

A Probe of the Level of Nigeria Maritime Sector's Vulnerability to Climate Change

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ABSTRACT

The study probed into the level of Nigeria maritime sector's vulnerability to climate change. It specifically provided answer to the questions raised, which were; how vulnerable are the Nigerian seaports to climate change? Is there relationship between level of rainfall and relative humidity in Nigeria? What are the conventional coastal challenges as a result of climate change? Are the Nigeria ports located in low lying coastal area? The study further hypothesized that there is no relationship between level of rainfall and relative humidity in Nigeria. The study adopted table, pictograph and correlation for analytical purpose. Findings unveiled that the Nigeria maritime sector is highly vulnerable to climate change. It was thus recommended that the nation should focus on improving the port infrastructure of the high port location and also embrace the concept of mobile port.

Keywords:-*Climate change, maritime, transportation*

INTRODUCTION

Climate change is defined as the systematic change in the long-term statistics of climate elements (such as air temperature, barometric pressure, or winds) sustained over several decades or longer (Glickman 2000) as cited in Leanna et al (2012)[5]. The change may be brought about through such factors as natural influence and human activities. Maritime transport is the shipment of goods and passengers by the use of sea or some other water ways. Component of maritime transport are; way, motive power, terminal and the vehicle. The way includes sea and other inland waters. Motive power in maritime transport is the turbine engine, the terminal is majorly the seaport, with different facilities and inland container depot. The vehicle in maritime include ship, boat sub-Marine canoe etc. Maritime transport is majorly used for international transportation and it is the most efficient

means of transporting bulky and non perishable goods over a long distance.

Maritime transport is an international trade in nature as it is the best mode of transport for highly voluminous goods and it offers service at the cheapest price when compared with other modes of transport. Although maritime transport is not limited to international trade, it is also of significant importance in the domestic trade of a nation. The bulkiness of cargo involved in the maritime sector makes maritime transport relevant, in the development of a nation.

Maritime operation can be defined as an all inclusive activities of service needed in moving goods, people and service through international waters, from point of origin to point of destination. The common features of maritime operations include; sea port, ship and shipment, international laws (i.e. ISPS code), national laws and

duty (i.e. custom duty, ban goods, condition of goods at delivery, immigration), overland shipment (i.e. road and rail), inland container, loading and offloading of cargo, sea port administration and management, dredging and maintenance of sea route, cargo handling and management, bank and banking service i.e. specialized bank (maritime bank). It is the term used to describe the activities involved in the movement of people, cargo and service from one region to another region through the use of water mode of transport and service of so many other agencies like custom, freight forwarders (clearing and forwarding agent) stacking of cargo at sea port and dry port, documentation and many other activities needed in international trade.

The seaport is the point of contact between the sea and the land which has been developed for the purpose of transport mode inter-change. It is naturally enhanced and a place where most of the administrative and management activities take place. Most of the shipment and cargo handling activities and operation take place at the seaport. The major factor that determines the location of a seaport is interaction between the sea and the land as point of contact. Ship is the term given to the vehicle that navigates her way through water. It can be sub-marine or the type that floats on water. Sub-marine ship or vessels are usually utilized by the military and researchers. The size of a ship varies according to her design. Shipment is simply the movement of freight which anchors a lot of processes and operations.

There are some laws that guide the international waters, such as ISPS code. The type of activities a nation can perform at the sea and where a country has limited

authority, not compromising the safety of her neighbouring country and also the type of vessel or ship that can be allowed to sail, safety of crew, safety of goods and insurance policy. The levels of implementation of these laws are given priority. For example the ISPS code was designed in level according to the needs and treats at the high sea or port and the attack the nation is exposed to pirate and terrorists' activities. It deals particularly on safety. Nevertheless countries also have their own nation law and duty, which guide maritime activities in a country. It varies across countries due to many reasons like hydro-geographical nature to level of development and application of information technology in maritime transport. Duties and service charge at the port also depend on the laws of the land.

