies.

They have established laws mandating the agencies to carry out their function effectively. However, ocean governance and management are not handled by one agency alone but by different agencies and ministries.

There might be some bureaucratic bottlenecks but overcoming them is the most critical aspect of the execution of delegated functions of the agencies involved.

Ocean governance's contribution to Nigeria's blue economy is the provision and conservation of the needed environment for other components of the blue economy to function appropriately.

Table 4: Nigeria Ocean Governance and Management

S/N	Ocean Governance Law	Agencies Involved	Functions	Regulating Laws
1.	Nigeria Maritime Jurisdiction	Federal Ministry of Justice	- provision of an executive bill to consolidate the Maritime Zone laws into a single statute by seeking an amendment from the National Assembly to the current Territorial Water Act and EEZ Act and an enactment into law of an Act to determine the Maritime Zones of Nigeria and for Matters Connected Therewith (Federal Republic of Nigeria, 2009).	- EEZ law
2.	Governance of Living Resources	-Federal Ministry of Agriculture and Rural Development through the Federal Department of Fisheries (FDF) and the Nigeria Institute of Oceanography and Marine Research (NIOMR)	- Engagement in policy formulation and implementation relating to national, regional and international initiatives. - Monitoring, control and surveillance. - Research activities.	- Sea Fisheries Act no. 71 of 1992 - Sea Fisheries (Licensing) Regulations, 1992 - Inland Fisheries Act no. 108 of 1992(FAO, 2010)
3.	Governance of Non-Living Resources and Ocean Energy Initiative	-Federal Ministry of Environment (FMOE) through National Oil Spill Detection and Response Agency (NOSDRA), - Federal Ministry of Petroleum Resources (FMPR) through Nigerian Upstream Petroleum Regulatory Commission (NUPRC) - Federal Ministry of Transport (FMT) through Nigeria Inland Water Authority (NIWA) - Federal Ministry of Mines and Steels Development (FMMSD)	- Regulations and protection of the environment as a result of the exploration and exploitation of oil and gas. -Implement and enforce compliance with the National Oil Spill Contingency plan	- Petroleum Industry Act (PIA) 2021 - International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) 1990
4	Marine Environment Protection and Climate Change	- Federal Ministry of Environment (FMOE) - Federal Ministry of Transport through Nigerian Metrological Agency (NIMET)	- Protection and sustainability of the biodiversity and ecosystem of the coastal and marine environment - Mapping of Marine Protected Areas (MPAs) - Participate in climate policy matters affecting the marine environment	- NIMET Act 2003
5	Maritime and Port Governance	- Federal Ministry of Transport (FMOT) through Nigerian Maritime Administration and Safety Agency (NIMASA) and the Nigerian Port Authority (NPA)	- Maritime Administration - Development of national blue economy policy and strategy to facilitate the sustainable development of deep seabed resources.	- NIMASA Act 2007 - Merchant Shipping Act 2007 - Coastal and Inland Shipping (Cabotage) Act 2003 - NPA Act 2004
6	Maritime Security	- Nigerian Navy (NN)	- Provide security to secure the national maritime zone -provision of security against illegal activities of ships in Nigeria waters	- Constitutional Powers

Source: Table by authors adopted from (Folami 2017)

*Coastal Protection and Infrastructure***:** Global climate change has become a major concern over time with regard to coastal zone development (Mmom and Chukwu-Okeah 2011). The business of coastal and shore protection system development projects is crucial to Nigeria given its extensive coastline and vulnerability to coastal erosion and floods; building seawalls, revetments, and breakwaters are examples of the protective measures used by this industry to keep infrastructure and coastal towns safe and to stop the loss of valuable coastal land (https://www.blackridgeresearch.com). Presently, the Nigerian government is building a 9-kilometer seawall as a flood and erosion control mechanism along the coastline through the Eko Atlantic City Project which will minimally reduce possible natural disasters coming from the coastal waters (https://www.blackridgeresearch.com). Nigeria cannot sustain the coastline infrastructure and protection without putting policies in place and

adequate legislatures. Coastal infrastructure development is not a cash-driving arm of the blue economy rather it is the conservative arm of the blue economy. If our coastal environment is adequately protected it will help in the sustenance of our marine environment and maximize output of Nigeria's marine ecosystem for economic development. The contributions of each of the ten components are shown in Table 5.

Table 5: The Contributions of each of the Components of Blue Economy to Nigeria Economy

S/N	Blue economic component	Contribution to national economy (Billion Naria)	Year	Remark
1	Maritime transport and shipping	62.66	2021	NPA component
2	Cruise tourism	-		Not documented
3	Fisheries and offshore aquaculture	386.24	2022	
4	Ocean renewable	-		Not documented
5	Oil and gas exploration	4231.9	2022	
6	Mineral Resources	-		Not documented
7	Recreation and sporting	-		Not documented
8	Biotechnology and pharmaceuticals	-		Not documented
9	Ocean governance and management	-		Not documented
10	Coastal production and infrastructure	-		Not documented

Source: Table by authors
Note: Nigeria 2022 budget is N10.13 Trillion

Conclusion: The work presented huge opportunities that exist especially in the non-oil/gas exploration sectors. It is very necessary that the government and private sectors pull efforts to stimulate activities in the non-oil/gas blue economic sectors in order to sustainably support the Nigerian national economic growth and stability.

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