Shipment means almost the same as freight which is goods in motion or trans-shipment. It is not limited to any mode of transport, it can be on road, rail and pipeline or even air as far as goods is in motion. Whenever cargo arrive a seaport, the next mode of transport is usually land or rail that is, overland which is a sub-set of maritime transport. Furthermore, Inland Container Depot (ICD) is an extension of the sea port across a land-locked area. The sole objective of the idea behind ICD is to decongest the port area and at the same time bring goods nearer to the consignees. In order for maritime transport to actually carry out its goals and objective, cargo either wet or dry must be loaded or unloaded before trans-shipment can occur. There are several methods applicable. One method of significant importance is containerization. When a ship is empty, ballast is adopted to enhance the stability of the ship, to prevent the ship from capsizing or sink. Seaport administration and management is the established

authority that sees to the control management and enforcement of established laws at the port. It is usually owned by the government and in case public and private partnership exists. Also the sea port administration and management is an inter-phase between maritime countries and land locked countries. The route at the sea port needs to be dredged to allow ship to sail through the territorial waters. Dredging is a process of clearing and cleaning debris and sand from a particular route, thereby increasing the water depth of the route. Specialists are needed for the operation and at the same time it is a capital intensive operation at the port. This is one of the major challenges confronting most sea ports in the area of ship berth. Cargo handling and management is that part of maritime transport operation that treat the cargo in order to ensure that goods are in their right condition throughout the shipment period (origin to destination) The impact of maritime transport to the development of a developing nation like Nigeria cannot be over emphasized. The importance of maritime operation includes; job creator (ship building and service), source of income to citizen, source of revenue to government, expose national need for technology, enhance international trade, improve domestic trade and commerce, increase standard of living and support national defense of a nation. However climate change has a hinge on each of the maritime operation and benefit. Research light has not been adequately beamed on the impact of climate change on the maritime operation in Nigeria. Against this background, this study probes the level of Nigeria maritime sector's vulnerability to climate change. To achieve this objective, the following questions were raised; how vulnerable are the Nigeria seaports to climate change? Is

there a relationship between level of rainfall and relative humidity in Nigeria? What are the conventional coastal challenges as a result of climate change? Are the Nigeria seaports located in low lying coastal area? It was hypothesized that there is no relationship between level of rain fall and relative humidity in Nigeria.

LITERATURE REVIEW

UNCTAD[7] said, the available scientific evidence suggested that growing concentrations of GHG in the atmosphere had already lead to significant climatic changes, that is most likely to increase in the future. The high rate of climate change occurrence created an urgent need for action to be taken in order to militate against the effect of climate change. Climate change continues to influence the uncertainty of the parameter use to measure pattern of the climate of the future. Although the parameter values may increase or decrease with distance from the coastline. Rainfall and precipitation may increase or decrease and change in temperature might be more difficult to predict.

FRN[2] noted that uncertainties regarding climate change may most likely be in terms of magnitude and not in direction. The effect of climate change on maritime operation may be highly devastating based on the magnitude of the uncertainty. The impact of the uncertainty of the level of rainfall and precipitation may be more than expected. In order to measure the vulnerability of the seaport to climate change, the level of exposure to continuous and history of over flooding in the coastal region needs to be examined. Table 1 and Figure 1 present the complexity of uncertainty as a result of climate change based on general circulation models.

The diagram illustrates the progression of climate change impacts through six stages, showing increasing uncertainty at each step:

- greenhouse gas emissions**
- greenhouse gas concentration**
- global climate** (utilizing **GCM** models)
- regional climate** (utilizing **down-scaling**)
- regional climate impact** (utilizing **runoff model**)
- regional measures for mitigation**

A vertical double-headed arrow on the right indicates the **range of uncertainty**, which expands as the process moves from emissions to mitigation measures.

The diagram illustrates the relationship between uncertainty and complexity for various climate variables. The y-axis represents 'uncertainty' and the x-axis represents 'complexity'. Five colored lines (green, red, blue, dark blue, and grey) show the progression of different variables as complexity increases. The variables are labeled along the lines: 'ecosystem function' (green), 'water quality' (red), 'sediment transport' (blue), 'waves' (dark blue), 'wind' (grey), 'sea level rise' (green), 'precipitation' (red), 'runoff' (red), 'temperature' (green), 'mean values' (blue), 'variability (inter-, intra-annual)' (blue), 'extreme values' (blue), 'small spatial scale' (grey), and 'large spatial scale' (grey). Arrows at the end of each line indicate the direction of increasing values.

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VULNERABILITY IN MARITIME SECTOR

Vulnerability as a concept cut across almost all sphere of life. Mathematically speaking, vulnerability can be represented by the formula

$$R + RE = Vu$$

Where

R = Risk

Re = Response to Risk

Vu = Vulnerability

Also, in Holzmann et al.'s (2008), as cited in Whitney[8] Vulnerability is a function of baseline, Hazard and response to the Hazard. Mathematically, it can be represented as

$$B + H + R = V$$

Where,

B = Base line

H = Hazard

R = Response to the hazard

V = Vulnerability as a result of the outcome.

According to Whitney[8] it is necessary to know; what is the extent of vulnerability? Who or what is vulnerability? What are the sources of vulnerability? How do we respond to shocks? What gaps exist between risks and risk management mechanisms? However, it is important to determine the main source of threat in vulnerability measures. The concern of this study is on climate change as a threat and/or unavoidable risk to the maritime sector. Raise or lower level of the sea, flood in the coastal area, event of act of God influenced by climate change and maritime operation were specifically probed.

METHODOLOGY

The study area is the whole coastal region of Nigeria suitable for seaport development. The level of coastal land and the rate of rainfall for a period of 31 years (1979-2010) were covered. Table, pictograph and correlation analysis were employed for the study.

RESULT AND DISCUSSION

The 31 years level of rain fall and precipitation level of Lagos, Calabar and Port Harcourt was obtained and the monthly mean was taken. Furthermore, the approximate height of the port location was also obtained for analytical purpose. Trend of rainfall is on the increase in Nigeria. Several researchers agreed that the trend is progressive based on monthly variation [6]. Nevertheless, it is necessary to investigate the relationship of rainfall with precipitation. Correlation of level of rainfall and relative humidity were carried out for a period of 31 years (1979-2010) in Table 2. The result showed that there is a significant relationship between level of rainfall and relative humidity. The general rule is that when the critical value is lower than 0.05, the null hypothesis is rejected and accept the alternate hypothesis. Since the critical p-value of the correlation was 0.000 which was lower than 0.05 significant level at two tailed, then the null hypothesis that there is no relationship between level of rain fall and relative humidity was rejected and the alternate hypothesis was accepted. Hence there is a relationship between the level of rainfall and relative humidity.

Table 2:-Correlations of the relationship between relative humidity and rain fall over a period of 31 years in Lagos, Calabar and Port Harcourt

		Rainfall	Relative Humidity
Rain fall	Pearson Correlation	1	.677**
	Sig. (2-tailed)		.000
	N	36	36
Relative humidity	Pearson Correlation	.677**	1
	Sig. (2-tailed)	.000	
	N	36	36

**Correlation is significant at the 0.01 level (2-tailed).
(Source: Author's computation 2016)

COASTAL AREA CHALLENGES IN NIGERIA

The conventional coastal challenges due to climate change in Nigeria is characterized with such scenario as increase flood risk, potential loss of lives and property, increased erosion in

the nation's coastal region, increased loss of transport infrastructure. The impacts of climate change on the maritime industry could lead to complete wipe away of the seaport infrastructure which is capable of grounding the nation's economy.



Fig.2:-Coastal challenge in Nigeria
(Source: wn.com)

VULNERABILITY OF NIGERIA PORT

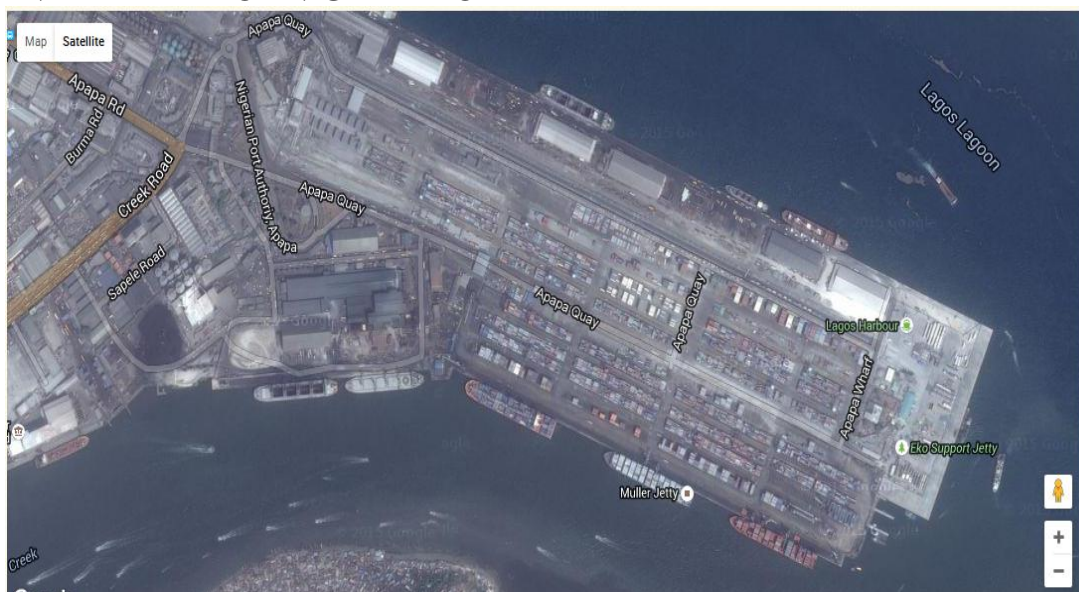


Fig.3:-Apapa port, Lagos aerial view
(Source: Google earth photo (2016))



Fig.4:-Onne port aerial view
(Source: Google earth Photo 2016)



Fig.5:-Calabar port
(Source:-Google earth Photo 2016)

SEA LEVEL OF LAGOS, CALABAR AND PORT HARCOURT Vulnerability of Nigeria Port to Climate Change

The distance of port location above sea level in the three sea ports and the rate of port activities in the three ports were used

as the yardstick to measure the vulnerability of the maritime sector (sea port) to the effect of climate change. The location was in line with most popular settlement in the port region. The distance above sea level was obtained across the state and the rate of port activities

represented the volume of cargo handle in the port (cargo through put). It was observed that the low laying port location had very high rate of port activities while the high laying port location had very low port activities. Since the low laying port location had very high port activities and the high laying port location had very low port activities, it was deduced that the Nigeria maritime sector (seaport) is highly vulnerable to the impact of climate change. They are also located at low laying.

Over the years, scientist had come out with evidence of the likely hood of sea rise in

pacific ocean. It is interesting to know that, there is widespread agreement among scientist that significant long term sea level rise will continue for centuries to come most especially in coastal regions of Nigeria. Scientific studies projected sea level rise to end of the 21st century relative to the global average sea level at the end of the 20th century. Their projection for this time period is for an increase in sea level between 18 and 59cm (7.1 and 23inch) according to intergovernmental panel on climate change (IPCC). Lagos state no doubt, falls to the range of being wiped away with the seaport.

Table 3:-Sea port location, distance above sea level and rate of port activities

	Location	Distance of port location above sea level	Rate of Port activities
1	Lagos	7 meter	Very High
2	Onne	30 meter	Very Low
3	Calabar	99 meter	Very Low

(Source:-Meteorology 2016 and Google earth 2016)

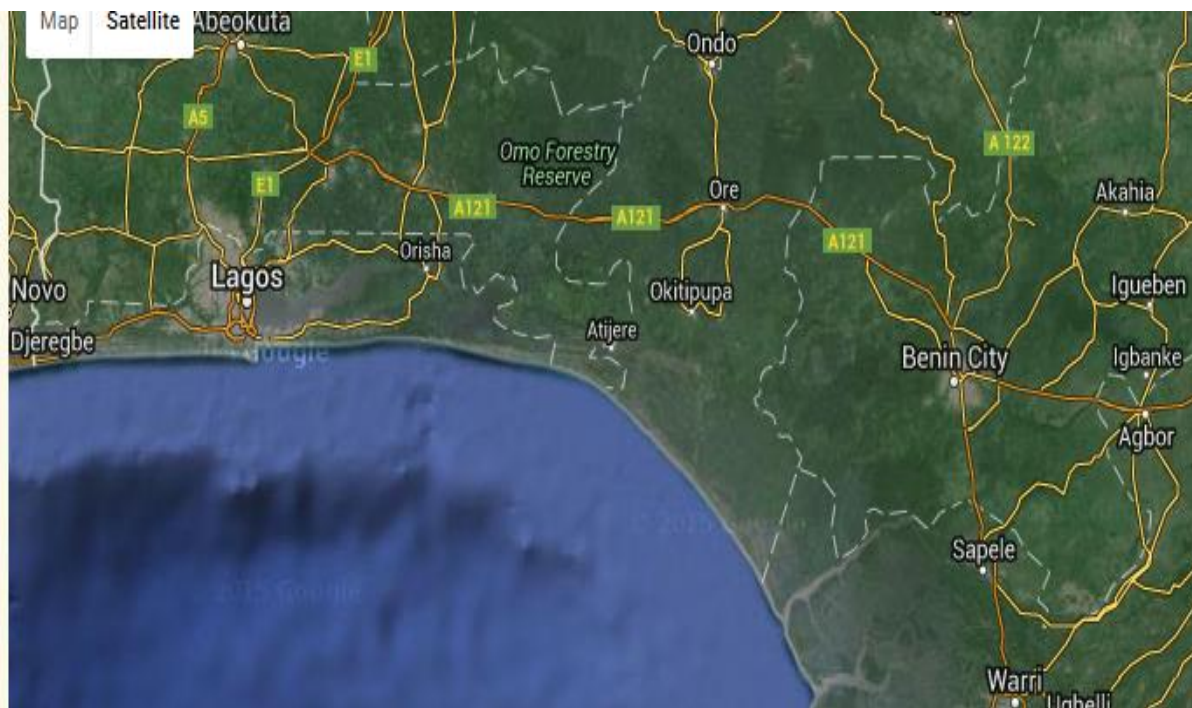


Fig.6:-Coastal region of Nigeria
(Source: Google earth Photo 2016)

CONCLUSION AND RECOMMENDATION

Based on the findings of the study, it was concluded that there is a relationship

between level of rainfall and relative humidity as a result of climate change. Also the coastal challenges as a result of climate change are increased flood risk,

potential loss of lives and property, increased erosion in the nation's coastal region, increased loss of transport infrastructure. Further finding unveiled the fact that the location of seaport in Nigeria is highly vulnerable to negative impact of climate change. In other words, the nation's maritime sector is at high risk of being washed away sub-merge as a result of flooding that may probably be caused due to climate change. The Intergovernmental Panel on Climate Change (IPCC) projection of increase in sea level between 18 and 59cm (7.1 and 23inch) in the Pacific Ocean agreed to this finding.

It was thus recommended that the nation (Nigeria) should look forward to upgrading the high location port (Onne sea port, Port Harcourt Port, etc.) as a way out of the threat imposed by climate change on the nation's maritime sector and the almost none existing idea and concept of mobile seaport should be embraced for the Lagos seaport and other highly vulnerable port to climate change around the world.

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